

Diplomarbeit

Acupuncture and Science

eingereicht von

Mag. Stefan Hötzing

zur Erlangung des akademischen Grades

**Doktor der gesamten Heilkunde
(Dr. med. univ.)**

an der

Medizinischen Universität Graz

ausgeführt an der

Klinik für Frauenheilkunde und Geburtshilfe

unter der Anleitung von

Ass.-Prof. Priv.-Doz. Dr. Trutnovsky Gerda

Graz, am 15.01.2016

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Foreword

Acupuncture takes an increasingly important role in alternative medicine and is more and more often demanded by patients as a therapeutic option. But is the growing demand justified from a scientific view?

In recent decades a number of studies have been conducted in this field. It is difficult and time consuming to draw an objective conclusion due to the seemingly unmanageable amount of literature available and the heterogeneity of the field. Nevertheless, this diploma thesis aims to provide an overview of the study results and answer the aforementioned question for specific applications of acupuncture.

Abstract

From a scientific view, verum-acupuncture studies (the acupuncture needle penetrates the skin) compared to "sham-acupuncture non-penetrating studies (the acupuncture needle do not penetrates the skin) shows no better effect. The difference between verum- and placebo-effects are zero. In „non-acupuncture points studies" (the subjects are treated on non acupuncture points) the verum effects are between 0-10%. But logical, these effects are most likely attributed to the no blinding of the therapist. Of all the indications which were examined in the context of this diploma thesis only PONV showing a positive verum effect. Therefore, apart from PONV, no noteworthy verum effect can be assumed in acupuncture.

Acupuncture in this form as it is applied nowadays is a very effective placebo (for most patients) and sometimes more effective than the conventional standard treatment. From a scientific perspective it is quite clear that acupuncture as applied today is almost exclusively based on placebo effects.

Is acupuncture therefore comparable with pure placebo treatments like homeopathy? Not really, because in the field of acupuncture there is also some evidence of real verum effects. But a much better scientific basis in this area would be necessary and old thought patterns, as they have proved to be wrong (and there are many), have to discard.

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I.

Overall Summary and Conclusion

The aim of this diploma thesis is a summary of current acupuncture explanatory models and the effectiveness of acupuncture based on study results. To look objectively to this topic, it is important to deal with a variety of subjects. For example: the placebo effect in medicine, study designs in acupuncture, acupuncture analgesia, teaching of TCM, explanatory models of acupuncture,... are just a few of these issues. In my opinion, only a contemplation of all these areas gives a clear picture for a statement to acupuncture.

When we speak in Europe about TCM, for many people TCM is a synonym for acupuncture. This thinking is logic, because acupuncture is the most widely used part of TCM in West. But from a historical point of view, this picture is completely wrong. According to Lehmann (2013, 1), the clinical application of acupuncture in ancient China was always a limited one. In 1822 acupuncture and moxibustion was even excluded from the Imperial Medical Academy in China (Lehmann, 2013, 1). This is easy to understand, if one realizes that acupuncture needles were very dick and were used repeatedly. Stainless steel did not exist at that time and also no knowledge of disinfection and sterility was present. Infections were a logical consequences. Therefore, in ancient China at all times, there were also warnings because of the dangers of acupuncture. Mao Zedong activated acupuncture thanks to socio-political considerations in 1954. (Lehmann, 2013, 1)

This in 1954 introduced “new acupuncture” is not comparable with those of the past and is a mix of new and old ideas. Some examples for new things are: concerning knowledge, terminology, diseases, setting, hygienic conditions, needle material, preferred acupuncture points etc. (Lehmann, 2013, 1). Therefore, the widespread belief, that acupuncture is based on a „old knowledge“, is only partially correct.

In the course of modernization of acupuncture, a basic research as we understand in the West, was never carried out.

Therefore, according to Lehmann (2013, 1) there are two important conclusions: most acupuncture is used today, and based on this standpoint, „the time of acupuncture is now“. And further, it is not very clever to fix acupuncture to old things. In the words of Lehmann (2013, 1): *„So let us go forward, with courage and open mind – advance! “*

And as a early conclusion of this work, I can total agree with this point of view, because from a scientific perspective that's right. But more to this topic in the following pages.

Medicine systems developed always in the background of cultures. The Chinese (east Asian) system of logic is not so much based on identity (objects), but more on correlations, or, in other words, they have a more „holistic“ way of perception and thinking. It is important to mention, that neither of those two cultures (west or east) uses one over the other way of thinking exclusively. The experiments by Nisbett (2005, 52) show that both types of thinking (object and context-bound) are present in both cultures. Nevertheless, at least partially, the difference in thinking led to different developments of those two cultures.

If you want to look from a scientific point of view on acupunctures, it is a good advice, if you engaged with placebo effects, because they play an important role. Generally, it can be stated, that somewhere between 0% and 100% of the results of medical interventions can be attributed to placebo effects. For example, there is some evidence that 100% placebo effect can be achieved in

arthroscopic operations. The study by Moseley et al. (2002, 4) showed no difference between a placebo-, a lavage, and a debridement group. Even such paradoxical effects like the following are possible: patients who receive a bronchodilator, thinking it is a constrictor, have a narrowing effect of the bronchia (Luparello 1970, 5). And it was shown that in mild to moderate depression the placebo effect is responsible for about 80% of the total effect (Kirsch 2008, 14). And another example: the effect of NSAIDs for migraine is based in the range of about 50% on placebo (Pardutz and Schoenen 2010, 7).

Therefore, the effect of treatments is always a sum of verum-, placebo- and spontaneous improvements, and effects from other interventions. To determine these three effects, three armed trials are the best method. Along the line, supply studies and economical studies are more application-oriented. (Meissner and Linde 2013, 6)

Contrary to popular belief, it is possible to create blinding in acupuncture studies. Laser needle acupuncture and the Streitberger needle (2008, 8) are good examples for this. Theoretically it is even possible to create double-blind studies in acupuncture. The acupuncturist could use Streitberger needles (or another placebo needle) on the patient, not knowing whether it is a placebo or verum needle. Afterwards a second person pushes the needles in the skin or respectively in the handle of the placebo needles. This complete blinding would ensure that neither the acupuncturist, nor the proband, knows the verum and placebo group affiliation. To avoid non-verbal communication between therapist and patient (otherwise results would be falsified) a privacy screen (e.g. curtain) can be used. Also acoustic interactions can easily be eliminated (sound-absorbing headphones). A variety of simple measures like this could increase the quality and validity of studies. This is what's urgently necessary in basic research of acupuncture.

Placebo effects are influenced by several conditions. Some examples are: the patient's age, the severity of the disease, the type of disease, the number of patients-doctor contacts or contacts itself (Kaptchuk 2010, 11), the quality of care (Egbert 1985, 12), the art of the pre-treatment discussion or the mere use of information (Bergmann 1994, 10), the use of diagnostic tools in general (Sox et al. 1981, 9), physical interventions (especially effective) (Moseley 2002, 4) and the patients' expectancy of the outcome (Linde 2007, 13).

Due to many factors acupuncture is at least partially a good placebo. It usually requires many doctor-patient contacts, where the doctor spends a lot of time with the patient. Acupuncture is an invasive procedure and therefore particularly placebo effective. To many patients, acupuncture is something "mysterious" which may increase the placebo effect. Overall, acupuncture has a high "placebo potential".

For a doctor in ancient China it was impossible to distinguish whether his treatment success was due to placebo, or verum effects. With a large number of patients, however, it was possible to quite accurately assess the overall effect of the treatment. Nevertheless, quantifying precisely and in detail verum and placebo effects is only possible with good studies.

The placebo topic raises the following question: which treatment is better? A pure verum treatment with an improvement potential of 40%, or a pure placebo treatment with 50% improvement potential? The patient only notices the improvements, not what caused them. It is not surprising that alternative medicine is harnessing this potential by occupying this „niche“. Only if the "scientific side" starts to incorporate those aspects, this controversy with alternative medicine can be avoided. From a logical perspective the „modern medical scientific side“ is not as scientific as they claim. Science (medicine) should attempt to include all known factors (including psychological/placebo), only then can it claim to be truly scientific.

An important area of acupuncture is the treatment of pain and also in a lot of acupuncture studies pain is a central issue. The body has the ability to produce endorphins and this lead to a reduction in pain sensation. This is an evolutionary strategy to control pain in important situations and can be found in all mammals (and also other animals).

With acupuncture, endorphin levels are enhanced for 20-30 minutes maximum. A longer period than this 20-30 minutes would not make sense physiologically, because when the needle is removed, the body's production of endorphins ends (17-20). Therefore, pain reduction for patients cannot be expected for longer periods and this cannot explain effects in acupuncture treatments. But during an acupuncture treatment, the pain threshold can be increased. For example Mayer et al. (1977) showed, that the pain threshold can be increase during this time by 20% with acupuncture (16), or in other words, a reduction of pain by a fifth.

There are some incredible reports from China where operations without conventional analgesia and only with acupuncture were executed. Considering the physiological facts this seems impossible, because acupuncture can achieve only a pain reduction (16-20). Whenever, it can be used in addition to conventional analgesia. In reality, the Chinese doctors used a combination of sedatives (Litscher 2015, 21) and local anaesthetic injections and used additionally very painful resistant patients.

A modern approach to explain acupuncture is the „segmental anatomy“. Skin, muscles, bones and internal organs are connected via the spinal cord. From the perspective of TCM we could add, as a fifth factor, the cortex. Therefore, we now have skin, muscles, bones, internal organs and the cortex (psychological area), and all of them are connected to each other. These areas receive nerval „information“(efferents) or send information in the direction to the spinal cord (afferents). In the spinal cord afferents gets cross-linked.

Looking at the core ideas (”network thought”), the theory of TCM is in line with those of natural sciences. Instead of using concepts like QI or meridians in the TCM, science uses neural structures to connect those systems to each other. And at least in part, experiments by Wernøe (1925, 22) showed in researches of fish the relationship between reactions on skin and visceral organ segments. Head Zones, MU and SHU points are practical examples, where this cross-linking between internal organs and the body surface can be observed (Beissner et al., 2011, 23).

From a medical perspective there is no question that this connections exist, the question is rather how it can be used for the patient and how important they are in medicine.

There are several studies which showed such „network effects“. For example, Streitberger (2008, 24) shows specific induced central and autonomic nervous system activity during acupuncture (1.1). Lau and Jones (2008, 25) showed, that a single session of Acu-TENS increased FEV1 (1.24 to 1.37 in the verum compared to 1.39 to 1.41 in the control group) and reduced dyspnoea in patients with chronic obstructive pulmonary disease. Litscher and Schikora (2004, 26) found short-term physiological changes by performing laser acupuncture. For example, they found specific changes in blood flow velocity in the anterior cerebral artery, and the posterior cerebral artery, by using different laser acupuncture schemes.

I could only find a single study examining long-term effects for “segmental acupuncture effects”. It was carried out by Beck (2012, 27). She tested the sense of smell and found long-lasting effects on the odour perception after verum laser acupuncture. This is an example of relatively simple basic research in the field of acupuncture leading to new knowledge.

In summary, there is evidence to assume that this “network” is being influenced by acupuncture (at least in some areas). Unfortunately, studies regarding this topic are very rare. But, these rare examples show, that significant, and therefore progress making results, can often be obtained with small experimental groups already (especially in basic research) and good questions.

The TCM was created on the basis of observations and experience. The performance of ancient Chinese in some areas deserves a lot of respect, but methods like these are also limiting the state of knowledge. We have a variety of ways to examine these relationships today. We can relatively easily measure the lung volume, oxygen saturation, heart rate, heart rate variability, blood circulation of vessels (measured by ultrasound), etc. Therefore, we can examine the effects of segmental correlations (= “network correlations”). These „network“ interventions don't necessarily require the use of needles, in research, as well as in therapy. Today, various methods exist to influence this “network”. Thermal, electrical, or laser methods may lead to even better results. Some questions according to acupuncture would be relatively easy to answer, if the methods were based on good basic research. Demystification and the creation of a scientific basis on the topics of TCM are important. Creative, scientific thinking is needed, as well as rejecting wrong ideas, adhering to proper methods to gain new insights.

If meaningful studies on acupuncture should be designed, the opportunity to treat according to TCM criteria has to be offered. Of course, the practitioner should be able to diagnose the disease by TCM criteria. Fixed acupuncture treatment regimen (= predetermined fixed point combinations) are not within the meaning of TCM. If acupuncture effects according to TCM should be determined, variability or „holistic“ thinking should be included, because this is the most important aspect of TCM.

Beissner and Henke (2011, 28) investigated methodological problems of acupuncture effects based on fMRI (Functional magnetic resonance imaging). According to the authors, up to 2009, more than 60 studies have been published on this topic. These studies, however, didn't adhere to the same standards that are usually used for fMRI on such brain effects. Because of this, the conclusion must be drawn, that a lot of resources are wasted, bringing no real progress to the field of acupuncture and science.

Before attempting to clarify the available data of a particular scientific area, of course, the question arises how reliable these data are.

Some countries (China, Russia, Taiwan, Hong Kong and Japan) have been found to publish mostly studies with positive results, and this not only in the field of acupuncture (Vickers 1998, 29). Perhaps the situation has improved in the meantime, but a statistical distortion should be expected. If results are fixed before, studies are wasted time. 100% positive results contradicts the principles of science. Therefore, the results of these studies should be handled with special care.

To interpret studies and meta-analyses in the field of acupuncture, some statistical knowledge is required. A funnel plot can show the publication bias, but therefore enough studies must exist. The literature search in context of this whole work showed, that for the most medical indication in acupuncture, there are not enough studies for funnel plots.

A guideline for acupuncture studies can enhance the quality of their results. One example for such a guideline is STRICTA (White and Filshie 2001, 30). The aim of the STRICTA working group was to create a checklist for acupuncture studies. With this list, studies in the field of acupuncture should become more transparent, reproducible and the results better interpretable.

Treatment effects in studies can always be divided in verum, placebo and other effects. Other effects are for example spontaneous improvement, statistical artefacts (regression to the mean) and co-interventions. In order to quantify these three types of effects, three arm studies are required. (Lundeberg et al. 1988, 31; Hansen 1997, 32)

However, it is important to understand that three arm studies are only the first step in a medical science process. Answering the question if the effectiveness of a treatment is scientifically proven by randomized controlled studies, supply studies, health supply studies and economic studies is the next step in the scientific process. Medical actions should not be founded solely on the results of randomized controlled trials. Supply studies and economic studies should enhance the scientific basis and allow a relationship to practice. (Suzanne et al. 2013, 33)

One important factor which should be eliminated as much as possible in studies is social desirability, because it might produce incorrect results. Personal patient surveys are naturally very susceptible to this influence. It is important that the subjects in surveys are unaffected according to their statements. (Meissner and Linde 2013, 33)

In studies which aim to differentiate between verum and placebo effect, a good blinding of patients and clinicians is a big challenge. In placebo group studies, two approaches for needle blinding are usually applied. Either the acupuncture needles are inserted at non-acupuncture points or non-penetrating needles are used.

Birch (2012, 35) believes that placebo acupuncture with non-penetrating needles is not a placebo treatment. He justified that statement by the fact that non-penetrating needles touch the skin and this may lead to verum effects. Yet, this argument does not make sense from a biological perspective. Generally, humans are constantly exposed to tactile stimuli. For example if one goes barefoot across a meadow, the pressure stimuli are significantly greater than in the non-penetrating acupuncture. Hence, from a physiological point of view it does not make sense to assume that biological systems which are stimulated by such a slight pressure would undergo significant changes leading to verum effects. Such sensitive systems would not be able to survive in this world.

To select the most promising indications in the field of acupuncture, the review "Evidence Map of Acupuncture" published by the Department of Veterans Affairs (DVA) build the basis for some chapters (Hempel et al. 2014, 36). This „review of reviews“ was published in 2014“. This work included 42 reviews that have been published since 2005. The categories pain, headache, depression, insomnia, smoking cessation and restless leg syndrome has according to the DVA „an evidence of a positive effect“ and additionally the largest "literature sizes". Therefore, I would like to look at this area in detail in some chapters.

In the field of depression no significant differences could be found between patients that were not subjected to any treatment (people on waiting list), patients treated by sham acupuncture and those treated by verum acupuncture (Smith et al. 2010, 37). Hence, in the treatment of depression there is no evidence for the usefulness of acupuncture.

In the Cochrane review regarding smoking cessation (White 2011, 38) no evidence was found that acupuncture treatment is better than no treatment (people on waiting list) or short- and long-term psychological interventions. No significant difference between the effects of verum versus sham acupuncture were found. The respective funnel plot includes 14 studies and shows no evidence for publication bias. Therefore, these data seem to be valid.

There are only few studies on restless leg syndrome (RLS) (only 170 included patients). In the Cochrane review by Cui et al. (2008, 39) only two studies met the inclusion criteria for this meta-

analysis. One study found no significant difference in treatment outcome between acupuncture and medications. One study examined the effects of three different treatments, one using a combination of medications and massage, another one only medications and a third one only massage. A reduction of unpleasant sensations in the legs and RLS frequency was found in this review. There was no difference according to the reduction of RSL.

In the meta-analysis by Lee et al. (2009, 40) concerning the prevention of postoperative nausea and vomiting (PONV), 40 trials with a total of 4858 participants were included. The authors found a significant reduction of nausea (RR 0.71, 95% CI 0.61 – 0.83) and vomiting (RR 0.70, 95% CI 0.59 – 0.83) as a result of verum compared to sham acupuncture

In the study by Streitberger et al. (2004, 41) with 220 included subjects postoperative nausea and vomiting (PONV) were investigated after gynecological and breast surgery. For the placebo group non-penetrating needles were used. Considering both, gynecological and breast surgery, there was no significant difference found between the effects of verum and sham acupuncture. However, by evaluating only the gynecological surgery group there was a statistical significant difference. The verum acupuncture group showed a reduction of about 20% related to PONV compared to the placebo group.

Throughout the whole literature research for this thesis, the study by Streitberger et al. was the only “non-penetrating acupuncture study“, which showed significant verum effects for acupuncture treatment. Therefore, considering this study by Streitberger et al. and the meta-analysis by Lee et al., a verum effect in the treatment of PONV, at least for some types of surgery, can be suggested.

In the area of dysmenorrhoea, there was only one study with a placebo group (Smith et al. 2011, 42). In this study (92 women) the placebo group was executed with Streitberger-needles. These needles do not penetrate the skin. After three months of treatment the pain intensity was reduced by 12% in the verum group and by 20% in the placebo group. Between these groups, there were no significant different in pain intensity. The menstrual pain intensity reduction was in the verum group from 5.6 (3.1) to 4.9 (3.2) and in the control group from 6.1 (2.5) to 4.9 (3.2).

According to this study, the pain reduction is not as big, and no verum effect could be shown.

The greatest study in the field of osteoarthritis was carried out by Scharf et al. (2006, 43). In this study 1007 patients were included. This study was a part of the GERAC project.

The placebo group received a sham acupuncture treatment at defined points. Acupuncture (53,1%) but also the sham acupuncture (51%) were significantly superior compared with conservative treatment (29.1%). There was no significant difference between the verum and sham group.

The second largest study in the field of osteoarthritis was carried out by Berman et al. (1999, 45) and include 670 patients. This working group used in the placebo group a insertion and noninsertion application. 2 needles were inserted in the skin on „non-acupuncture-points“ the other needles did not penetrate the skin. On the baseline the patients in the verum and sham group had a pain value of 8,9. After 4 weeks the reduction in the verum group was -2,22, the placebo group -1,98 and the education group -0,84. The patients had the greatest benefit after 26 weeks (-3,79, -2,92, -1,69).

In the osteoarthritis study by Foster et al. (2007, 45) 352 patients were included. In this study three groups were build: an „advice and exercise-“, an „advice and exercise and real acupuncture-“ and an „advice and exercise and non-penetrating acupuncture group“. In the placebo group, they used a needle at which the shaft disappeared in the handle and did not penetrating the skin. Therefore, this was the only study in the field dysmenorrhoea and osteoarthritis which was single blinded and three-armed (with a control group). The baseline pain score was 9.1, 9,3 and 8,9 (control, verum,

placebo). After six months the mean reductions in pain were 2.28, 2.32 and 2.53. There was no significant difference at all time points, as well as for all examined parameters, in the placebo and verum group.

In the osteoarthritis study from Vas et al. (2004, 46) 97 patients were included. They used also in the verum and placebo group an electro stimulator. In the placebo group the applied „Streitberger and Kleinhenz“ needles without penetrating the skin. The pain visual analogue scale was at baseline in the verum group 58,9 and in the placebo group 60,3. After treatment, the pain visual analogue score was in the intervention group 10,6 (verum) and in the control group 27,2 (placebo).

This is a huge reduction from 82%. I have never seen this in any other study in the area of acupuncture. A value of 10 in the VAS corresponds nearly to a complete cure, the people were nearly pain free. In the Cochrane review by Manheimer et al. (2010, 47) there were also five other studies which used electrical stimulation of the needles (Berman 1999; Sangdee 2002; Berman 2004; Stener-Victorin 2004; Vas 2004) . But no studies shows this huge results.

But logically considered, the placebo group was not a placebo group. When electro acupuncture is announced as treatment, the patients expect a sensation of this. When applying electro acupuncture you feel the flow stream (assuming that there are sufficient ampere). At high current flow, it can even lead to muscle contractions. But this happened only in the treatment group, so that blinding might have been lost.. To achieve a current flow through the skin, you have to use pats, such as those used for example in sport for muscle stimulation. Only in this way, the conductive surface is increases and the resistance is reduced by a conductive gel.

Probably this „no blinding effect“ explain the high dropout rate of 8 people in the placebo group. With a little common sense, the people knew which group they were assigned.

In the funnel plot, this study was a huge outlier. So, in conclusion about this study, the question arises: can these values reflect reality?

Summary conclusion regarding to osteoarthritis: the effects of acupuncture in pain reduction in osteoarthritis is about 30 to over 50%. Therefore, with acupuncture a strong pain reductions can be achieved. However, verum and placebo acupuncture show nearly equal effects.

In tension type headache both „non penetrating placebo studies“ showed no significant difference between the verum and placebo group (Karst 2001, 48; White 2000, 49). Therefore, all effects in this both studies are placebo effects. No verum effect could be determined. But the observed effects are not marginal, they are in a range by 40%. But this studies included only 110 patients and therefore larger number of cases would increase the validity of these „non penetrating placebo studies“ in the field of tension type headache.

In the "Non-acupuncture points" studie by Melchart et al. (2005, 50), also a waiting list was included. In this study after three-month, the verum group showed a 43%, the placebo group a 39% and the waiting list a 6% reduction based on days with headache. Therefor, 6% of the reduction is based on spontaneous changes, etc. About 10% of the effect is based on verum- and about 90% of the effect is based on placebo-effects. But this 10% verum effects must not be necessarily „real verum effects“. This can also be explained by blinding effects. The therapist is not blindet and higher values in the verum group therefore are logical.

The study of Endres el al. (2007, 51) showed similar results. In this study no control group was integrated. Therefore, spontaneous changes etc. could not be evaluated. The verum group showed a

56% and the placebo group a 45% reduction. Concerning the interpretation the same interpretation applies as in the previously described study by Melchart et al.

Summarized, tension type headache treatment with needle acupuncture can cause effects from 50% (or even more) based on reduction in headache days. This effects are large. Compared with routine care (analgesic,..) acupuncture is far superior. In depression no significant difference between the waiting list the sham acupuncture and the verum group exist (Smith et al. 2010, 37). In smoking cessation (White 2011, 38) there was no significant difference between acupuncture versus placebo acupuncture. In the area of dysmenorrhoea, there were no significant difference in pain intensity in „non-penetrating“ studies (Smith et al. 2011, 42). In the field of osteoarthritis „non-acupuncture-point“ studies (Scharf et al. 2006, 43; Berman et al. 1999, 45) showed no significant difference between the verum and sham group. In the „non-penetrating“ osteoarthritis study by Foster et al. (2007, 45) there was no significant difference in the placebo and verum group at all-time points, as well as for all examined parameters. In tension type headache both „non penetrating placebo studies“ showed no significant difference between the verum and placebo group (Karst 2001, 48; White 2000, 49). In the "Non-acupuncture points" study by Melchart et al. (2005, 50) and Endres et al. (2007, 51) the verum group showed slightly greater effects as the placebo group (a few percent). In the meta-analysis by Lee et al. (2009, 40) for preventing postoperative nausea and vomiting the authors found a significant reduction of nausea and vomiting compared with sham treatment. And also Streitberger et al. (2004, 41) found in PONV after gynaecological surgery a reduction by about 20% compared to the placebo group (but not in the breast surgery group).

Adds it all together, from a scientific view, verum compared to sham acupuncture shows no better effect in „non-penetrating studies, the difference between verum- and placebo-effects are zero. In „non-acupuncture points studies the verum effects are between 0-10%. But logical, these effects are most likely attributed to the no blinding of the therapist. Of all these indications only PONV showing a positive verum effect. Therefore, apart from PONV, no noteworthy verum effect can be assumed in acupuncture. It should also be mentioned, that in this work only study were selected with a high prospect of positive verum effects.

Considering all this studies together, there is a very clear picture. Acupuncture in this form as it is applied nowadays is a very effective placebo (for most patients) and often much more effective than the conventional standard treatment. How to use these effects in practice is an ethical discussion and this question is not subject of this thesis. It is probably also important to distinguish between the medical application and the scientific research in acupuncture. In my opinion, from a scientific perspective it is quite clear that acupuncture as applied today is almost exclusively based on placebo effects.

Is acupuncture therefore comparable with pure placebo treatments like homeopathy? Not really, because in the field of acupuncture there is also some evidence of real verum effects (compare chapter „segment anatomy“). But a much better scientific basis in this area would be necessary and old thought patterns, as they have proved to be wrong (and there are many), have to discard.

And so I would like to fall back again to the words of Lehmann (2013, 1) there are two important conclusions: *„most acupuncture is used today and the time of acupuncture is now. It is not very clever to fix acupuncture to old things. So let us go forward, with courage and open mind – advance! “*. And from a scientific perspective, this is definitely correct!!!

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II.

East Asian and Western Thinking

Summary and Conclusion of this Chapter:

This chapter depicts the „way of Chinese thinking“ because TCM (traditional chinese medicine) is influenced by this. The Chinese (east Asian) system of logic is not so much based on identity (objects), but more on correlations, or, in other words, they have a more „holistic“ way of perception and thinking. It is important to mention, that neither of those two cultures (west or east) uses one over the other way of thinking exclusively. The experiments in this chapter show that both types of thinking (object and context-bound) are present in both cultures. Nevertheless, at least partially, the difference in thinking led to different developments of those two cultures.

According to Nisbett (1), those differences are based on the differences between the ancient Chinese and the ancient Greek culture: China was an agrarian society with central organization, very hierarchical, with the emperor on top. Every child grew up in a social context that left little room for individuality. The Chinese people tried, as much as possible, to balance their situation, and often the best way to accomplish this is a middle path to balance all the influencing factors.

In Greek city-states individual freedom was part of the daily life: Many cities were located next to the sea. The inhabitants engaged in trade, bringing lots of goods into the region. Additionally, conflicts often led to fighting. This encourages a way of thinking where A is either A or non-A, in contrast to the Chinese ”middle-way-thinking”.

When Asians immigrated to the United States they gradually started to adopt the „western view“ (1). This means that those two different thought patterns are being learned, therefore, they can also be changed. It should again be noted that these differences should not be considered „black or white“. Both types of thinking can be found in both cultures. Every human being can switch between focusing on objects, and focusing on the context side of things, in certain situations.

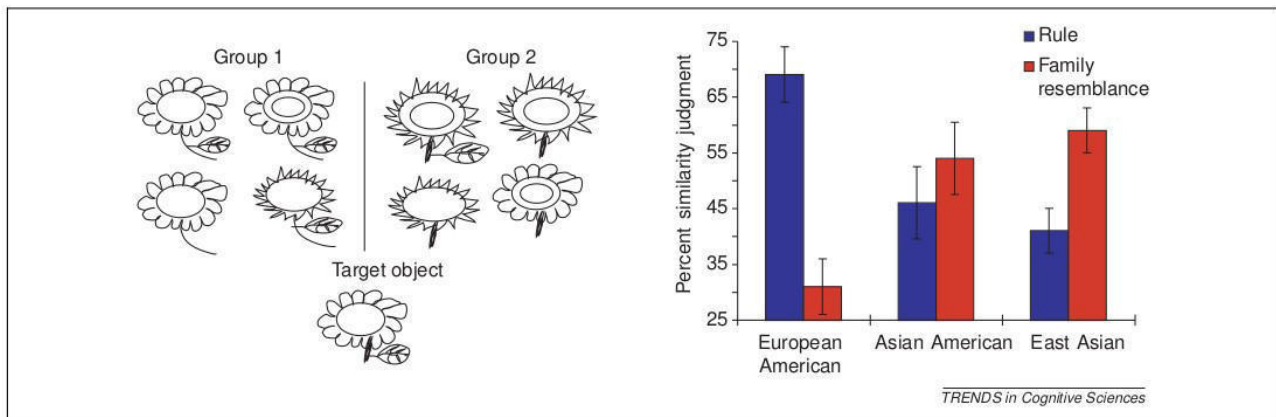
In my opinion, in our culture more attention should be paid to context-bound perception and thinking. For example, children in school are still thought in distinct subjects, which of course leads to a “non-holistic“ mindset. The problems of the future cannot be solved this way, because they are „network problems“ (=multifactorial problems). Even university medical education is strongly oriented this way. However, many diseases cannot be explained by simple correlations. For example, the mono-causal thinking is well suited for treatment of bacterial diseases. A particular antibiotic is effective against a particular bacterial strain. In mono-causal areas like that, medicine has made great achievements in recent decades (vaccinations, antibiotics, surgery, anaesthesia, medications). Maybe, this “western approach” is inferior for more complex diseases, both in medical science and practice alike.

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1. Cultural differences in the way people perceive similarities

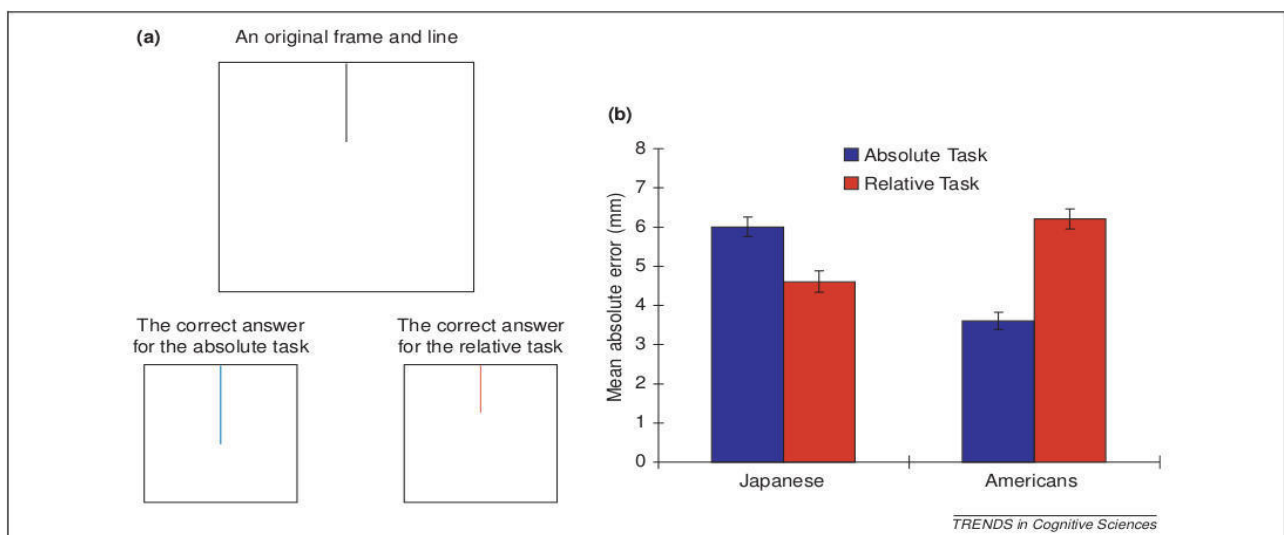
A good study of categorization tasks for different cultures was carried out by Norenzayan et al. (3). “European Americans” see 70% more similarities in “group 2”, while Asian subjects see more similarities in “group 1”. Approximately 40% of “Eastern Asians” see more similarities in “group 2” and 60% of them in „group 1“. “Asian Americans” lie somewhere in between those two groups.



The following example illustrates the difference in perception quite well. If you show Chinese and American children three images – one of a cow, one of a chicken and one of a meadow – and ask them afterwards which of them belong together, Chinese children more often combine “cow and meadow”, because both belong to the same context. US children combine “cow and chicken” more often, because both fall into the animal category.

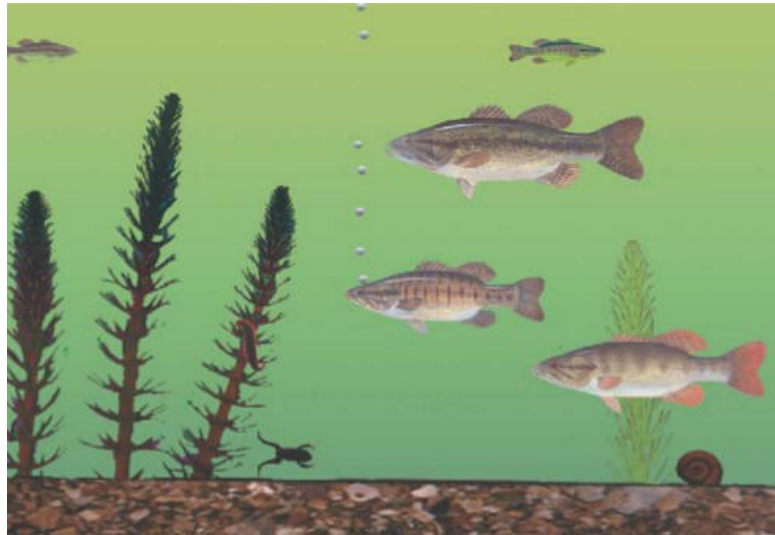
2. Focusing on objects versus focusing on context in different cultures

The following illustration shows results from Kitayama et al (4). The so called Framed-Line test was used in this study. It is a very general test that allows measurement of holistic versus analytic perception. The first square in this illustration represent the “original frame and line”. If you show a smaller square (lower region of illustration) to a person, and then ask them to draw in the line, there are basically two possibilities. The line can be drawn either absolute, or relative, to the size. Japanese people on average draw the line a little shorter than Americans, therefore they relate the length to the context.



3. Attending to context in different cultures

Masuda and Nisbett investigated how Japanese people and Americans pay attention to an underwater scene. The following figure shows an example of such an underwater scene. Focal objects (fish) and contextual objects (animals, plants and rocks) are shown. If you ask Americans for a statement regarding this image, they often mention the focal objects first. Japanese people, however, mention context objects first about twice as often as Americans. Throughout this report, Japanese people mention contextual objects and changes in the background of the image 60% more frequently than Americans.



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III.

Psychological factors and acupuncture

Summary and Conclusion of this Chapter:

Psychological factors play an important role in preventing and managing diseases. The goal of this chapter is to discuss different aspects of placebo effects.

Generally, it can be stated, that somewhere between 0% and 100% of the results of medical interventions can be attributed to placebo effects. Currently there is no evidence for biochemical parameters being influenced by placebo effects (4.6.). However, while biochemical parameters play an important role in Immunology, it's certainly also connected to the psyche. In stress situations, cortisol excretion, for example, is influenced by the psyche, and therefore can be manipulated by placebo effects. In arthroscopic operations the extreme of 100% placebo effect can be achieved (7:12.).

Every interpersonal action in medicine is carried out by people, which means that there is a psychosocial context to all medical actions. Logically, placebo influences on patients are part of all medical actions.

There are two basal mechanisms for placebo effects. On the one hand you have conditioning processes, on the other hand there are learning processes (2.2, 7.5.). Learning processes depend on expectations of patients, therefore they differ from person to person.

Factors such as colour, smell, taste, sound, tactile sensation, visual impression, all play an important role in medical contexts. In some cases placebo effects can be so pronounced that they convert the effect of drugs. For example, patients who receive a bronchodilator, thinking it is a constrictor, have a narrowing effect of the bronchia (7.8). Rituals like taking drugs, syringes, surgeries, diagnostic procedures... all play an important role (2.3.1).

Also patient-practitioner interaction, the treatment, and the environment produce psychological and placebo effects (2.3.).

The endogenous opioid system and the dopaminergic system play an important role in placebo effects (3.1., 3.2.). These two body chemicals are two examples of biochemical correlates that influence placebo effects. By placebo the body produces biochemical substances, such as endogenous opioids, which affect the dopaminergic system. Verum (I.e. the active ingredient in a drug) and placebo effects influence each other, therefore a simple summation of the two effects is not possible. (3.3.).

Placebo effects cause a characteristic activation pattern in the brain (3.4.). Learning processes, as they occur in placebo effects, always lead to changes in the brain/neural network (which indeed occurs in any learning process).

The effect of treatments is always a sum of verum-, placebo- and spontaneous improvements, and effects from other interventions (4.2.). Three armed trials are the best method to determine verum- and placebo-effects, (4.3.). Network-meta-analysis is an indirect method (4.5.).

Good science should always bring new knowledge, to understand cause and effects on a deeper level. Three armed trials are not able to answer all questions. Supply studies and economical studies provide further knowledge. These studies are more application-oriented (5). Basic science and application-oriented research, both are important in science.

Unfortunately, in general too little attention is paid to good basic- and application-orientated science in medical research. Also acupuncture studies need to be improved in this respect.

Theoretically it is possible to create double-blind studies in acupuncture. The acupuncturist could use Streitberg needles on the patient, not knowing whether it is a placebo or verum needle. Afterwards a second person pushes the needles in the skin or respectively in the handle of the placebo needles. This complete blinding would ensure that neither the acupuncturist, nor the proband, knows the verum and placebo group affiliation. To avoid non-verbal communication between therapist and patient (otherwise results would be falsified) a privacy screen (e.g. curtain) can be used. Also acoustic interactions can easily be eliminated (sound-absorbing headphones). A variety of simple measures like this could increase the quality and validity of studies. This is what's urgently necessary in basic research of acupuncture.

Placebo effects are influenced by several conditions: the patient's age, the severity of the disease, the type of disease, the frequency of patient-doctor contacts, contacts to other people (7.6), the quality of care (7.7.), pre-treatment discussions, the information from the doctor to the patient (7.4), the use of diagnostic tools in general (7.3.), physical interventions (especially effective) (7.12), the patients expectations for the outcome (7.10) etc. (4.6.).

In many cases the interpretation of studies is the interpretation of average values from large populations. It should not be forgotten though, that the individual factors, causing placebo effects, have individual characteristics for every person. In non-scientific medical treatments, the single person should be at the centre of consideration. An individual approach is essential in medical practice.

It was shown that in mild to moderate depression the placebo effect is responsible for about 80% of the total effect (7.2). Osteoarthritis treatments too showed a high placebo proportion of about 70% (4.5). Results in pain studies indicate that a "good placebo" may have a huge impact on pain reduction (3-6 VAS (visual analogue scale) reduction can be expected) (4.5.).

Due to many factors acupuncture is at least partially a good placebo. It usually requires many doctor-patient contacts, where the doctor spends a lot of time with the patient. Acupuncture is an invasive procedure and therefore particularly placebo effective. To many patients, acupuncture is something "mysterious" which may increase the placebo effect. Overall, acupuncture has a high "placebo potential". Of course the magnitude of the placebo effect is also very dependent on the type of disease. The chapter "evidence map of acupuncture" shows that for many diseases no verum or placebo response can be found, meaning that there is no treatment response to acupuncture for such diseases. Understandably, a high placebo effect of 3-6 VAS can be expected in acupuncture treatments for pain reduction (4.5.).

In my opinion, too little attention is paid to psychological factors in medical treatments. Even today, all too often, doctors think of people as machines, receiving „medical input“. However, science shows that this approach falls short. It is not surprising that alternative medical procedures are very popular among the population. One reason for this is the negation of "psychological factors" in

medicine. And in some cases, „psychological factors“ are only another word for humanity or "common sense".

It is common practice today to rationalize medical institutions. Rationalisation is important in many areas, because resources are naturally limited. However, if psychological factors are not taken into account, much can get lost in the process. Hospitals become “pure administrative structures“ and humanity gets lost. There ought to be a shift to incorporating psychological factors to a higher degree. „Pure administrative structures“ cannot provide a satisfactory environment for the patient, as well as the doctor.

The historical perspective regarding the development of study design is very interesting. The way we build scientific knowledge nowadays is the result of a 250 year development process. Even today there is still a progress in the constriction of studies. Some aspects in this field must also be considered critical (compare chapter: Trustworthiness of Studies). However, only modern science can provide answers which would remain hidden otherwise. For example, for a doctor in ancient China it was impossible to distinguish whether his treatment success was due to placebo, or verum effects. With a large number of patients, however, it was possible to quite accurately assess the overall effect of the treatment. Nevertheless, quantifying precisely and in detail verum and placebo effects is only possible with good studies.

Listening to debates between alternative medicine and natural science supporters is always interesting. The proponents of alternative medicine appear „open and friendly“ most of the time, while the scientific debaters usually appear a little bit cold and distanced. As a result the audience is attracted mostly to the side of alternative medicine. Persons with less medical background have not the ability to form an objective opinion on medical topics. Audiences mostly judge on the basis of sympathy, where the alternative part usually wins. However, alternative medicine supporters do negate important scientific facts. Whatever the reason may be, it seems to be impossible for them to obtain an objective view. A fitting quote by Einstein: “it is more difficult to smash a preconception than an atom“. Maybe objective and analytical thinking is just not their strength. They may have a strength in other areas though, like emotional ones. But facts remain facts.

In such discussions, placebo effects are often considered as insignificant and more of a hindrance. The alternative side generally argues, that their treatments are largely based on verum effect. The scientific side argues, that it's only placebo and therefore unimportant in a wider sense. Strictly speaking, both sides are wrong. On the one hand the effects are definitely not exclusively verum effects, on the other hand placebo effects are very important (at least for many diseases). Some study examples in this chapter show how powerful placebo effects can be in some cases.

This raises the question: which treatment is better? A pure verum treatment with an improvement potential of 40%, or a pure placebo treatment with 50% improvement potential? The patient only notices the improvements, not what caused them. It is not surprising that alternative medicine is harnessing this potential by occupying this „niche“. As mentioned above, this not only applies to the placebo effect, but to psychological and social aspects in general. Only if the “scientific side” starts to incorporate those aspects, this controversy with alternative medicine can be avoided. From a logical perspective the „modern medical scientific side“ is not as scientific as they claim. Science (medicine) should attempt to include all known factors (including psychological/placebo), only then can it claim to be truly scientific.

This poses the question: are placebo interventions ethically acceptable treatment options?

According to the German Medical Association (2011), placebo interventions are justified if: (1) No approved effective (pharmacy) therapy is available; (2) there are relatively mild symptoms and the

patient expresses a wish for the treatment; (3) there is a chance of success by using placebos for this disease.

In my opinion, from a clinical point of view, the question is how psychological as well as placebo effects can be optimized to maximize the benefits for patients. In most cases psychological/placebo and verum effects are not separable parts of a treatment, so the question is not whether to use them or not, but rather how to use them effectively. As already mentioned, almost every doctor-patient interaction triggers certain placebo effects.

In my view, the patient has the right to be informed about the expected outcome and the causes of treatments effects. Ultimately the patients, not the doctors, should decide if they agree to a treatment (except for emergencies, etc.). Unfortunately, this is not yet common practice in all cases. I believe treatments should not be based on false information, which is often the case in alternative medical treatment. On the other hand, effects based on placebo are sometimes very large and should not be ignored. Objectively speaking, there is plenty of room for improvement on both sides (alternative medicine and natural science), and there are better ways to make good use of psychological and placebo effects on both sides.

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1. Psychology

Psychology (gr. Psyche 'touch, soul, mind' and -logia 'teaching or science') is an empirical science. It describes and explains experiences and behaviour of humans, their development, and relevant internal and external influences and conditions. (Wiki. German: Psychologie)

1.1. What is a psychosocial factor? (1)

A psychosocial factor can be defined as a combination of social environment factors and physiological factors. Placebo effects always occur in a psychosocial context.

2. Placebo effect

2.1. Definition of the placebo effect

In a narrow sense a placebo (Latin. **“I am pleased”**) is a sham drug which does not contain a medical agent, and therefore does not have a pharmacological effect. (German wiki: Placebo) In a wider sense, **medical interventions per se**, like sham surgery or sham acupuncture can also be regarded as placebo.

Placebo effects influence the subjective condition of a person, as well as objectively measurable bodily functions. The cause for these changes can be found in the **symbolic meaning the patient assigns to the treatment**. Such placebo processes **occur in all kinds of treatments**, or more generally, in **all actions of personal life**, not only in sham treatments. (1)

In conclusion, placebo effects are psychological and physical reactions which are not attributable to verum effect, instead they are caused by the **psychosocial context** of the treatment. (1)

The counterpart to the placebo effect is the **„nocebo effect“**. These are unwanted effects, which are based on psychologically similar processes as the placebo effect. (German wiki: Placebo)

Knowledge in the field of placebo effects has increased in recent years. A brief overview of this field shall be given in this chapter.

2.2. The two basal mechanisms – learning and expectations effects

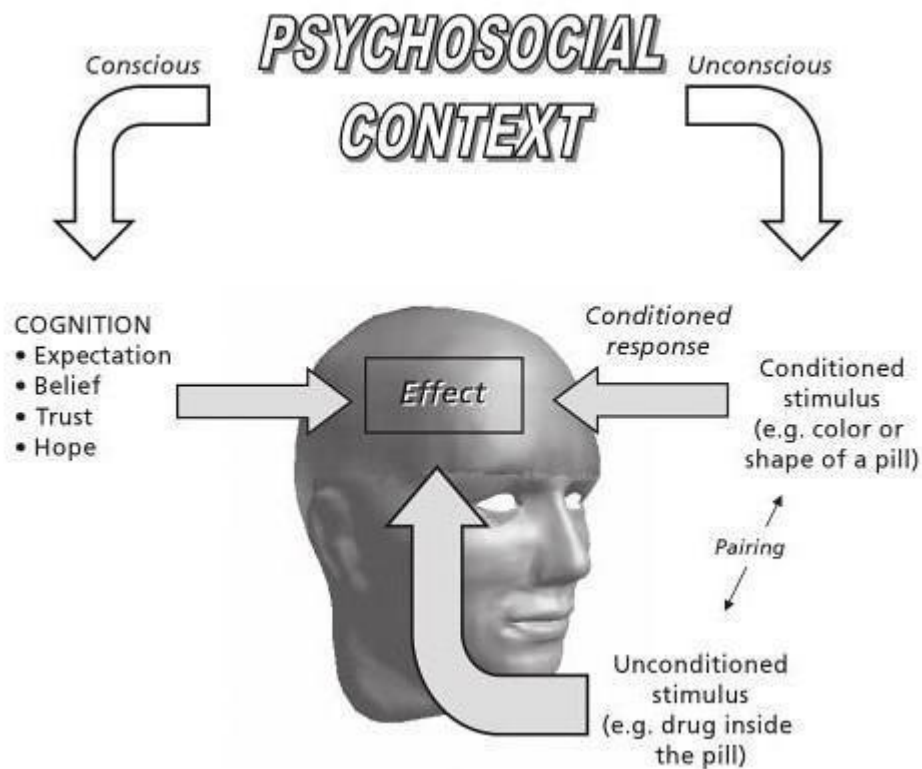
There are two basal mechanisms causing placebo effects.

On the one hand there are **learning effects or conditioning**. Those can work consciously as well as subconsciously. For example: A patient takes antihypertensive medicine for a long time. **Through conditioning** the patient's body has **learned** that the intake of this medicine is followed by a reduction in blood pressure. If the patient takes a placebo tablet instead, the reduction in blood pressure still occurs (at least partially). This is similar to the **Pavlov effect**. **When the dog hears the bell, salivation** occurs automatically, even if there is no food. This effect has been demonstrated experimentally in other animals as well. Schedlowski, for example, used mice to demonstrate this (11). Trebst examined this effect in humans (12).

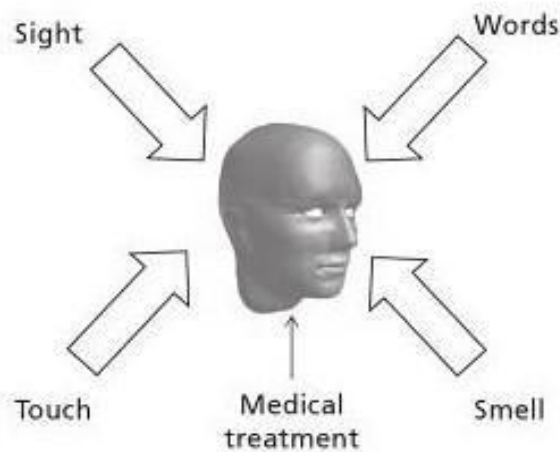
The second mechanism are **expectation effects**. **In contrast to conditioning effects they don't require a learning history**, therefore, expectation effects can **occur in the first treatment session already**.

Placebo effects can be further divided into **unconscious and conscious processes**. Examples for conscious processes are expectations and anticipations the patient has regarding the treatment. Examples for unconscious mechanisms are the size, colour, price and taste of drugs being taken. Large and colourful capsules for example, are more effective than small white tablets. (14)

The following figure illustrates how a psychosocial context influence the placebo effects.

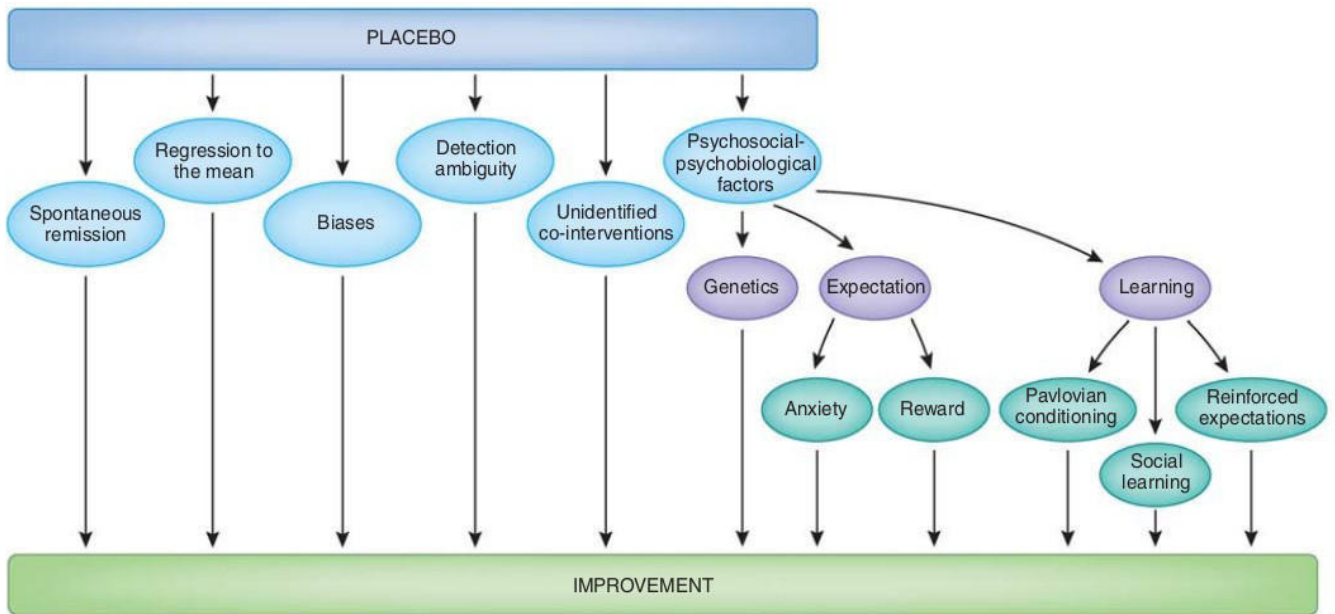


2.3. External and internal factors



Placebos are influenced by **external factors** such as **words, visual impressions**, but also by **touch** and **smell**. In a wider sense, **internal factors** such as **rituals, symbols** and **opinions/attitudes** are important. They cause **changes in the brain** of the patient. The **psychosocial context is crucial** for placebo learning effects. (15) External factors like sight, words, touch and smell influencing the placebo effect. (Source: Benedetti, 2008 (14))

Placebo effects cause different processes in the brain of the patient. The following figure from Benedetti et al. illustrates this. (15)



(Source: (15))

Kontextfaktoren in der Medizin (Di Blasi et al. (28))

Characteristics of the patient: e.g. attitudes and expectations regarding the disease and treatment, anxiety, adherence

Characteristics of the physician: e.g. status, gender, attitudes and expectations regarding the disease and treatment

Doctor-patient interaction: e.g. verbal suggestions, reassurance, empathy **Treatment**

characteristics: e.g. colour, size, and form of the drug **The medical environment:** e.g. patient at home or in a hospital

2.3.1. Rituals and the placebo effect

Rituals are an important cause for placebo effects. In medicine many actions have a ritual value for patients, thus causing placebo effects. The following figures show examples of important rituals in medicine.

The ritual of taking a pill



The ritual of an injection

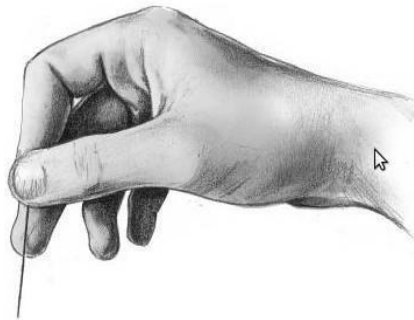




The ritual of surgery



The ritual of using medical devices



The ritual of acupuncture

3. Placebo effects in the brain

Placebos cause a variety of effects in the brain. A brief insight into some of these processes will be given in the following lines.

3.1. Descending pain inhibitory opioid system

This system has its **origins in the cerebral cortex**. It sends neurons to the hypothalamus (**HYPO**) and periaqueductal grey (**PAG**). The PAG is synaptically connected to the rostroventromedial medulla (**RVM**), which in turn has **connections to the spinal cord**. (Source: 14)

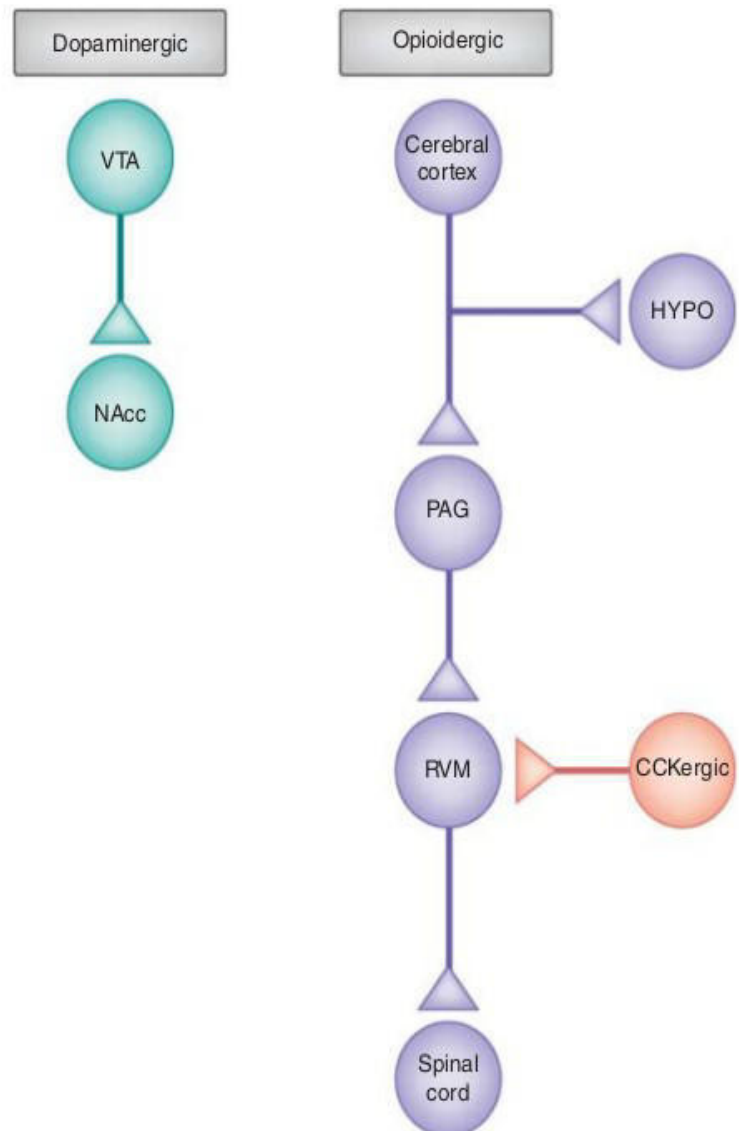
3.2. The dopaminergic reward system

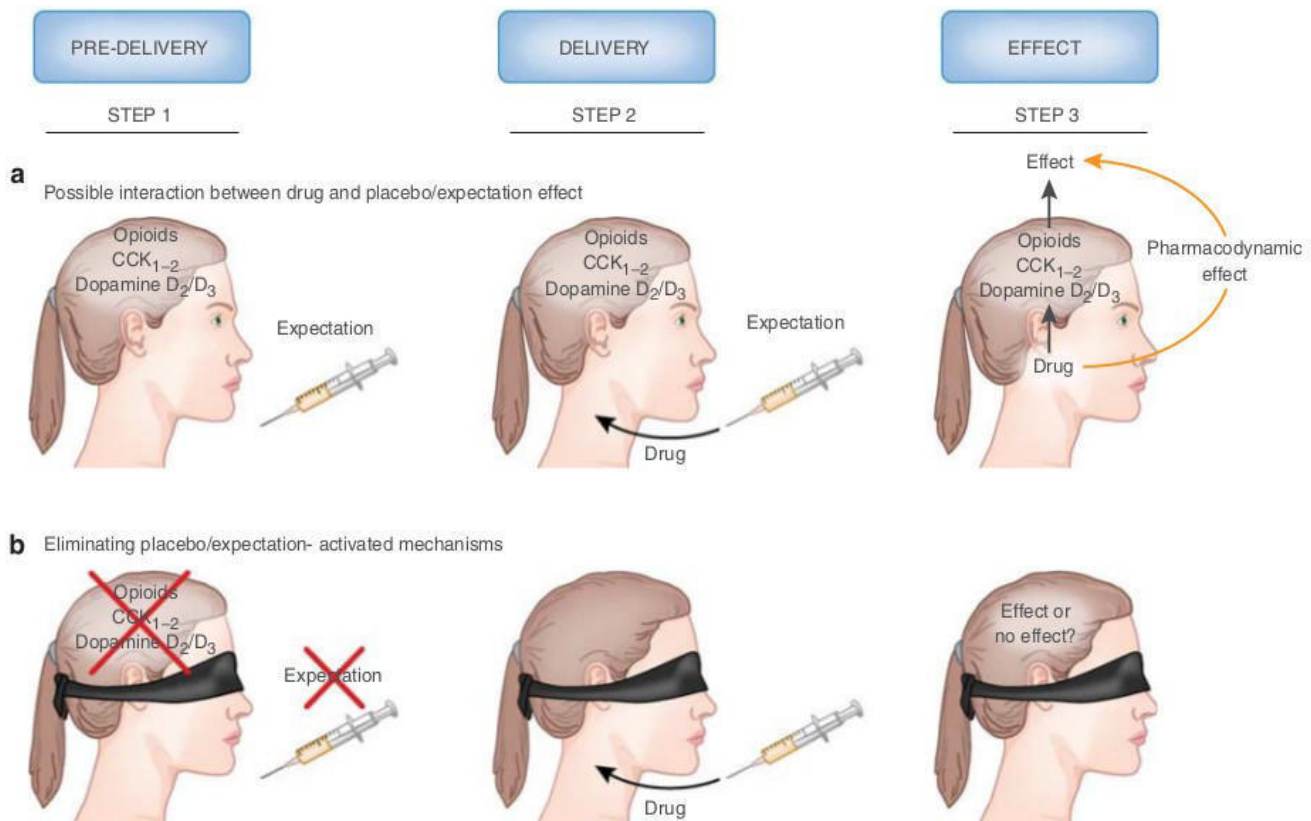
This system has its origins in the ventral tegmental area (**VTA**) and those neurons project to the nucleus accumbens (**NAcc**). (14)

Nocebo effects can antagonize this system. (14)

3.3. The interfering effect of drugs and biochemical processes behind the placebo effect

Under placebo the body produces biochemical substances, such as endogenous opioids, which affects the dopaminergic system. Verum (e.g. the active ingredient in a drug) and placebo effects can influence each other, therefore a simple summation of the two effects would be wrong.



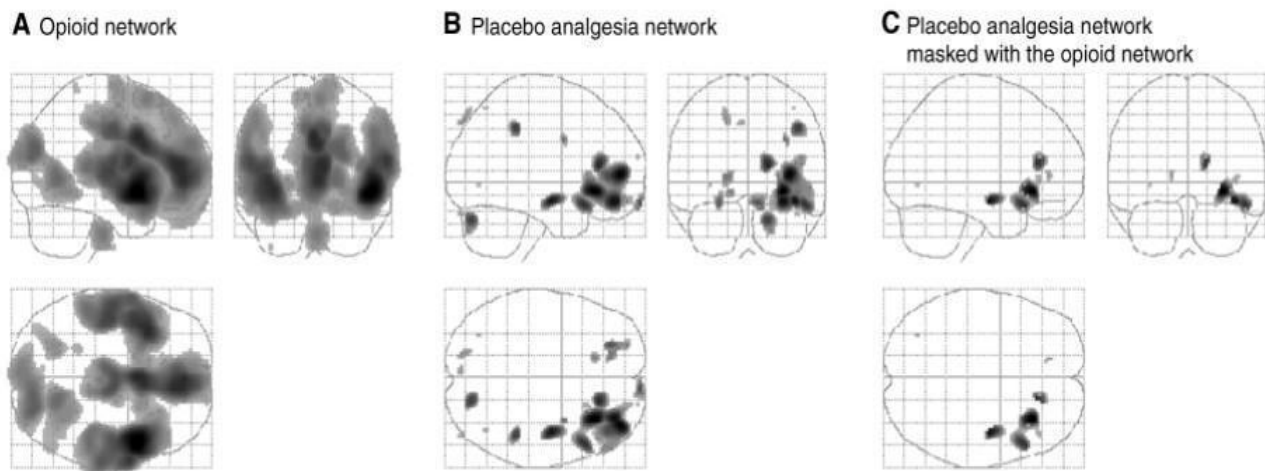


This figure illustrates the effect of drugs on biochemical processes in regard to the placebo effect. When confronted with a syringe, the patient's body produces opioids, dopamine, and cholecystokinin (CCK) due to the placebo effect (**step 1**). Afterwards the drug gets injected. Its ingredients interfere with from the body released substances (placebo) (**step 2 and 3**).

The effect of the drug gets influenced by the placebo effect, and the outcome of the treatment depends on the interactions between these two effects. (Source: 14)

3.4. Petrovic (17) et al. - Effect of placebo on brain areas

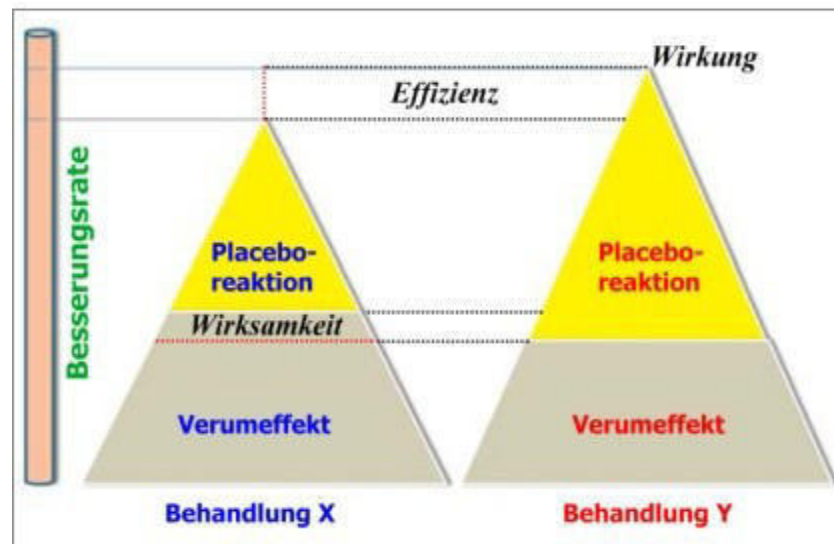
Petrovic et al. found placebo effects in different brain areas by using Positron Emission Tomography. The following figure shows **activation patterns in those brain areas after opioid analgesia**. The rostral anterior cingulate cortex (**rACC**) and the **brainstem** are important structures in opioid analgesia. Opioid and placebo analgesia are associated with increased activity in the rACC, which means that both, the **placebo effect and opioid analgesia, are at least partially connected to the same brain structures**.



4. Effects of treatment – a summation of verum and placebo effect?

4.1. Summation of verum and placebo

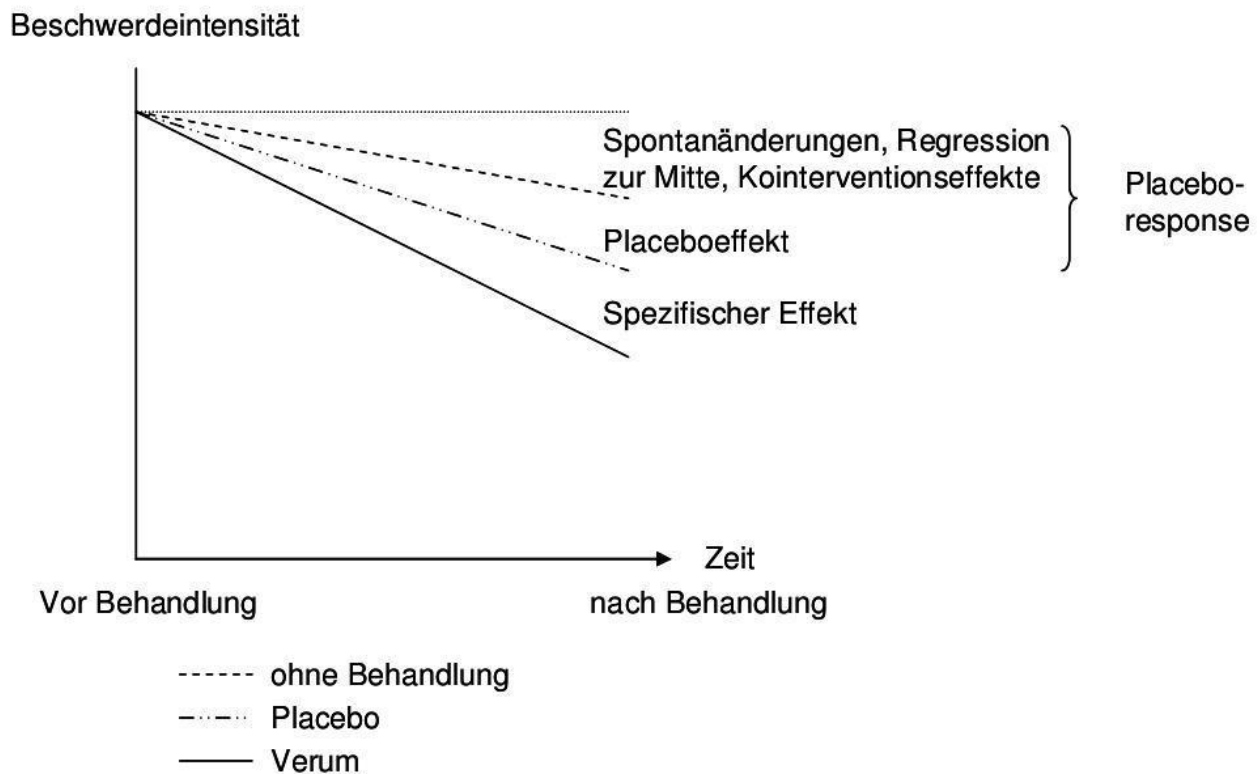
Treatment effects are always based on **verum and placebo effects**. The following figure shows two pyramids representing the **overall effect of a treatment**. The left pyramid shows a greater verum effect than the right pyramid. The overall treatment effect of the right pyramid is higher due to a larger placebo effect.



(source: www.neuraltherapie-blog.de)

4.2. Other distortion effects from studies than placebo

According to Meissner and Linde (27), all too often, all changes occurring in therapy in randomized trials are called placebo effects. As an example, if pain intensity decreases by 40% in a study, all 40% are attributed to placebo effects. **Spontaneous improvement**, **statistical artefacts** (regression to the mean), and **co-interventions** could also be responsible for the observed change. (27) A good example for non-placebo-caused effects are spontaneous improvements. For example, patients with a simple infection of the upper respiratory tract usually cure over a period of two weeks. Those are not placebo effects, they are normal healing effects (spontaneous improvements). (27) In studies spontaneous improvements should be considered statistically. For example, if **symptom severity in patients is stable over a longer period, spontaneous improvements are low**. Untreated control groups may very well show spontaneous improvement effects. (27)



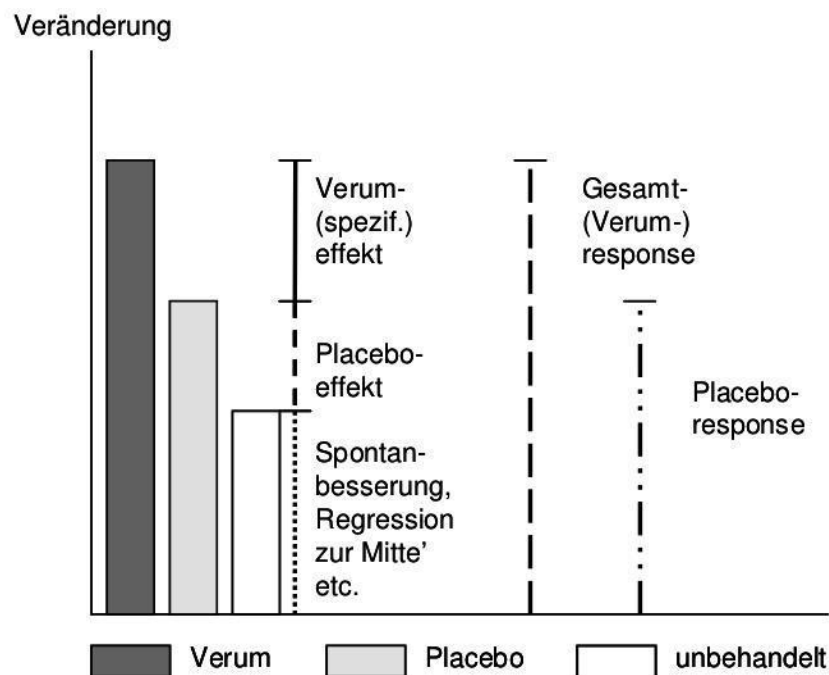
This figure shows specific effects, placebo effects, and „**other reasons for treatment effects**” over time (27). In this figure the sum of placebo effects and other reasons are referred to as „**placebo-response**“.

Another example for spontaneous improvement effects can be found in the paper by Meissner and Linde (27). We can call those effects „excluding bias“. This error is often made, for example, in trials for migraine. In these study designs patients with less than 2 migraine attacks in the baseline phase are often excluded. Since those patients are systematically excluded, the **average frequency** of attacks in the remaining patients is **overestimated**. When the **frequency of attacks is determined in the following months**, it comes in some patients (also **without any intervention**) **to attack free months or months with only one** migraine attack. This means that the corresponding average is **below the average in the baseline** period. (27) To avoid spontaneous improvement effects, patients with low headache frequency should be included as well. Of course the same principle also applies to other diseases. As mentioned earlier, an untreated control group can also make this effects visible. (27)

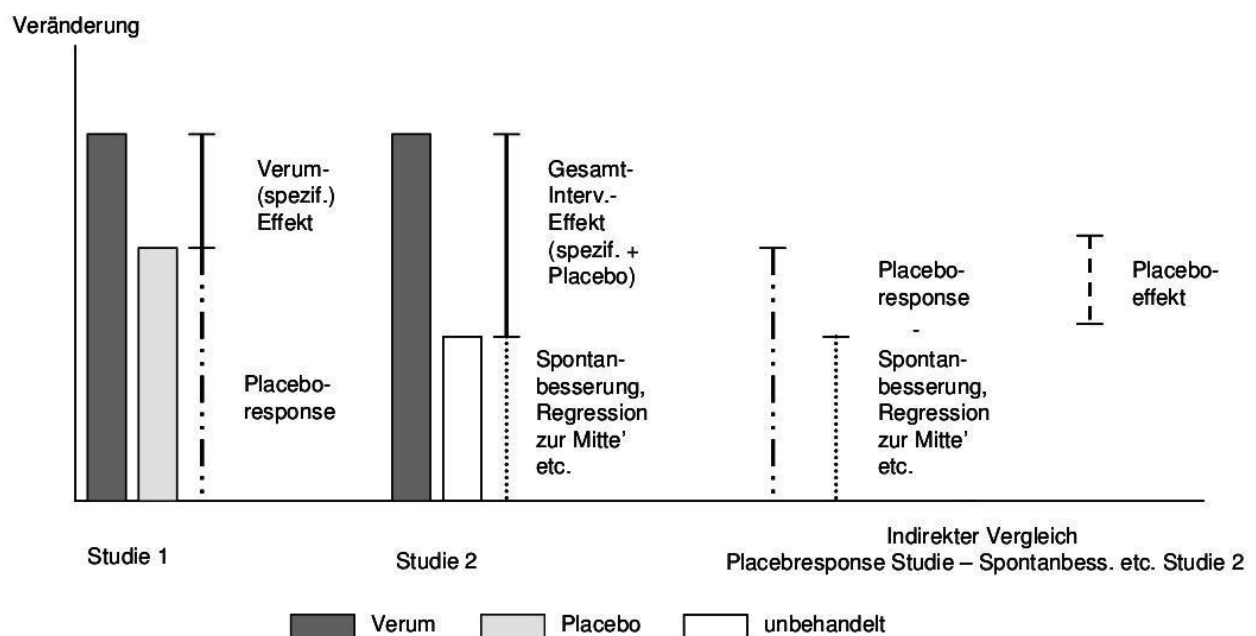
A very important factor for treatment effects in studies about acupuncture is “**social desirability**”(27). For example, a patient **reports an improvement in a survey, despite the fact that he did not feel any, telling** a lie because he does not want to disappoint the questioner. Personal patient surveys are naturally very susceptible to „social desirability“ influences (same by phone). Surveys of patients should be run **completely anonymous**, and without contact between the patient and the interviewer.

4.3. Three-arm studies

To determine placebo effects, **three-arm studies** are the most direct method. These studies include a verum, a placebo, and a control group (untreated group). The principle of this study design is shown in the following figures.



Three-arm study to determine verum and placebo effects. (27)



Three-armed study: Study 1 compares verum to placebo effects, study 2 compares active treatment to an untreated control group; the placebo effect is determined, by subtracting “other improvement factors” (spontaneous improvement, regression to the middle, etc.) from study 1. A two-arm, placebo-controlled study does not allow for a proper investigation of placebo effects. (27)

4.4. Different levels of evidence in studies

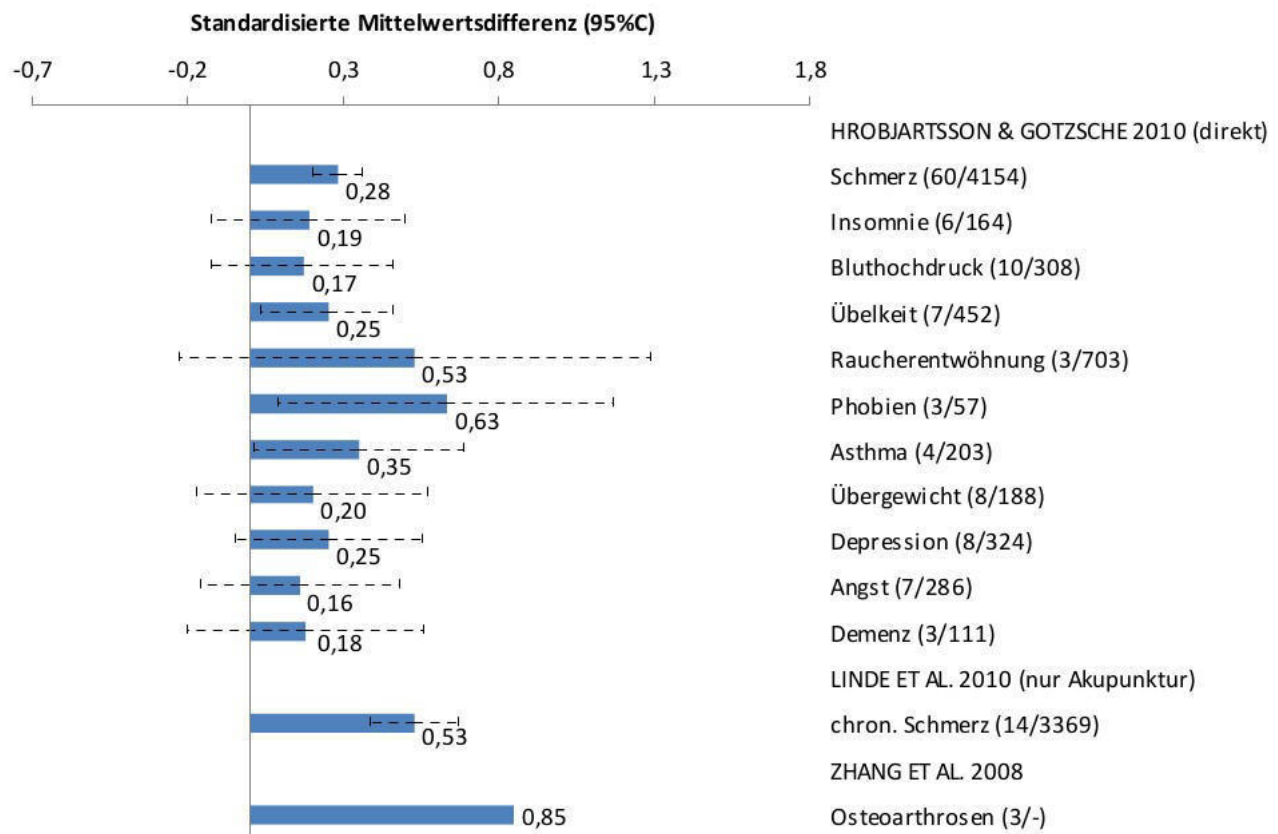
Meissner and Linde (27) distinguish three levels of validity in studies regarding to placebo effects:

- 1) Highest level of evidence: placebo effect sizes are based on direct comparisons between the verum-, placebo- and control-group.
- 2) Average level of evidence: determination of the placebo effect based on meta-analyses, in which a meta-analysis which shows the placebo response is compared to a meta-analysis which shows the response in an untreated control group.
- 3) Lower level of evidence: effect sizes of placebo is based on meta-analysis and the placebo response is compared to the verum response.

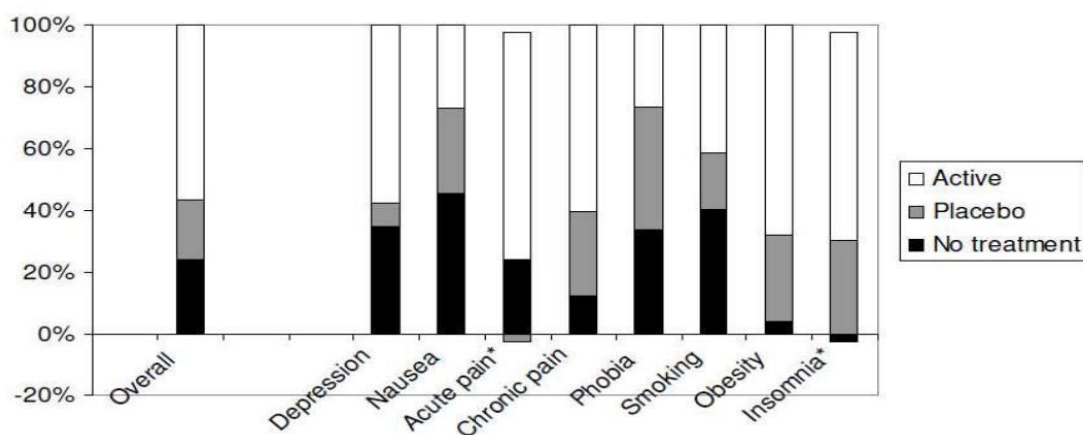
4.5. Meta-analysis of three-arm trials

As already mentioned, the most telling studies about the level of the placebo effect are three-arm trials (verum, placebo, and untreated control groups). Those are usually **very expensive**. **Network meta-analysis** can also quantify placebo and verum effects. In meta-analysis verum, placebo and effects in untreated control groups can be compared (involving similar patient populations) and placebo effects can be determined indirectly (in so far as the data allow this). (27)

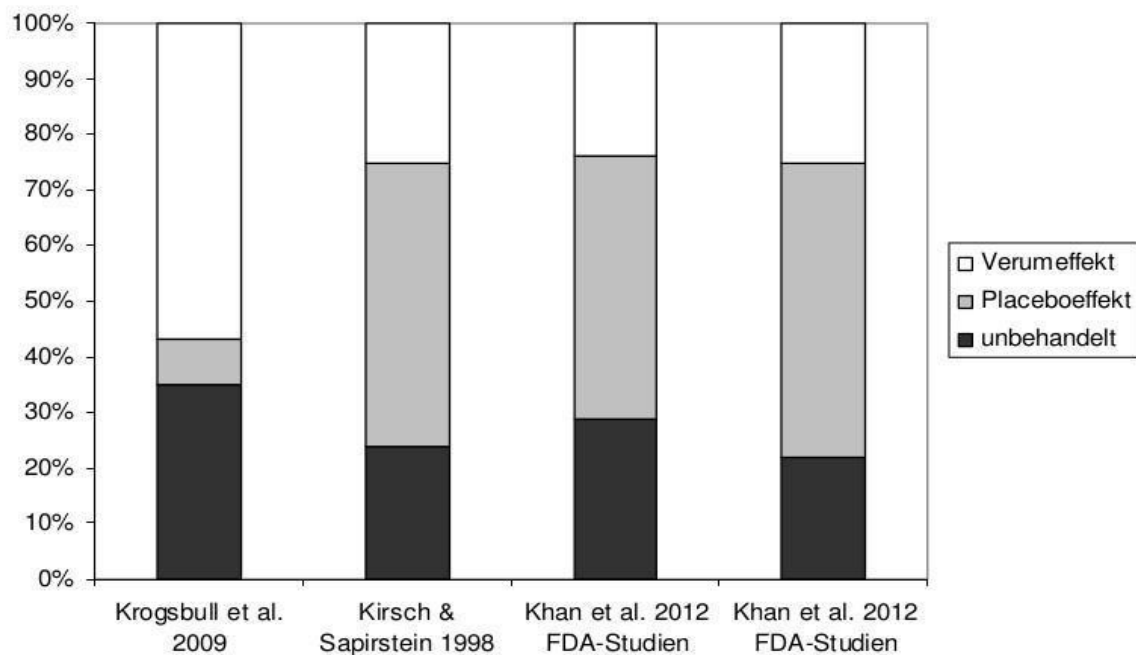
The following figure shows the **size of placebo effects for different diseases**. These are results of meta-analysis carried out by Hrobjartsson & Gøtzsche (29). The values for chronic pain were submitted by Linde et al. in 2010, and the values for osteoarthritis were submitted by Zhang et al. In 2008. (95% CI)



Krogsboll et al. (30) determining **verum**-, **placebo**- and **spontaneous improvement** effects for different diseases. The following figure only shows medical conditions for which at least 3 studies were available. (27)



The following figure shows the percentage of spontaneous improvement, compared to specific placebo effects in studies on **depression**. (27)



The last three pictures show how placebo, verum and “no treatment” effects **can differ widely between different diseases**. According to these authors, the verum treatment effect in **mild to moderate depression only accounts for 20%** of the overall treatment effect. The **verum effect in osteoarthritis seems to be very low as well**. **Pain associated diseases** are in general good influenceable by **placebos**. The **influence on anxiety and dementia** in contrast is relatively **low**. (27)

As described in previous chapters a **variety of factors** influence the characteristic of placebo effects. For example, the nature of the disease is only one of many factors. For every **single person many different factors add up to a total effect**. (27)

According to Meissner and Linde (27) there are currently **too little data** from studies based on the placebo effects, therefore it is currently impossible to determine the exact amount of the placebo effect.

4.6. Other conditions for placebo

The placebo effect is also dependent on the **severity of the considered disease**. Evidence supporting this claim can be found, at least for diseases where pain plays an important role. In six pain reviews Meissner and Linde (27) found indications that **initial higher pain intensity** correlates with **greater placebo response** (insomnia, dyspepsia, sexual dysfunction, irritable bladder, allergy, fatigue in cancer and Crohn's disease).

But the opposite can also be true. Four studies on **depression** indicate that **lower initial depression levels** result in a **higher placebo response**.

Also the **duration of the disease** is one factor which can influence the placebo effect. (27)

To some extent the placebo effect also depends on the **age of the person**. Children and young people with various diseases showed greater placebo response than adults, while in adult populations older people showed a greater response. (27)

Interactions between therapist and patient influence the placebo effect (compare chapter 7.6). Not only the **quality**, but also the **frequency**, of doctor-patient contacts are important (usually **frequent contacts lead to greater placebo response**). (27)

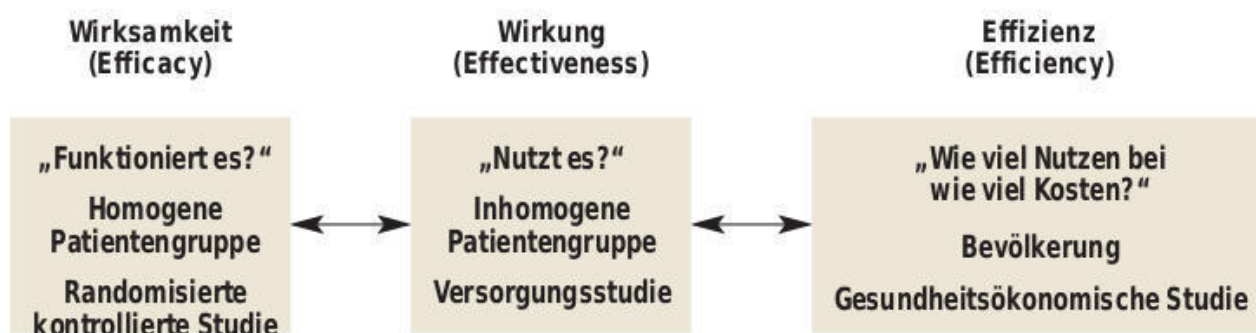
Also the **type of intervention** influences placebo effects. **Injections** usually show **greater placebo effects than tablet intake**. **Physical interventions** are highly effective. In **operations** the **placebo effect can be up to 100%** (compare chapter 7.12). Less placebo effect can be expected for **patients receiving truthful information** about their condition, than for patients receiving more euphemistic information. (27)

According to Meissner and Linde **no placebo effects have been reported in biochemical parameters**. (27)

5. Science and placebo-controlled, double-blind, randomized studies

As mentioned in previous chapters **placebo-controlled, double-blind, randomized (three-armed-) studies are „the gold standard“ for investigations of verum effects in medicine.** The basic principle of this method is very simple. Some of the subjects receive either a verum- (e.g. drug with active substance or a treatment) or a placebo intervention (e.g. drug without an active substance or a sham treatment), while the control group receives no treatment.

It is important to understand that this type of study design (randomized controlled study) is **only the first step for a medical science process.** Randomized controlled studies can scientifically prove the effectiveness of treatments. **Supply-, health supply-, and economic-studies** (these studies examine the economic medical aspects) often provide great benefits. They are **the next step in the scientific process. Medical acts should not be founded solely on the results of randomized controlled trials.** Supply studies and economic studies can enhance the scientific basis. (6) Some treatments in medicine are based purely on placebo effects. How do we deal with these therapies in medicine? There are two possibilities: On the one hand we could argue that placebo treatments are adequate interventions in medicine, because to the patient only the end result matters. In this point of view further supply studies and health economic studies should be carried out. On the other hand, if one believes a pure placebo effect is **morally unacceptable**, appropriate actions should be taken in this direction. But the best way to handle placebo effects can also lie between these two opinions.



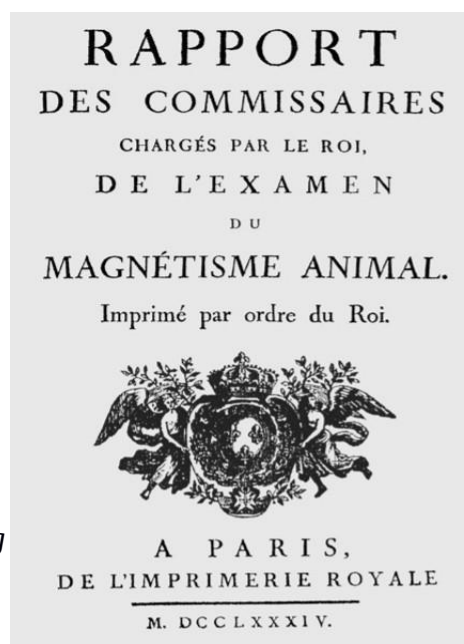
This figure shows three different questions (efficacy, effectiveness and efficiency) in medical scientific research. (6)

6. Placebo controlled studies – historical background

6.1. The first psychological study concerning the placebo effect, Benjamin Franklin 1784 (3)

Franz Friedrich Anton **Mesmer** (1734-1815) was a **German healer**, and the founder of the theory of animal magnetism, also called „**mesmerism**“. His efforts in finding a scientific explanation for „mesmerism“ made him a **pioneer of parapsychology**.

The following lines from a work of Mesmer give an impression of his ideas: „*Hat man sich vorläufig darin sichergestellt, so berühre man beständig die Ursache der Krankheit, unterhalte die symptomatischen Schmerzen bis man sie in kritische verwandelt. Hierdurch unterstützt man die Anstrengung der Natur gegen die Ursache der Krankheit, und führt sie zu einer heilsamen Krise, das einzige Mittel, von Grund aus zu heilen.*“ „*If you are provisionally sure, you constantly touch on the cause of the illness, maintaining the symptomatic pain until it gets transformed into critical pain. By doing that, you support the efforts of nature against the cause of the disease, turning it into a salutary crisis, the only way to heal from the ground up.*“ (German wiki: Anton Mesmer; Animalischer Magnetismus) Mesmer claimed that there is some kind of “fluid” in the body, and **he was able to influence this fluid from a distance**. The King of France wanted to assess the correctness of Mesmer's assertion, so he summoned a committee to investigate this phenomenon. **Some of the best minds of the time** came together, among them **Lavoisier** and **Benjamin Franklin**. The following letter (from the work of Donaldson, 3) was sent to **Lavoisier**:



**To M. Lavoisier,
of the Académie des Sciences**

Versailles, 2 April, 1784.

The King has chosen you, Sir, to proceed with several other persons distinguished by their enlightenment and their experience to the examination of the method or practice derived from the claimed discoveries of the *sieur* Mesmer, about which the *sieur* Deslon, doctor of the Faculté of Paris agrees to explain. I do not for a moment doubt that you will fulfil this commission with the zeal and attention which it deserves. When MM. the Commissioners have drawn up a detailed report and their opinion, I shall give an account of it to His Majesty.

I am entirely,

Sir,

Your most humble and most obedient servant.

Le Baron de Breteuil

P.S. It was, Sir, the doctors themselves who wished to combine their report and their opinion with the members of the *Académie*.

The committee developed several tests. In one of them, the **subjects were behind a curtain**, when they were told that they were being „mesmerized“. This **information could be either right or wrong** (Mesmer was, or was not, behind the curtain). This test showed that the **success of the treatment was only dependent on the subjects believe, whether they believed they were being „mesmerized“ or not.**

6.2. The St. Petersburg trial – possibly the first study to include a control group (4)

Probably the **first study including a control group was designed** in St. Petersburg military hospital. In this study patients were admitted to an experimental **homeopathic** group, an allopathic group (drugging and bleeding – contemporary standard medical treatment) and an untreated group. The untreated group benefited from baths, tisanes, good nutrition, rest, pills containing white breadcrumbs or cocoa, lactose powder, and salt infusions. This group may have been the first control group in history. **The control group showed better results than the homeopathic and allopathic groups**, meaning that good care was more helpful than the treatments themselves (4)

6.3. The Nuremberg salt test of 1835 – probably the first double blinding study (5)

In 1835 an experiment was designed in Nuremberg to determine the effectiveness of **homeopathy**. A test protocol was designed. **100 vials** were first numbered and then **randomly divided into two groups, each containing 50 vials**. All vials were filled with **distilled snow water**. In 50, of the 100 vials, a **grain of salt was resolved** in the water for homeopathic **treatment**. The **list containing the vial data was kept in secret, so nobody could tell apart pure-water vials from homeopathic vials**. Afterwards the vials were distributed to volunteers. **Three weeks later the subjects were asked if they experienced anything unusual**. There was no difference between the two groups, in terms of „unusual experiences“.

This study is very interesting, because it was the first „modern **double blinded study**“. **It's design was thought out very well, the number of participants was relatively large, good randomization was applied, a control group receiving placebo was used, the trial was double blinded, comparative statistics of the results were compiled, irregularities were carefully recorded.** (5)

7. Recent studies on the placebo effect

7.1. Vase et al. (18) – A comparison of placebo effects in clinical analgesic trials versus studies of placebo analgesia

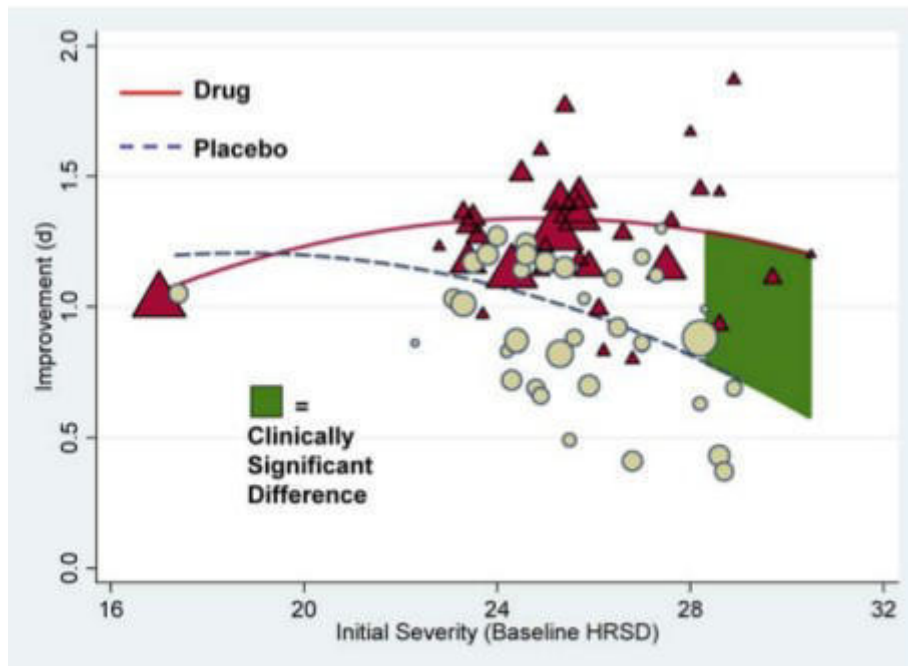
In a **meta-analysis** Vase et al. investigated placebo effects in clinical analgesic trials to placebo analgesia trials. They compared 23 clinical studies, in which **placebos were only used for control**, to **14 studies investigating placebo analgesic mechanisms**. Those 14 studies **showed a much higher placebo effect (mean effect size=0.95)** than the first 23 studies (mean effect size=0.15), so the effect was **about six times higher**. The significance for this meta-analysis was very high (**P=0.003**). The authors concluded that the **difference in effect size is a result of different judgements of the patients in different study designs**, which means that a combination of suggestion and conditioning enhances the placebo effect.

7.2. Kirsch et al. (31) – Placebo, SSRIs and psyche

A meta-analysis by Kirsch et al. included 47 clinical trials, in which the effects of **antidepressants (SSRIs)** were examined. The following figure shows the effect (change) of verum medication and placebo treatment. According to this, the treatment effect is mostly attributable to the placebo effect.

Drug (Manufacturer)	Drug						Placebo					
	Protocol Number ^a	Baseline	Change	<i>d</i>	[95% CI] <i>d</i>	<i>N</i>	Baseline	Change	<i>d</i>	[95% CI] <i>d</i>	<i>N</i>	
Fluoxetine (Eli Lilly and Company)	19 [27]	28.6	12.5	1.44	[0.79, 2.09]	22	28.2	5.5	0.63	[0.17, 1.10]	24	
	25	26.2	7.2	0.83	[0.24, 1.41]	18	25.8	8.8	1.03	[0.50, 1.56]	24	
	27 [28]	27.5	11	1.15	[0.96, 1.34]	181	28.2	8.4	0.88	[0.69, 1.06]	163	
	62 (mild) [29]	17	5.89	1.02	[0.88, 1.16]	299	17.4	5.82	1.05	[0.71, 1.38]	56	
Venlafaxine (Wyeth Pharmaceuticals)	62 (moderate)	24.3	8.82	1.13	[0.98, 1.27]	297	24.3	5.69	0.72	[0.39, 1.05]	48	
	203 [30]	25.6	11.2	1.37	[1.19, 1.55]	231	25.3	6.7	0.82	[0.58, 1.06]	92	
	301 [31,32]	25.4	13.9	1.77	[1.36, 2.17]	64	24.6	9.45	1.20	[0.91, 1.50]	78	
	302 [33]	25	11.9	1.16	[0.84, 1.49]	65	24.4	8.88	0.87	[0.60, 1.14]	75	
	303	23.6	10.1	1.27	[0.94, 1.59]	69	24.6	9.89	1.24	[0.94, 1.54]	79	
	313 [34,35]	25.7	11	1.34	[1.16, 1.52]	227	25.4	9.49	1.15	[0.85, 1.45]	75	
	206 [31,36]	28.2	14.2	1.45	[1.02, 1.89]	46	28.6	4.8	0.43	[0.12, 0.74]	47	
	Nefazodone (Bristol-Myers Squibb)	03A0A-003 [37]	25.4	9.57	1.15	[0.90, 1.41]	101	25.9	8	0.92	[0.59, 1.26]	52
03A0A-004A		23.4	8.9	1.17	[0.97, 1.38]	153	23.5	8.9	1.17	[0.88, 1.47]	77	
03A0A-004B [38]		25.3	11.4	1.41	[1.18, 1.63]	156	25	9.5	1.17	[0.87, 1.47]	75	
030A2-0004 / 0005		23.4	10	1.31	[0.99, 1.63]	74	24	9.84	1.27	[0.94, 1.59]	70	
	030A2-0007 [39]	25.7	12.3	1.42	[1.20, 1.63]	175	26.4	9.8	1.11	[0.74, 1.49]	47	
	CN104-002	23.3	10.8	1.36	[0.99, 1.73]	57	23.1	8.2	1.03	[0.70, 1.36]	57	
	CN104-005 [40]	24.5	12	1.51	[1.20, 1.83]	86	23.3	8	1.01	[0.75, 1.27]	90	
	CN104-006	23.8	10	1.34	[1.03, 1.65]	80	23.5	8.9	1.20	[0.90, 1.49]	78	
Paroxetine (GlaxoSmithKline)	01-001	28	13.5	1.67	[0.99, 2.34]	24	27.4	10.5	1.30	[0.71, 1.88]	24	
	02-001 [41,42]	26.6	12.3	1.28	[0.89, 1.66]	51	25.9	6.8	0.70	[0.39, 1.01]	53	
	02-002 [43,44]	25	10.9	1.23	[0.78, 1.69]	36	24.9	5.8	0.66	[0.27, 1.04]	34	
	02-003 [45]	28.6	9.7	0.93	[0.50, 1.35]	33	28.9	7.2	0.69	[0.29, 1.08]	33	
	02-004 [46]	28.9	12.7	1.87	[1.29, 2.44]	36	27.3	7.6	1.12	[0.70, 1.54]	38	
	03-001 [47,48]	24.9	10.8	1.60	[1.11, 2.09]	40	24.8	4.7	0.69	[0.33, 1.06]	38	
	03-002 [49,50]	24.9	8	1.14	[0.72, 1.55]	40	25.6	6.2	0.88	[0.50, 1.26]	40	
	03-003	25.7	9.9	1.18	[0.76, 1.59]	41	27	10	1.19	[0.78, 1.60]	42	
	03-004 [51]	27.6	10.4	1.33	[0.86, 1.79]	37	27	6.7	0.86	[0.46, 1.25]	37	
	03-005 [52]	26.1	10	0.99	[0.60, 1.39]	40	26.8	4.1	0.41	[0.08, 0.73]	42	
	03-006 [53]	29.7	9.1	1.11	[0.69, 1.52]	39	28.7	3	0.37	[0.02, 0.71]	37	
	PAR 09 [54]	25.2	9.1	1.28	[1.15, 1.41]	403	24.5	8.2	1.14	[0.77, 1.50]	51	
	UK 06 [55]	23.7	6	0.97	[0.38, 1.57]	19	24.2	6.2	0.83	[0.31, 1.35]	22	
	UK 12	22.8	9.1	1.23	[0.57, 1.88]	19	22.3	6.7	0.86	[0.00, 1.73]	10	
	UK 09	26.8	8.8	0.80	[0.26, 1.35]	20	25.5	4.5	0.49	[0.01, 0.97]	21	
	PAR 07	30.5	13.1	1.20	[0.38, 2.03]	13	28.3	10.9	0.99	[0.19, 1.79]	12	

The following figure shows correlation between the strength of depression and the weighting of placebo and verum effects. The intensity of depression was measured according to the **Hamilton Rating Scale for Depression (HRSD)**. The scale ranges from **0-66**. A value of 0-7 indicates that the patient is without depression. Values of 20 or higher represent a moderate, severe, or very severe depression. The figure shows how **a verum effect is detectable above 20 HRSD of depression**. **The more severe the depression, the greater the verum part, and conversely, the lower the placebo effect**. In general though, the **verum part is very low**.



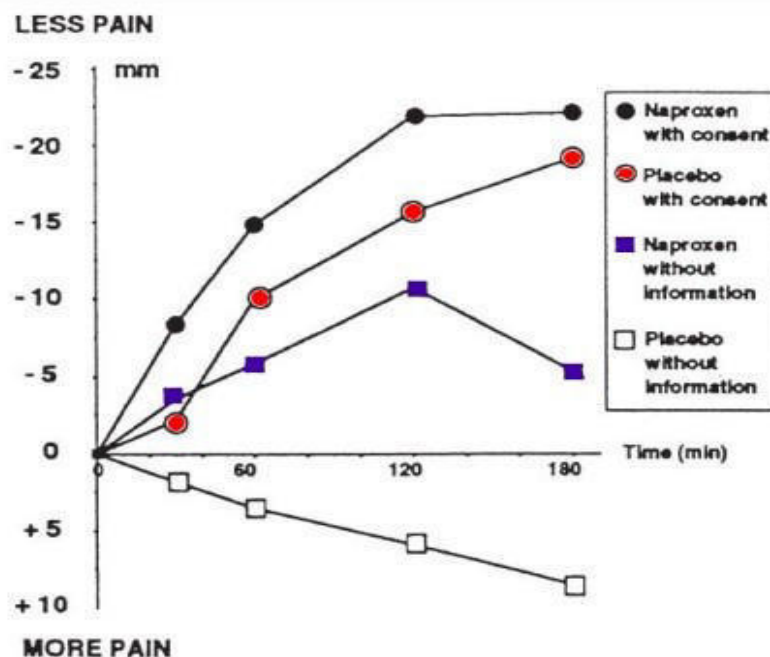
In conclusion of this meta-analysis: the authors conclude that the effect depends on the severity of depression, but even for severe depression, the effect is relatively small. The **majority** of the **effect** stems from **placebo effects**.

7.3. Sox et al. (19) - Placebo effects in diagnostic tests

Sox et al. tested 176 patients suffering from **non-specific chest pain**. Subsequently they divided the patients into two groups. The first group obtained an electrocardiogram, and the serum creatine phosphokinase values were determined (**test group**). For the second group, no tests were carried out (**no-test group**). After this intervention **20%** in the test group reported a "short-term disability". In contrast, in the no-test group **56%** of patients observed a „short-term disability“ ($p = 0.001$). In conclusion, these results indicate that the diagnostic tests were an independent predictor of recovery. Supervised patients felt better ("better than usual") in the treated group (57%) compared to the no-test group (31%). (19)

7.4. Bergmann et al. (7) – the influence of information as part of a treatment

Bergmann et al. investigated the effect of **naproxen** and placebo in a double blind study on 49 volunteers with **cancer pain**. One group was informed about the medication, while the other group **received, either the medication or the placebo, without any pre-treatment discussion**. After 30, 60, 120, and 180 minutes the pain intensity was determined employing the visual analogue scale of pain. The following figure shows the results. The informed group showed significantly better results in the placebo, as well as the treatment group. In the informed group about three-quarters of the treatment effect were caused by placebo. In conclusion: the informed placebo group benefits more than the uninformed verum group.



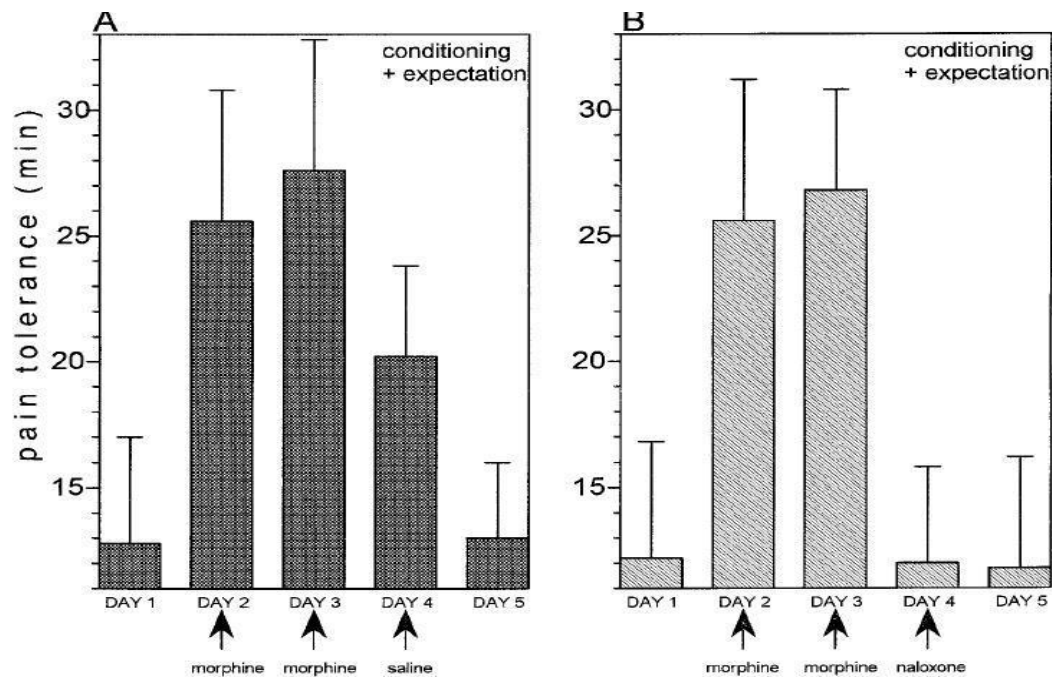
7.5. Amanzio et al. (20) – Placebo can also be a learning process

Amanzio et al (20) investigated the **activation of endogen opioids by placebo** analgesia in 229 patients. They caused ischemia **in the arm** (tourniquet technique) by producing a tourniquet (300 mmHg) in the forearm. After the intervention the probands performed an exercise using a forearm exerciser (12 contractions, 2 sec of pressure, followed by 2 sec of rest). In order to examine the placebo effect, the subjects received **either the opioid agonist morphine hydrochloride, the non-opioid ketorolac tromethamine (NSARD, a COX-inhibitor), or naloxone**.

The following two figures show the effects of morphine, naloxon, or saline administration on 5 different days.

A) After administration of morphine on day 2 and 3 a saline injection followed, but the volunteers believed it was morphine. This intervention caused a **strong effect in the saline group due to conditioning** („mimics the morphine“) **and expectation effects**.

B) After administration of morphine on day 2 and 3 a naloxone injection followed. This injection suppressed those endogen placebo opioid effects.

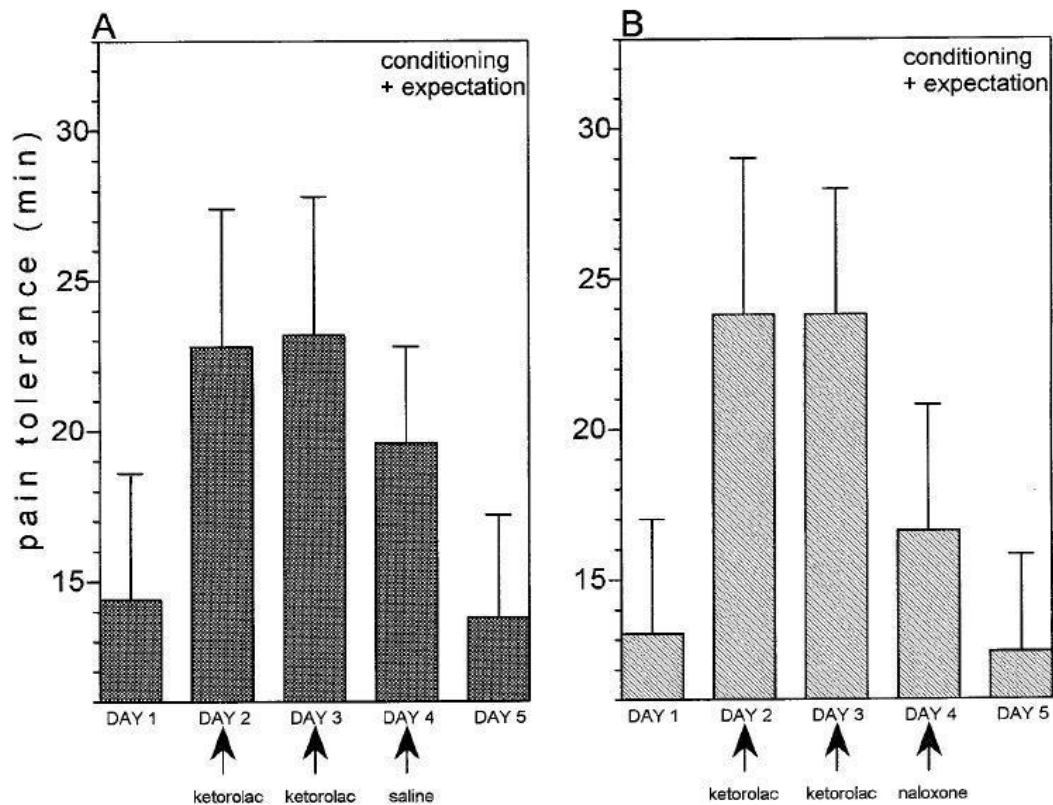


- C) After administration of morphine on day 2 and 3 a saline injection was given. However, the patients were told that this intervention would involve antibiotics. The effect was not as great as in A), but it was still present. **The effect was largely based on conditioning effects, not on expectation effects.**
- D) A naloxone injection, with patients believing its antibiotics, suppresses the morphine conditioning effect.

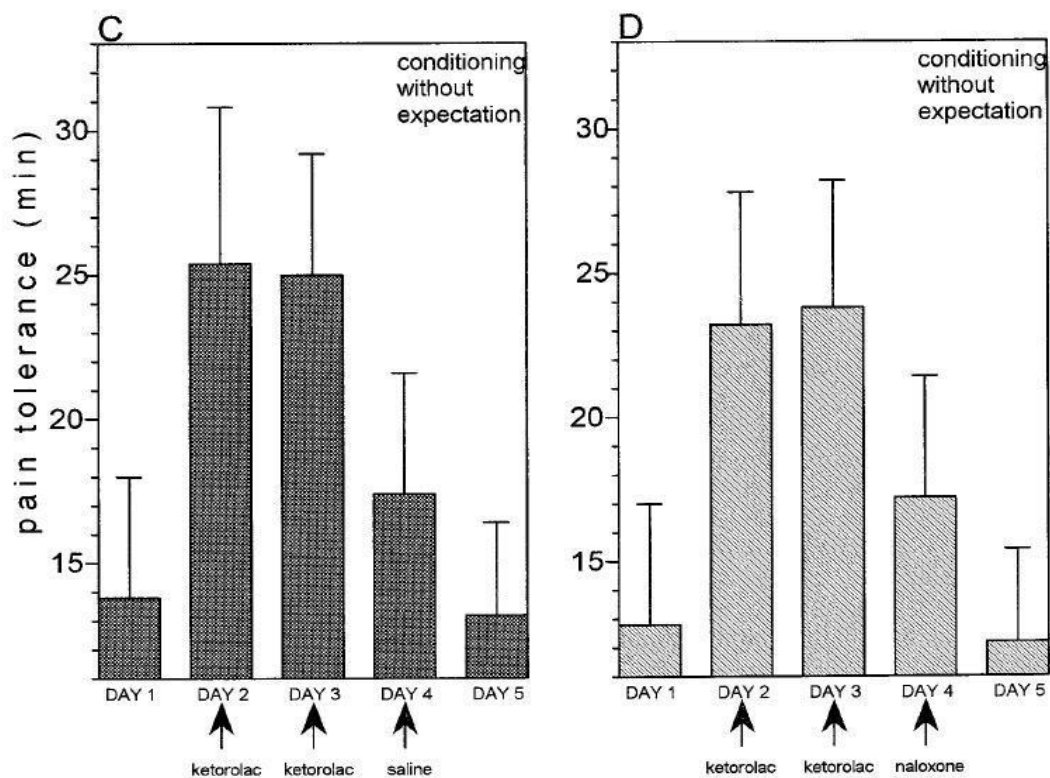
The following two figures show the effects of morphine, naloxon, or saline administration on 5 different days.

A) After administration of ketorolac on day 2 and 3 a saline injection followed, but the volunteers were told it was ketorolac. This caused a strong effect in the saline group, due to **conditioning** („mimics the morphine“) **and expectation effects.**

B) After administration of ketorolac on days 2 and 3 a naloxone injection followed. This injection only suppressed the expectation effect, but not the conditioning effect (partial suppressing effect).



- C) After administration of ketorolac on day 2 and 3 a saline injection followed, but the volunteers were told it was antibiotics. **The response was similar with the ketorolac response.**
- D) After administration of ketorolac on days 2 and 3 a naloxone injection followed, and the subjects were told it was antibiotics. There was no supressing effect and the values were just as high as in group C on day 4.



In this study, 262 patients with **irritable bowel syndrome** were randomized into three groups: Six weeks of observation in the **waiting list**, six weeks of **sham acupuncture** (with **Streitberger needle** at non-acupuncture points) **without care of the therapist** ("limited interaction"), **six weeks of sham acupuncture with strong positive therapist attention** (long time attention, active attention and empathy, positive conclusions about the effectiveness of acupuncture,...)

This study brought the following results:

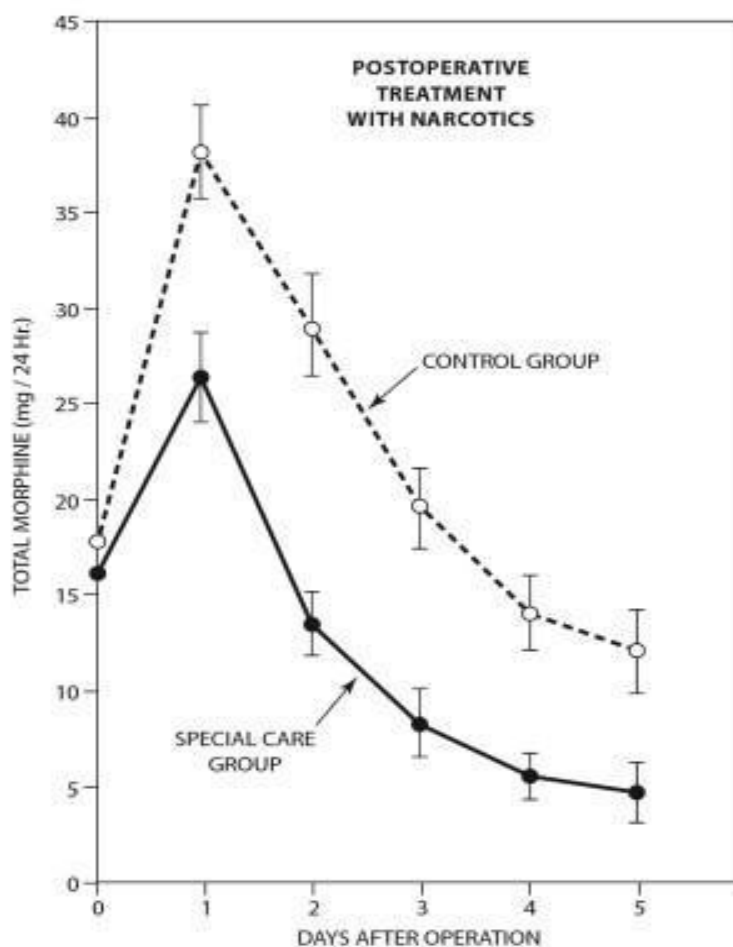
After three weeks the global improvement scale showed a value of 3.8 (SD 1.0) for the waiting list vs. 4.3 (SD 1.4) for the „limited“ vs. 5.0 (SD 1.3) for the „augmented“ group. The **relief pattern** was **28% for the waiting list, 44% in the limited group, and 62% in the augmented group**. The symptom severity score showed 30 vs. 42 vs. 82 respectively. The quality of life was 3.6 vs. 4.1 v s. 9.3 for these groups. Through statistical analysis a correlation coefficient $P < 0.001$ was obtained for all groups.

This study differentiates and quantifies three important “ingredients” of so-called placebo effects: The positive response to observation and study participation (Hawthorne effect).

1. The spontaneous improvement under observation.
2. The effect of a strong, positive, doctor-patient interaction. (8)

7.7. Egbert et al. (9) – abdominal surgery and interaction with therapist

In this study 97 patients were included after going through **intra-abdominal surgery**. The patients were divided into two groups. **One group** received **no information, regarding pain after surgery**. The **second group, the “special care” group**, was **informed about pain after surgery**, the intensity of pain, as well as the location and duration of pain. On the day after surgery the patients in the „special care group“ were given the following information: their pain is based on muscle spasms and can be influenced by relaxation (those patients received more advice than the others). The analgesics (morphine) consumption was measured for all patients during the next two days. The following figure shows the amount of analgesics consumed by the control group, as well as the “special care group”. These results show a **morphine reduction of approximately 50% for the „special care group“**.



7.8. Luparello et al. (10) – Asthma and paradox placebo effects

20 patients with **asthma** were included in this study. For this experimental setup they used two different drugs: isoproterenol, which **extends the bronchi**, and carbachol, which **narrows the bronchi**. Carbachol usually leads to aggravation of asthma.

The patients were divided into four groups:

- 1) In the first group the subjects received a bronchodilator (isoproterenol), and were told they would be inhaling a bronchodilator.
- 2) The second group also received a bronchodilator, but they were told they would be inhaling a bronchoconstrictor.
- 3) The third group received a bronchoconstrictor (carbachol), and they were told they would be inhaling a bronchoconstrictor.
- 4) The last group received a bronchoconstrictor, but they were told they would be inhaling a bronchodilator.

After administration the lung volume and air flow was measured for all patients. The outcome was calculated using the following formula:

$$\frac{\text{Baseline value} - \text{Postdrug value}}{\text{Baseline value}} = \text{percent change}$$

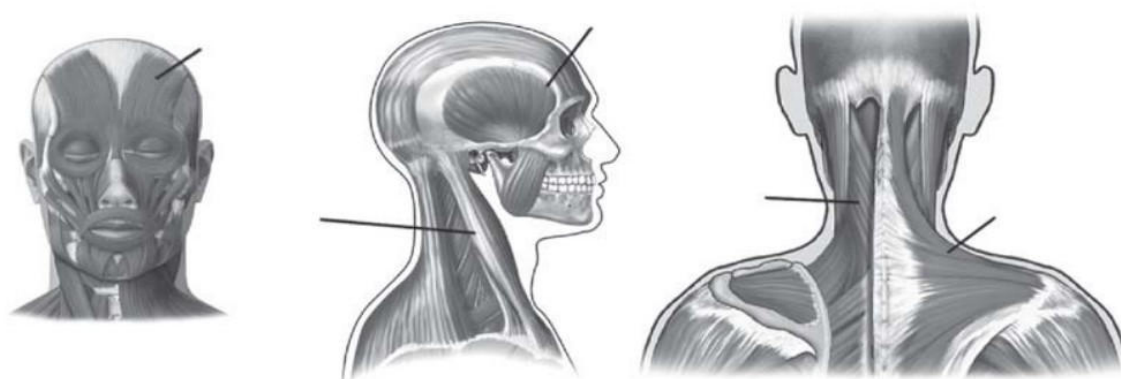
The results are shown in this figure.

Mean change in Ga/TVG from baseline		Comparison of conditions			
Condition	Percent change	Condition	N	T value*	p (two-tailed)
1	+39.6				
2	+20.1	12	20	43 [†]	0.02
3	-22.3				
4	-12.8	34	19 [†]	39 [§]	0.05

The first group (+/+) showed a change of approximately 40%. In the second group (+/-), the given information that a bronchoconstrictor was used, caused a reduction of about 50% of the intervention effects. The third group (-/-) showed a change of approximately -20%. The pure belief, that a bronchoconstrictor was being used (-/+), reduced the effect by about 50%. In conclusion: about 50% of the overall effects are due to placebo effects.

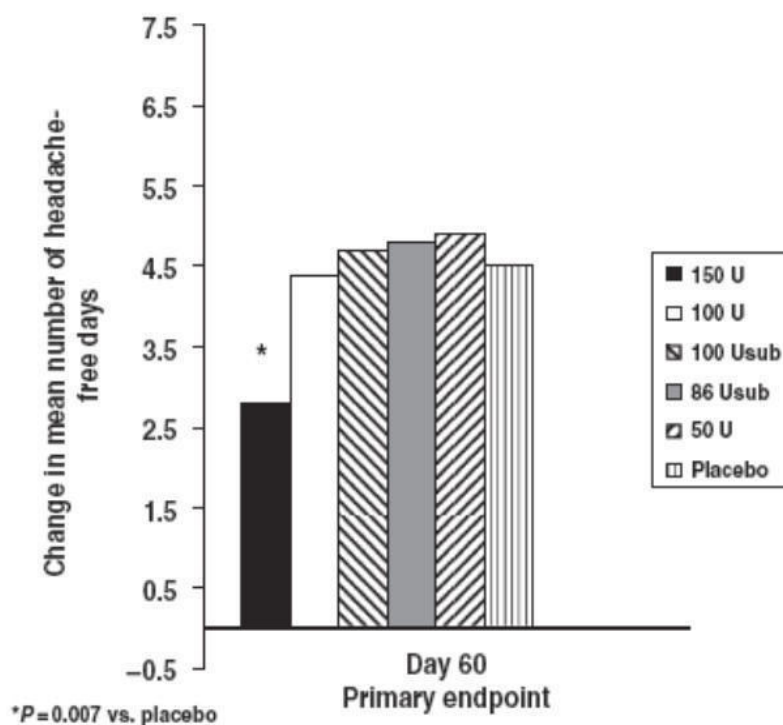
7.9. Silberstein et al. (13) – Tension type headache and placebo

On 300 subjects Silberstein et al. studied the effect of **botulinum toxin type A for the prophylaxis of chronic tension type headache (CTTH)**. These people suffered on CTTH for 14.7 years on average, and the subjects had headaches about 24 times per month. Botulinum Toxin has been used at doses of **0 U (placebo group)** 50 U, 86 Usub, 100 Usub, 100 U, and 150 U. The term „sub“ means that the group received a syringe only in three muscles. In the other groups, the subjects received 10 injections each. In this study only one treatment was performed. The following figure shows the muscles used in this intervention.



After 60 days, the severity of headache was calculated again.

The following figure shows the primary endpoint. You can see the change in mean number of headache days for different groups.



It is interesting that the **placebo group showed the same amount of change as the other groups** (with the exception of 150 U).

7.10. Linde et al. and Bausell et al. (22) - Acupuncture and expectation

Linde et al. (21) investigated the effect of **expectations in acupuncture on 864 patients**. Four randomized controlled trials of acupuncture for migraine, tension-type headache, chronic low back pain, and osteoarthritis of the knee were developed. The patients received either 12 sessions of **acupuncture or minimal acupuncture** (superficial needling of non-acupuncture points) over a period of 8 week.

Before the first intervention, the subjects were asked to **judge the effectiveness of acupuncture, and what their expectations were regarding this treatment**. After three treatments the patients were asked how much confidence they had in the treatment progress.

The patients were divided into two groups. **More sceptical** patients had an odds ratio of **1.67** (95% confidence interval 1.20-2.32). Patients with **higher expectations** had an odds ratio of **2.35** (1.68-3.30). The 6 month follow-up showed similar results. This study shows how expectations have a large influence on the outcome of treatments.

Bausell et al. (22) investigated similar effects. In their study a placebo acupuncture group and a verum group was formed. In both trials, the **pain felt during dental surgery, was measured**. **Between the placebo and the treatment group no statistically significant difference was measurable**. However, **patients who believed that they received real acupuncture, reported significantly less pain**, no matter if they were in the verum, or the placebo acupuncture group.

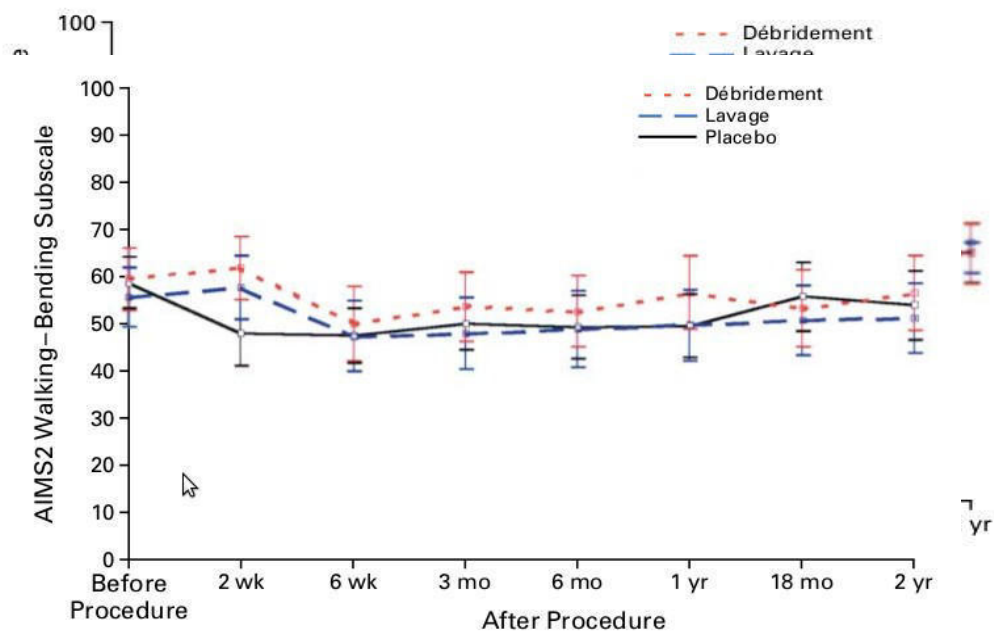
7.11. The German acupuncture trials (23, 24, 25, 26)

The GERAC studies (German Acupuncture Trials) are the **world's largest prospective and randomized studies** on the efficacy of acupuncture. They were carried out in 2002-2007. **Chronic low back pain, chronic pain in osteoarthritis, chronic tension headaches, and chronic migraines** were studied. In all study arms **no statistical significant effects other than placebo** could be detected, but, compared to **conventional treatment, acupuncture showed significantly greater effects (in some cases the differences were very large)**. Acupuncture showed **three times greater effects** for chronic **osteoarthritis pain in relation to daily medication with painkillers and anti-inflammatory agents**. For **chronic low back pain, acupuncture was approximately 1.7 times superior**, compared to conventional standard therapy.

7.12. Moseley et al. (34) - Arthroscopy for osteoarthritis of the knee

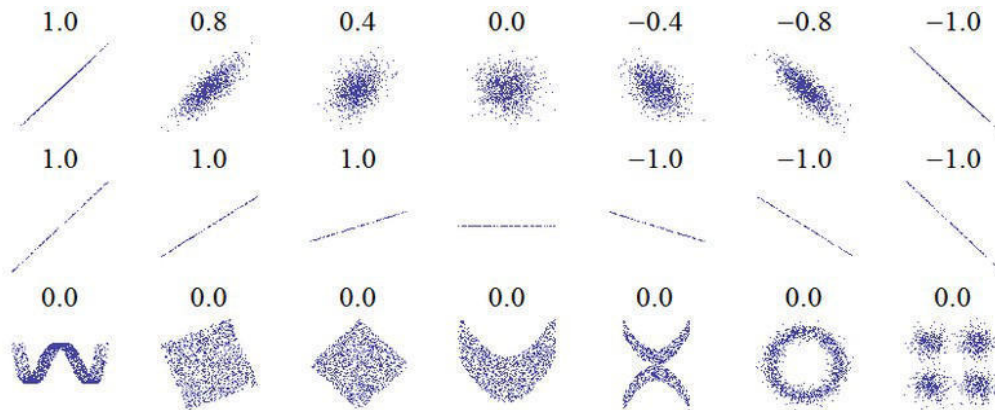
In the study of Moseley et al. 180 patients with **knee osteoarthritis** were included. The patients received either **arthroscopic debridement, arthroscopic lavage, or placebo surgery**. The Patients in the placebo group only received **skin incisions**, without further interventions. The patient, as well as the support staff, did not know which group the patients were assigned to. The Knee-Specific Pain Scale (range from 0 to 100) was used. According to the pain scale, the results were 48.9±21.9 in the placebo group, 54.8±19.8 in the lavage group and 51.7±22.4 in the debridement group. After one year the respective values were 51.6±23.7, 53.7±23.7, and 51.4± 23.

According to those results, **no difference between the groups was found**. The following figure shows the pain values and the walking-bending subscale for these three groups.



8. Statistic basics

8.1. Correlation coefficient (**also called Pearson correlation PCC**) The PCC ranges from -1 to +1. A value of +1 (or -1) indicates a completely positive (or negative) linear relationship between the observed characteristics. A correlation coefficient of 0 means the two characteristics have no linear correlation. As can be seen in the following figure, there can be correlations, which are not detectable with the PCC.



(Source: German wiki: Statistische Signifikanz)

8.2. Statistical significance

In the field of acupuncture studies, if a result is called “statistically significant”, that means that there are differences between the verum-, placebo- and control- group. Those differences have a certain margin of error.

The results in studies can show different p-values (significance level): For example, a significance level of $p = 0.05$ means that the study could be wrong with a probability of 5%. $P = 0.1$ is wrong about 10% of the time and $p = 0.01$ means that the study produces 1% of incorrect results on average.

A p-value of less than or equal to 5% is called „significant“.

A value of $\leq 1\%$ is „very significant“.

A value of $\leq 0.1\%$ is „highly significant“. (Wiki: Deutsch: Statistische Signifikanz)

The term “significant” is often misinterpreted as “strong (deutlich)”. But “significant” in statistics does not mean “strong”, it means „certain (eindeutig) “. Highly significant results are not results showing large effects, instead they are results with a low probability of error. Highly significant effects can be very small, they may even be irrelevant to the patient. The lower the effect of an intervention, the higher the sample size (number of subjects) must be, in order to produce significant results in studies.

The following example helps to illustrate this point: treatments with statins for primary prevention show 345 fatal and non-fatal stroke events in a population of 20.302 people in the treatment group. Additionally they show 442 fatal and non-fatal stroke events in a population of 19.993 people in the placebo group. Those treatment effects are very low, that's why a large number of participants (40.000) is necessary to obtain significant results. (This data was taken from a Cochrane meta-analysis on primary prevention with statins (32)).

A simple example for a study, for which only a few subjects are required to get significant results, would be a strength training study, measuring the strength of subjects in a control group. With only 20 people included, highly significant result can easily be achieved.

Both studies, the statin, as well as the training study, can produce highly significant results. One group needs 40.000 people, where the other only needs 20, because the intervention effects are so different.

In many cases, studies with a low significance level were not published. However, this leads to so-called “publication bias” (incorrect result in meta-analysis). (33) This is also referred to as the „type 1 error“.

8.3. Effect size

The following example should clarify what effect size means: the VAS (visual analogue scale) scale is often used in studies to evaluate pain levels of patients. Usually, the VAS has a range of 1-10. Therefore, the effect size after a treatment can range from 1-10.

8.4. Standardized effect size (SES)

In meta-analysis this term is often used when target values in different studies are measured using different methods. The SES should not be misinterpreted as the RR (relative risk). The values of the SES and RR are often in the same range in meta-analysis, but they define not the same.

As a rule of thumb: a SED of 0 means there's no difference, a SED 0.40 represents a small effect, 0.40 to 0.70 a medium effect, and >0.70 a large effect (Cochrane Collaboration, 2008). (27)

However, the values for small, medium, or large effect sizes, strongly depend on the target values, therefore the SES should only be assessed in the proper context.

8.5. Relative risk (RR = Risk Ratio)

An example for RR: In one study the placebo group has 20% responders, and the control group has 10%. In this case the RR is 2. (27)

The RR in the previously mentioned statin meta-analysis was 0.78. The verum and placebo group included approximately 20,000 subjects. The RR can be calculated as follows: The 345 fatal and non-fatal stroke events in the treatment group get divided by the 442 people in the placebo group.

If the placebo and verum groups are different in sample size, the difference must be taken into account.

A fictional example: in a group of 10,000 smokers, 500 suffer a heart attack. In the group of 50,000 non-smokers, the number of people with heart attack is also 500. The calculation would look like this: $RR = (500 / 10.000) \text{ divided by } (500 / 50.000) = 5$.

8.6. Confidence Interval

A confidence interval describes the probability for a specific parameter value (e.g. an average value) to fall into a given range. A frequently used confidence interval in meta-analysis is 95%. In this case, at least 95% of the measured values, are in the given range. In the previously used statin

example with a RR of 0.78, the 95% confidence interval occupies the range from 0.68 to 0.89. This means that in this meta-analysis 95% of the measured values are between 0.68 and 0.89.

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IV.

The physiology of pain-sensation

Summary and Conclusion of this Chapter:

In a lot of acupuncture studies as well as in therapy pain is a central issue. Therefore, pain processing is explained in detail in this chapter.

Pain is in general a very complex issue. But finally we can state, pain perception (“consciousness”) occurs only in the cerebrum (1.).

The first pain processing takes place in the dorsal horn. The signals are then sent to the brainstem and thalamus. The last station is the cerebrum in which consciousness occurs (3.).

The periaqueductal gray has a high density of opioid receptors and the ability to inhibit pain in the dorsal horn (3.). The periaqueductal gray receives top-down information from the cerebrum (4.). Pain can be modulated by cognitive and affective/emotional processes in the cerebrum brain areas (5). Therefore, sensation of pain is very flexible and has a very individual character.

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1. Pain regulation

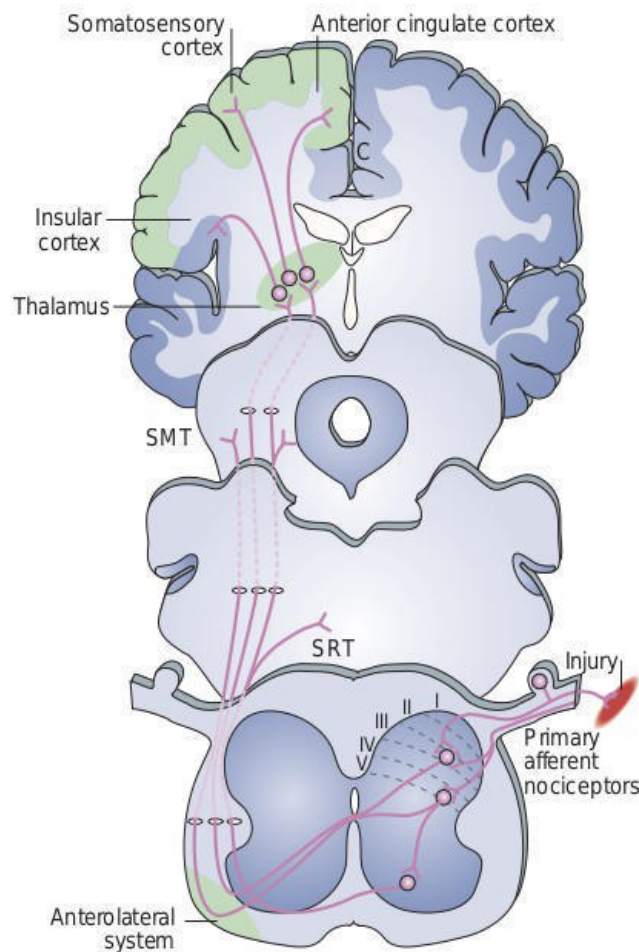
Often it is assumed that pain only depends on an excitation of the peripheral pain receptors. The process leading to the emergence of pain sensation is much more complex of course. For example, initially there are no pain feelings in severe physical trauma. (1) Thus, the body has the **possibility of pain regulation**. Finally, the **perception of pain (“consciousness”) occurs only in the cerebrum**.

2. Pain stimulus uptake in the periphery

As first process in the development of pain nociceptors must be stimulated (except in the case, for example, phantom pain). Such nociceptors are found in the periphery in the skin, skeletal muscles, tendons and joints or in organs. These nociceptors “sleep” to a large extent, which means that they are usually not active. When pain receptors are stimulated, they send signals to the spinal cord or brain stem where this information is processed further. (1)

3. Pain processing in the CNS

The following figure shows the **path of pain processing in the CNS**. In the periphery a nociceptor is energized and sends information to the **dorsal horn**. In the dorsal horn of the spinal cord the **second neuron** is activated by **release of glutamate and peptides**. These neurons send information **up to the thalamus and brainstem**. From there, neurons are activated / inhibited and finally the cerebrum can percept pain. Specifically, the **somatosensory, anterior cingulate and insular cortices** are responsible for these processes (1).



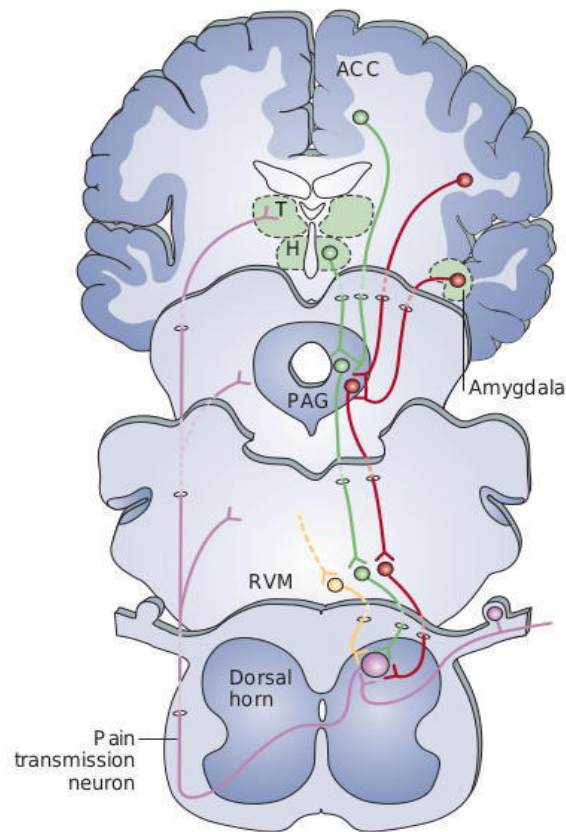
(Source: Fields 2004) SMT, spinomesencephalic tract; SRT, spinoreticular tract. (1)

Reynolds, Mayer and Liebeskind demonstrated in experiments on rats that **stimulation of the periaqueductal gray (PAG) suppresses the pain** avoidance behavior (2, 4). Also in humans caused a stimulation of the PAG a significant pain relief (5, 6). The stimulation of the PAG results in an **inhibition of pain neurons** in the dorsal horn in the spine.

In addition, pain causes an increase of the heart rate, respiratory rate and the release of stress hormones.

4. Pain modulating circuit

The following figure shows the **opioid-sensitive pain-modulating circuit**. It is a **top-down pathway**. Limbic forebrain areas, including the **anterior cingulate cortex (ACC)**, other frontal cortical areas, the **hypothalamus (H)** and central nucleus of the **amygdala project to the midbrain periaqueductal gray (PAG)**. The **PAG has a high density of opioid receptors**. In summary, the PAG therefore can be seen as an output path of the limbic system. The PAG can now inhibit (green) or facilitate (red) areas in the spinal cord. The **target is the dorsal horn** and the **rostral ventromedial medulla (RVM)**. (1)



(Source: Fields 2004)

5. Dimensions of pain processing

- **Motor-vegetative dimension:** the spinal cord, brainstem (muscular and hormonal activities)
- **Sensory-discriminative pain processing:** the lateral thalamo-cortical system
cortical areas: primary somatosensory cortex (SI), secondary somatosensory cortex (SII), insula.
Subcortical areas: the thalamus, basal ganglia, cerebellum, Periaqueductal gray (PAG): Various counter-irritation procedures engage in these regions.
- **Cognitive pain processing:** prefrontal cortex (PFC) and the supplementary motor area (SMA). (PFC: regulation of inhibition of pain and negative emotions, such as regulating the ACC (distraction, increasing the control and anticipation of competence)
- **Affective-motivational pain processing:** limbic system: anterior cingulate cortex (ACC), insula and amygdala (ACC = "neural alarm system") (1)

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V.

Acupuncture Analgesia

Summary and Conclusion of this Chapter:

An important area of acupuncture is the treatment of pain. This chapter should give a short overview of the physiological basis of acupuncture analgesia. When the terms acupuncture and anesthesia are entered in PubMed, the database shows nearly 3000 results (September 2015). For this thesis it is impossible to deal with all the available studies. Nevertheless, there is an attempt to give an objective overview of this topic.

The body has the ability to produce endorphins (1.). This is an evolutionary strategy to control pain in important situations and can be found in all mammals (and also other animals). Endorphins bind to mu-receptors and control pain via top-down processes.

Acupuncture enhances the endorphin level and endorphins can be blocked by naloxone (2.). With acupuncture, endorphin levels are enhanced for 20-30 minutes maximum. The pain threshold can be increased by 20% during this time with acupuncture, which of course also means that the patient still felt 80% of the pain (2.). A longer period than this 20-30 minutes would not make sense physiologically, because when the needle is removed, the body's production of endorphins ends (2.). Therefore, pain reduction for patients cannot be expected for longer periods and this cannot explain effects in acupuncture treatments. A reduction of 20% in medical practice is not particularly high.

The study of Pomeranz and Chiu (1976) is seen by many authors as scientific evidence for the effectiveness of acupuncture. But this is an over interpretation of the results in this study because there is no logical connection between this study and long lasting treatment effects with acupuncture.

Some studies showed no difference in pain reduction between acupuncture points and „non-acupuncture points“, some showed a difference (3., 8.). From a physiological perspective, it makes sense that acupuncture points have a greater potential to reduce pain. Acupuncture points are very pain sensitive and have therefore a greater potential than „normal skin areas“. But every part of the body has an analgesic potential. And as previously mentioned, this potential ends shortly after the needle is removed.

Laser acupuncture showed no analgesic effect (8.). This can be explained by the fact that lasers have a lower potential to stimulate pain receptors compared to needles.

There are some incredible reports from China where operations without conventional analgesia and only with acupuncture were executed (18). Considering the physiological facts this seems impossible, because acupuncture can achieve only a pain reduction (2.). Whenever, it can be used in addition to the conventional analgesia. In reality, the Chinese doctors used a combination of sedatives (18) and local anesthetic injections.

Everyone can test the effectiveness of analgesia by acupuncture on himself. You need only a few acupuncture needles and an acupuncture electrostimulation device. LI-4 and ST-36 are common used points. An operation under this analgesia would not be possible without extreme pain.

But a lot of studies with incredible results are published in Japan and China, where almost 100% positive study results are presented (see chapter: Trustworthiness of Studies) and so, with due respect, they cannot be regarded as objective.

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1. Synthesis, Storage and Secretion of Beta-Endorphins

The word endorphin is a combination of the words “endogenous” and “morphine” and refers to an opioid which is **self-produced** by the body.

Beta-endorphins are primarily synthesized and stored in the anterior pituitary gland, from their precursor protein proopiomelanocortin (POMC).

In the central nervous system **beta-endorphins bind to mu-receptors**. The analgesic effect is caused by a **reduced release of the neurotransmitter GABA. GABA is an inhibitory neurotransmitter**. This leads to an **increased release of dopamine**. Dopamine is associated with the **feeling of pleasure**.

Mu-receptors are mainly found in brain regions that are associated with the **descending pain control** (top-down processes). These include the amygdala, mesencephalic reticular formation, periaqueductal gray matter (PAG) and rostral ventral medulla.

In the **spinal cord**, a pain stimulus is **suppressed by beta-endorphins** when it arrives on the afferent nerves in the spinal cord and is normally switched and routed to the brain. (2)

Endorphin release is a **natural process**, associated with stress and pain. Leonard et al. were able to show that plasma beta-endorphin values correlate with the intensity of postoperative pain. (4)

2. Acupuncture Studies – Endogenous Opioid Release after Acupuncture

A brief overview of acupuncture studies regarding endogenous opioids release is given below.

Many authors dealing with acupuncture analgesia denote the work by **Pomeranz and Chiu (1976)** as groundbreaking. (12) Pomeranz and Chiu found that **electro acupuncture treated mice** showed a **54% latency to squeaking** after a pain stimulus compared to untreated mice. Subcutaneously applied **naloxone** neutralized the effect of acupuncture. After naloxone application the latency reduced even in the non-acupuncture-treated mice (17%). This means that also in non-treated mice a **basal endorphin release** takes place. (1)

A similar study was done by **Mayer et al. (1977)**. In 35 subjects the authors examined the influence of acupuncture on a pain stimulus. The pain stimulus was given by irritating a dental with electricity. An acupuncture point in the area of dorsal interosseous 1 was needled on both sides. According to the authors this point can be considered for analgesia of this tooth. The **pain threshold increased by 20%**. By a dose of **naloxone** the increased pain **threshold could be reversed** briefly. (11)

There are a variety of experimental animal studies which also demonstrate an increased endogenous opioid concentrations by acupuncture. This has been demonstrated both with electro acupuncture and “normal” acupuncture without electricity. Increased opioid concentrations could also be demonstrated in various brain areas. Studies have been realized with sheep, horses, rats and monkeys (13-16). The **results were relatively similar in all studies** concerning the positive analgesic effect from acupuncture. These could be **abolished by antagonists such as naloxone**. In order to give a brief insight into the structure of these experiments, two of these studies are presented below.

3. Bing et al. 1991

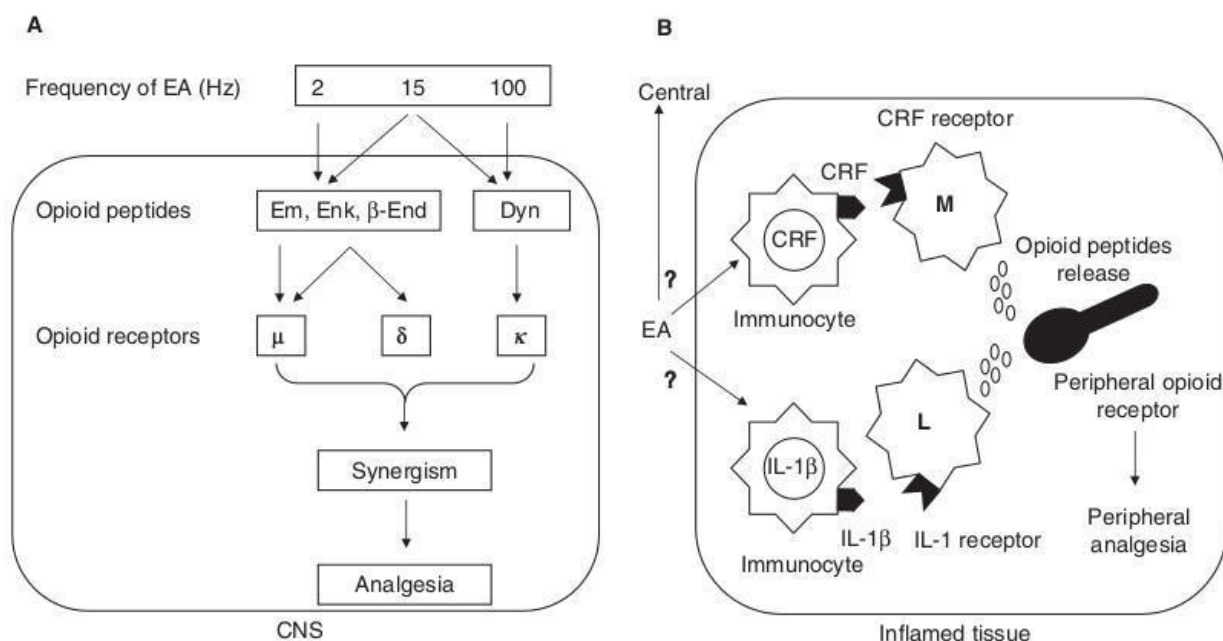
Bing et al. (1991) examined the increase of **Met-enkephalin** values in the **lumbar and cervico trigeminal area** with acupuncture in rats. For this purpose they washed the spinal cord with “artificial cerebrospinal fluid”. The needles were either inserted into a “**non-acupuncture point**” or the acupuncture point “**Zusanli**”. In the **lumbar area no increase** in Met-enkephalin levels was found. In the **cervical trigeminal zone**, the values were significantly **increased**. But there were **no differences** between **acupuncture point** and “**non-acupuncture point**” treatments. (6)

4. Bossut et al. 1986

Bossut et al. (1986) investigated the effect of electro acupuncture on the **plasma beta-endorphin** value in 26 sheep. They used an acupuncture point at the lumbar area (Yao Pang) and one in the thoracic limb area (San Yang). No injurious cutaneous stimuli were applied, using a calibrated pin prick sample, a clamp and a contact heat (75 to 95°C) sample. At seven parts of the body the pain sensitivity was tested before and after administration of naloxone. According to the plasma values, the authors **shared the animals in “good or bad responder” for acupuncture analgesia**. Sheep’s with **higher beta endorphin levels showed better analgesic effects**. There was also a **better analgesic effect** from needling the **San Yang Lu point** compared to the **Yao Pang point**. (8)

5. Acupuncture Anesthesia and Analgesia for Clinical Acute Pain

The following figure shows the different opioid peptides released as an effect of electro acupuncture. This peptides bind to the receptors and result in analgesia.



(Source: Bing et al. 1990)

6. Bing et al. (1990) – Trigeminal convergent neurons

Bing et al. investigated the effect of acupuncture on **trigeminal convergent neurons**. They studied the needling effect of the acupuncture point “Zusanli” (**St 36**), the needling effect of a “**non-acupuncture point**” and the application of a **heat stimulus**. These three different stimuli send impulses via C-fibers to convergent trigeminal neurons. On the trigeminal neurons they received the following values (St 36, non-acupuncture point, heat stimulus): **77.9 +/- 4.4%**; **72.5 +/- 4.6%** and **78.5 +/- 3.6%** inhibition. (5)

7. Borgoin et al. (1986) – Duration of enhanced encephalin values

Borgoin et al., similar to Bing et al. (1990), attempted to determine the met-enkephalin-like values in the lumbar and cervical trigeminal zone. For this purpose they injected **50 μ l of a 10% formalin solution in the nose of rats**. Here, the values in the cervical trigeminal zone increased. After **injection into the hind paw**, an increase of the values in the lumbar area was observed. In both cases the **values increased 5-10 minutes after injection** and were on this **high level for another 5-10 minutes**. (7)

8. Brockhaus et al. (1990) – Laser vs. needle acupuncture

Brockhaus et al. investigated the effect of **laser acupuncture and needle acupuncture** on pain stimuli in humans. A thermal stimulus (43°C on the skin) was applied and the time until the subject perceived the heat was measured. They used the point Hegu (LI 4) for both, laser- and the needle acupuncture. It was found that the **pain threshold was not increased with laser acupuncture**. **Needle acupuncture increased it significantly**. **Needling at point LI4 showed significantly better values compared to needling at “non-acupuncture points”**. (9)

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VI.

Segmental Anatomy and Acupuncture

Summary and Conclusion of this Chapter:

The body consists of different “segmental parts” which are innervated via spinal nerves. And this segmental parts are connected together by nerves.

Wancura differentiates the following segmental parts: the dermatome

- the myotome
- the sclerotome
- and the enterotom (2.1.)

In order to simplify this, we can use the words – skin, muscles, bones and internal organs, instead of dermatome, myotome, sklerotome and enterotome. Skin, muscles, bones and internal organs are connected via the spinal cord. These areas receive nerval „information“(efferents) or send information in the direction to the spinal cord (afferents). In the spinal cord afferents gets cross-linked. From the perspective of TCM we could add, as a fifth factor, the cortex. Therefore, we now have skin, muscles, bones, internal organs and the cortex (psychological area), and all of them are connected to each other.

Looking at the core ideas (“network thought”), the theory of TCM is in line with those of natural sciences. Instead of using concepts like QI or meridians in the TCM, science uses neural structures to connect those systems to each other.

By doing research on fish, Wernøe (1925) showed the relationship between reactions on the skin and correlated reactions on visceral organ. He showed that a visceral irritation causes a cutaneous pigment reaction (and vasoconstriction) (2.5.). Head Zones, MU and SHU points are practical examples, where this cross-linking between internal organs and the body surface can be observed (2.7.).

From a medical perspective there is no dispute that this connection exists. The question is, how it can be used to benefit the patient.

Streitberger shows specific induced central and autonomic nervous system activity during acupuncture (1.1).

A single session of Acu-TENS increased FEV1 (1.24 to 1.37 in the verum compared to 1.39 to 1.41 in the control group) and reduced dyspnoea in patients with chronic obstructive pulmonary disease (1.2.).

Litscher and Schikora found short-term physiological changes by performing laser acupuncture (11). For example, they found specific changes in blood flow velocity in the anterior cerebral artery, and the posterior cerebral artery, by using different laser acupuncture schemes (1.3.).

I could only find a single study examining long-term effects for “segmental acupuncture effects”. It was carried out by Beck (1.4.). She tested the sense of smell and found long-lasting effects on the odour perception after verum laser acupuncture. This is an example of relatively simple basic research in the field of acupuncture leading to new knowledge.

In summary, there is evidence to assume that this “network” is being influenced by acupuncture (at least in some areas). Unfortunately, studies regarding this topic are very rare.

Beissner and Henke investigated methodological problems of acupuncture effects based on fMRI (Functional magnetic resonance imaging). According to the authors, up to 2009, more than 60 studies have been published on this topic. These studies, however, didn't adhere to the same standards that are usually used for fMRI on such brain effects. Because of this, the conclusion must be drawn, that a lot of resources are wasted, bringing no real progress to the field of acupuncture and science.

In my opinion, there is too little basic research in acupuncture and medicine about physiological effects. Many believe, that only with thousands of subjects, valid results can be obtained. But, significant, and therefore progress making results, can often be obtained with small experimental groups already (especially in basic research).

The TCM was created on the basis of observations and experience. The performance of ancient Chinese in some areas deserves a lot of respect, but methods like these are also limiting the state of knowledge. We have a variety of ways to examine these relationships today. We can relatively easily measure the lung volume, oxygen saturation, heart rate, heart rate variability, blood circulation of vessels (measured by ultrasound), etc. Therefore, we can examine the effects of segmental correlations (= “network correlations”). This „network“ interventions don't necessarily require the use of needles, in research, as well as in therapy. Today, various methods exist to influence this “network”. Thermal, electrical, or laser methods may lead to even better results. Some questions according to acupuncture would be relatively easy to answer, if the methods were based on good basic research. Demystification and the creation of a scientific basis on the topics of TCM are important. Creative, scientific thinking is needed, as well as rejecting wrong ideas, adhering to proper methods to gain new insights.

In my opinion the book of Wancura (Segment-Anatomie – Der Schlüssel zu Akupunktur, Neuraltherapie und Manualtherapie, 4) and König and Wancura (Praxis und Theorie der neuen chinesischen Akupunktur. Band 1, 5) have some good suggestions, but in this books there are a lot of scientific unproven statements and over interpretations. Scientific studies in recent years have shown that many of this assumptions are wrong. This shows the importance of good scientific research and that we cannot build medicine only on “intuition”. “Intuition” is based on ideas, values, prejudices ... of people and no one is omniscient, incorrect results are partially logically. There should be a good balance between “intuition” and science-based facts. In the past centuries, acupuncture was built only on “intuition” and therefore in this field there are a lot of incorrect assertions.

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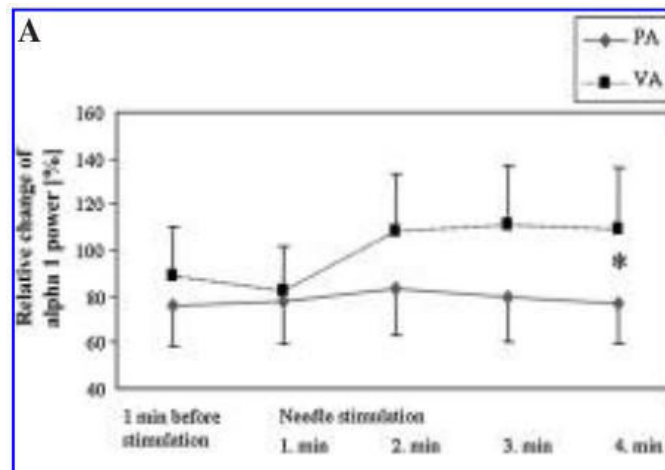
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1. Acupuncture and „physiological network effects“

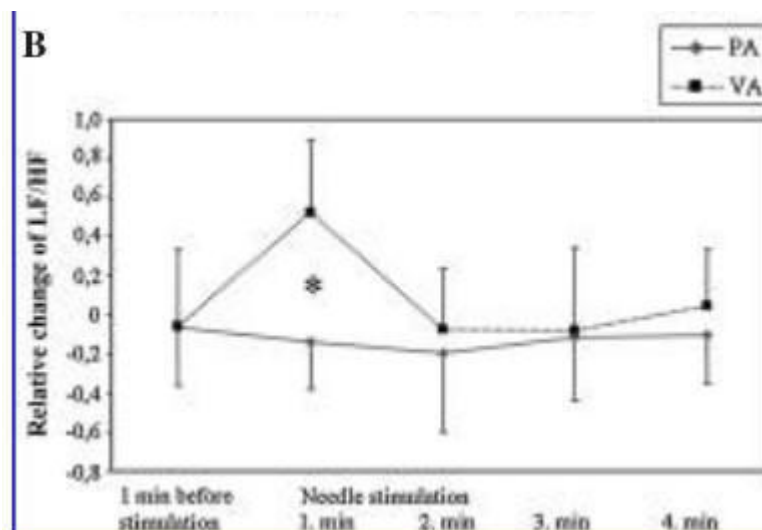
1.1. Streitberger et al. (9) – Effects of Verum Acupuncture compared to Placebo Acupuncture on Quantitative EEG and Heart Rate Variability

In a single-blind randomized crossover study Streitberger et al. investigated the effects of manual acupuncture on electroencephalography (qEEG) and heart rate variability (HRV). Twenty volunteers received either a **verum acupuncture** (VA) at the acupuncture point **Large Intestine 4**, or **placebo acupuncture** (PA) at a sham point.

The following figure shows the **electroencephalogram power spectrum**. A verum acupuncture (VA) group was compared to a placebo acupuncture (PA) group. These values were measured from the occiput region. (A) Displays the values based on the alpha 1 baseline change. **After needle stimulation, those values increased.**



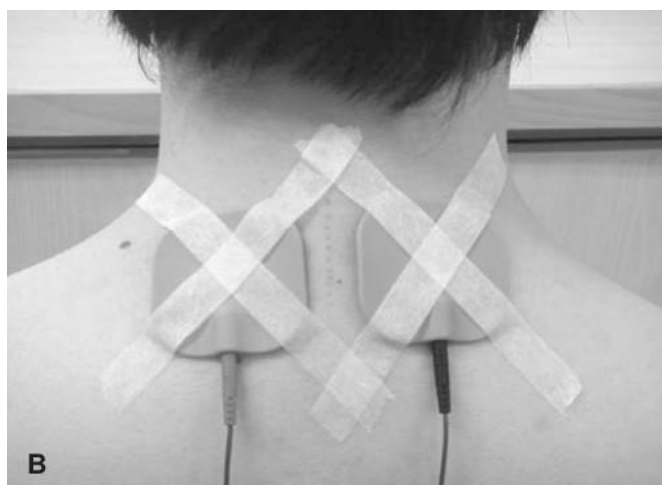
In the following figure the **HRV** parameters are shown. During the first minute of stimulation, a **significant increase of the low frequency/high frequency (HF) ratio** in the VA occurred. This may indicate an initial increase of sympathetic activation.



According to the authors, these results show **specific induced central and autonomic nervous system activity during acupuncture**.

1.2. Lau and Jones (10) – A single session of Acu-TENS increases FEV1 and reduces dyspnoea in patients with chronic obstructive pulmonary disease

After a single 45-minute session of transcutaneous electrical stimulation of an acupuncture point (Acu-TENS) Lau and Jones investigated the **immediate effect on lung capacity and dyspnoea** in 46 patients with **chronic obstructive pulmonary disease**. The specific point was **Ex-B1**. For the control group the electrodes were placed on the same point, but without current. The subjects in the control group were told that the stimulation would not be perceivable.



The following figure shows the obtained values according to the **FEV1** (forced expiratory volume in 1 second) and the **FVC** (forced vital capacity) in the experimental (Exp) and the control (Con) group. In the experimental group they found an increase of **FEV1** from **1.24 to 1.37**, compared to **1.39 to 1.41** in the control group. The **FVC** increased in the experimental group from **1.7 to 1.77** and remained stable at **1.77** in the control group.

Outcome	Groups				Difference within groups		Difference between groups
	Pre		Post		Post minus pre		Post minus pre
	Exp	Con	Exp	Con	Exp	Con	Exp minus Con
Lung function							
FEV ₁	1.24	1.39	1.37	1.41	0.13	0.01	0.12
(I)	(0.46)	(0.43)	(0.47)	(0.43)	(0.09)	(0.03)	(0.07 to 0.15)
FVC	1.70	1.75	1.77	1.77	0.07	0.02	0.05
(I)	(0.44)	(0.53)	(0.44)	(0.52)	(0.09)	(0.09)	(-0.01 to 0.10)

According to the authors, **this non-invasive intervention might be helpful to patients with chronic obstructive pulmonary disease**.

Also the work of Ngai (12) and Liu et al. (13) indicates the positive effect of Acu-TENS for FEV1 and dyspnoea scores in patients with obstructive airways disease.

1.3. Litscher and Schikora (11) – Laser Needle Acupuncture

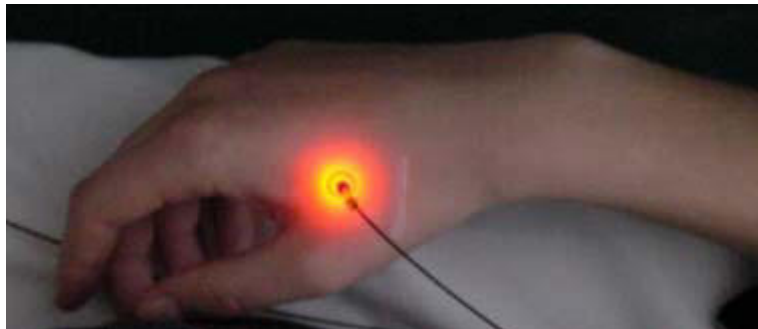
The first public presentation of a laser needle system took place in 2000 (11). Since then, it is possible to perform **non-invasive, painless acupuncture** (11), making it relatively easy to carry out a “proper” **randomized controlled trial**.

Laser is focused, and therefore, allowing high local intensities. In laser needle acupuncture, the light-emitting surface of the optical fibre cable is placed directly on the skin. The laser radiates **monochromatic light**. Litscher and Schikora used an emission wavelength of 685 nm (red light) during their investigations (11), a wavelength falling into the visible light range of the spectrum (380-780 nm). In laser acupuncture the applied intensity (5-10 W / cm²) **can be quantified precisely**, making it possible to determine a **dose response relationship** (11).

According to Litscher and Schikora (11), tissue in the direct contact area is heated up by about 1 degree celsius during a 20 min treatment.

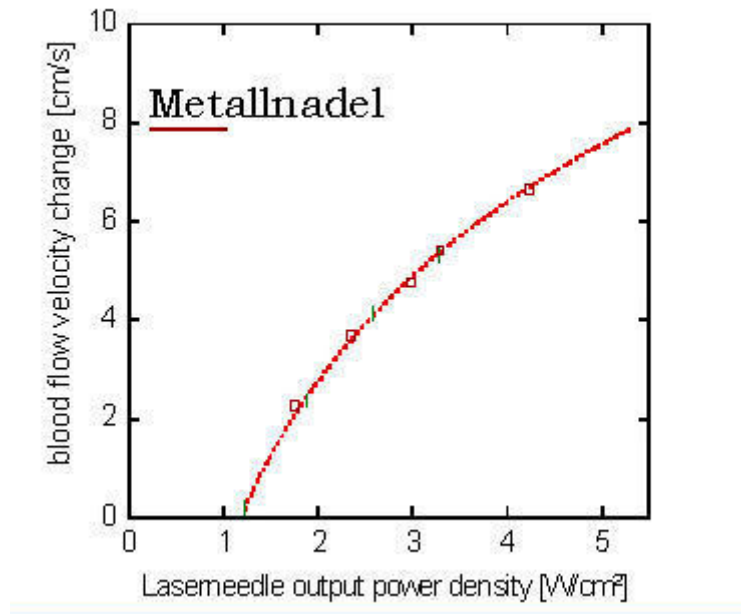
Especially for people with fear of pinpricks, laser needle acupuncture might be an option. Although side effects of traditional acupuncture are very rare, **side effects in laser acupuncture are non-existent**.

During the experimental procedure the subjects and the therapist put on glasses, so they couldn't see the light emission. As a result, **a blinding of patients and the examiner is possible**. Up to 8 laser needles can be used simultaneously for stimulation (11).



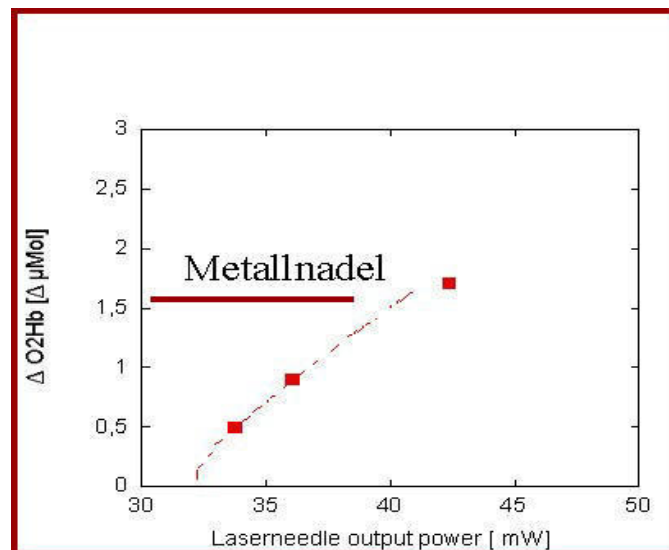
(Source: (11))

According to Schikora (11) a laser stimulus of 5 W / cm² power density is comparable to the effect of a metal needles based on blood flow velocity.



This figure shows the change in blood flow velocity of the A. opthalmica. The dotted line represents the laser intervention. The solid line shows the rate of blood flow change when a metal needle was used. (11)

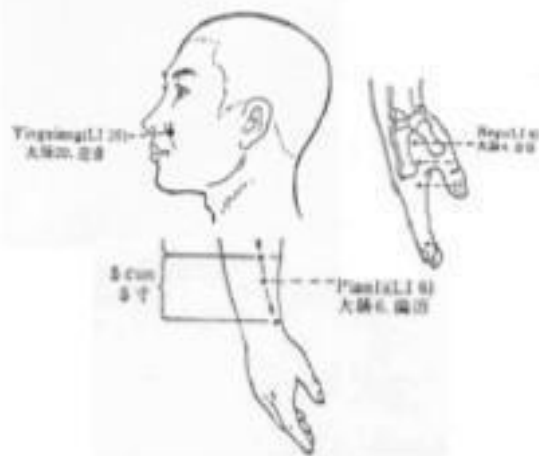
Litscher and Schikora also examined the change of cerebral oxyhemoglobin concentration, during the application of metal needles, as well as laser needles. The following figure shows, how a laserneedle with 40 mW power output has an equivalent effect on oxyhemoglobin concentration as a metal needle.



With the help of laser acupuncture, these authors researched a variety of **short-duration physiological changes** (11). The following figure shows an example of this. The authors measured the **change in blood flow velocity (vm) while using different laser acupuncture schemes**. Scheme (A) operates on the **olfactory system** according to the theory of TCM, and scheme (B) does the same for the **optical system**. **Scheme A caused a significant increase in blood flow in the anterior cerebral artery (ACA). Scheme B showed a significant change in the posterior cerebral artery (ACP).** (11)

Volunteers n=22
12 female, 10 male, 21 - 29 years (24.4 ± 2.6 years; $\bar{x} \pm SD$)

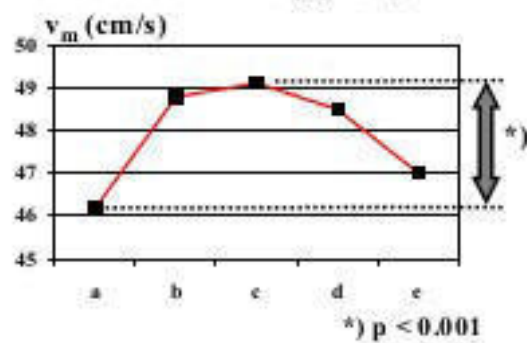
Laser puncture scheme A



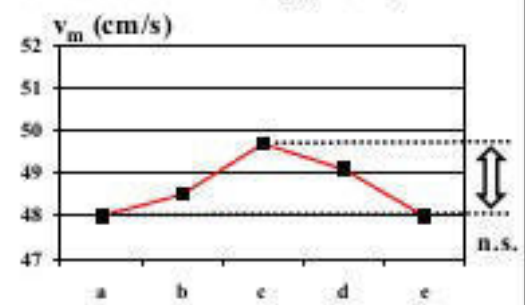
Laser puncture scheme B



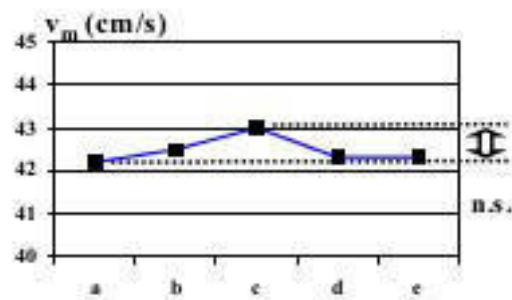
Anterior cerebral artery (ACA)



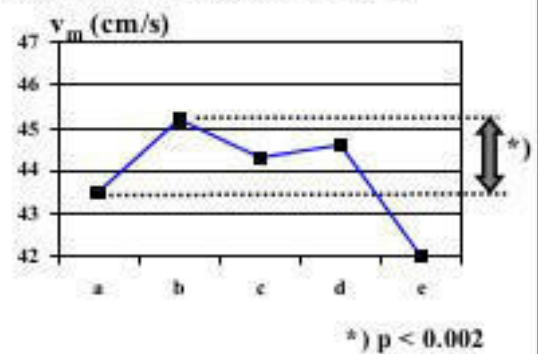
Anterior cerebral artery (ACA)



Posterior cerebral artery (PCA)



Posterior cerebral artery (PCA)



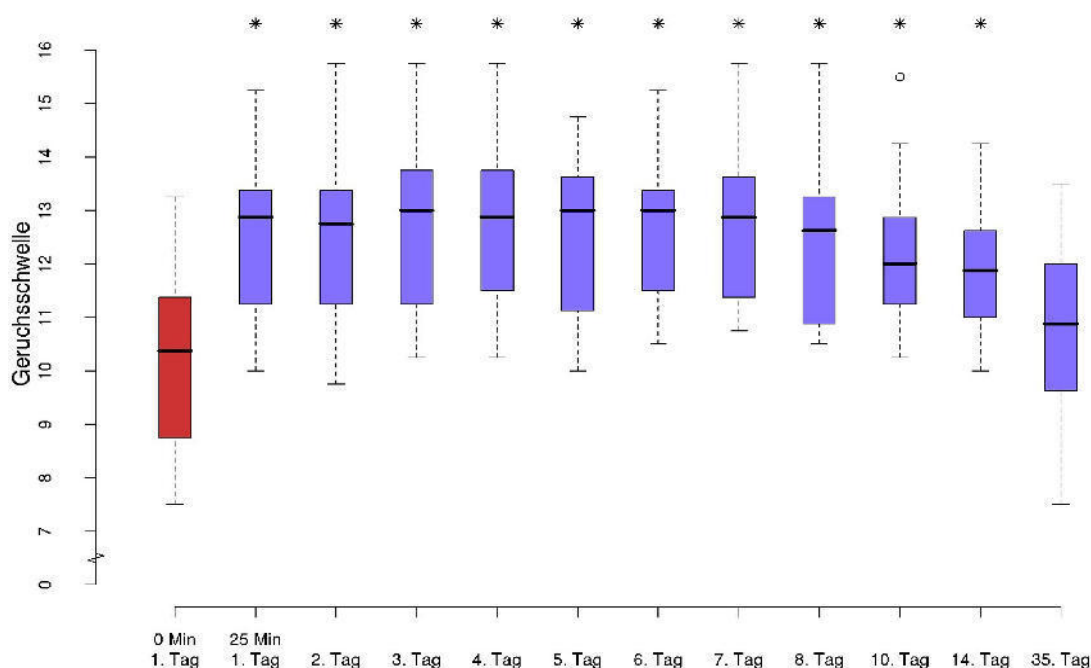
1.4. Beck (15) – Effects of Multiple Laser needle acupuncture on the odour perception

In a **double blind randomized, placebo-controlled** design study carried out by Beck, the effects of **repetitive treatment with laser needle acupuncture on the sense of smell was investigated**. 32 healthy **volunteers were treated daily, over a period of one week**, using either **verum, or placebo** laser needle acupuncture. After each acupuncture session the **sense of smell was tested with „Sniffing sticks“**.

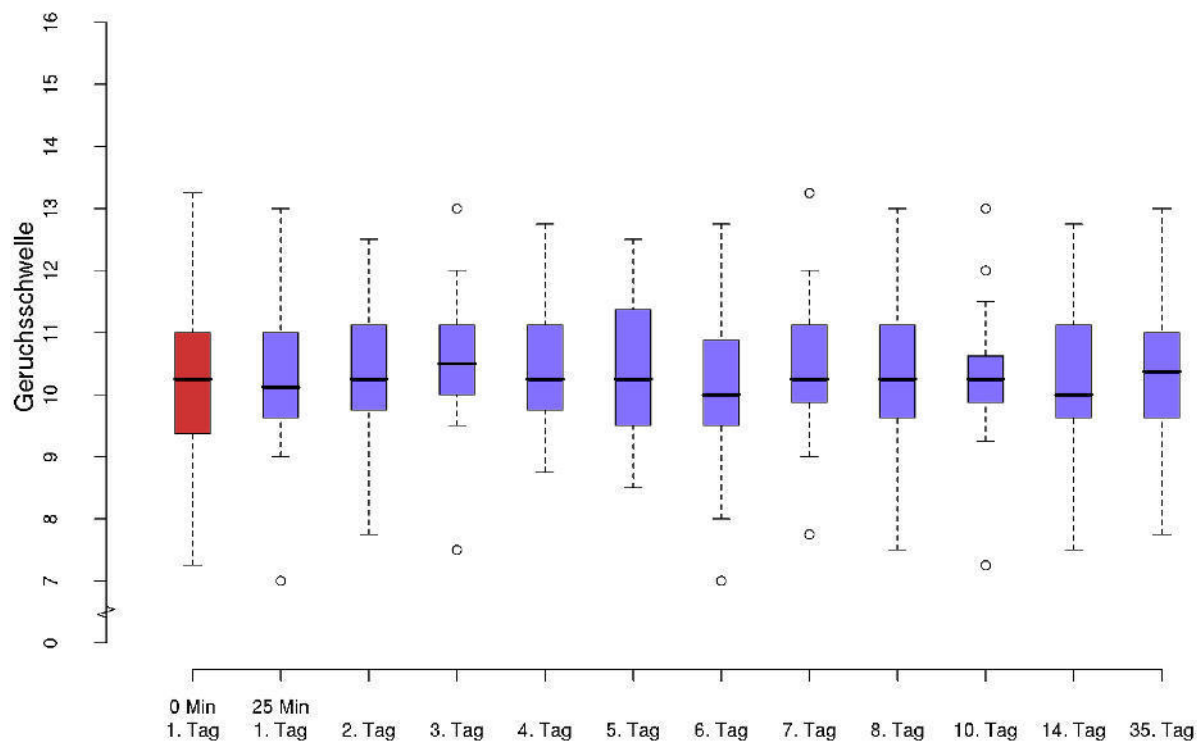


The following figure shows the test protocol. First, the sense of smell was tested, afterwards, a laser needle verum or placebo treatment followed. Then the sense of smell was tested again on the same day. During the first week, the treatment was carried out on a daily basis, measuring the sense of smell afterwards. **From the eighth day onward only sense of smell was tested.**

The following figure shows olfactory sensitivity of the verum group over time. The box plot represents the 75th and 25th percentile, the horizontal line the median. Those results showed a **significance of $p < 0.05$** . **The effect held on for more than a week after the last acupuncture treatment.** However, **the effects from the first treatment could not be heightened through multiple stimulation.**



The following figure shows the olfactory sensitivity of the placebo group.

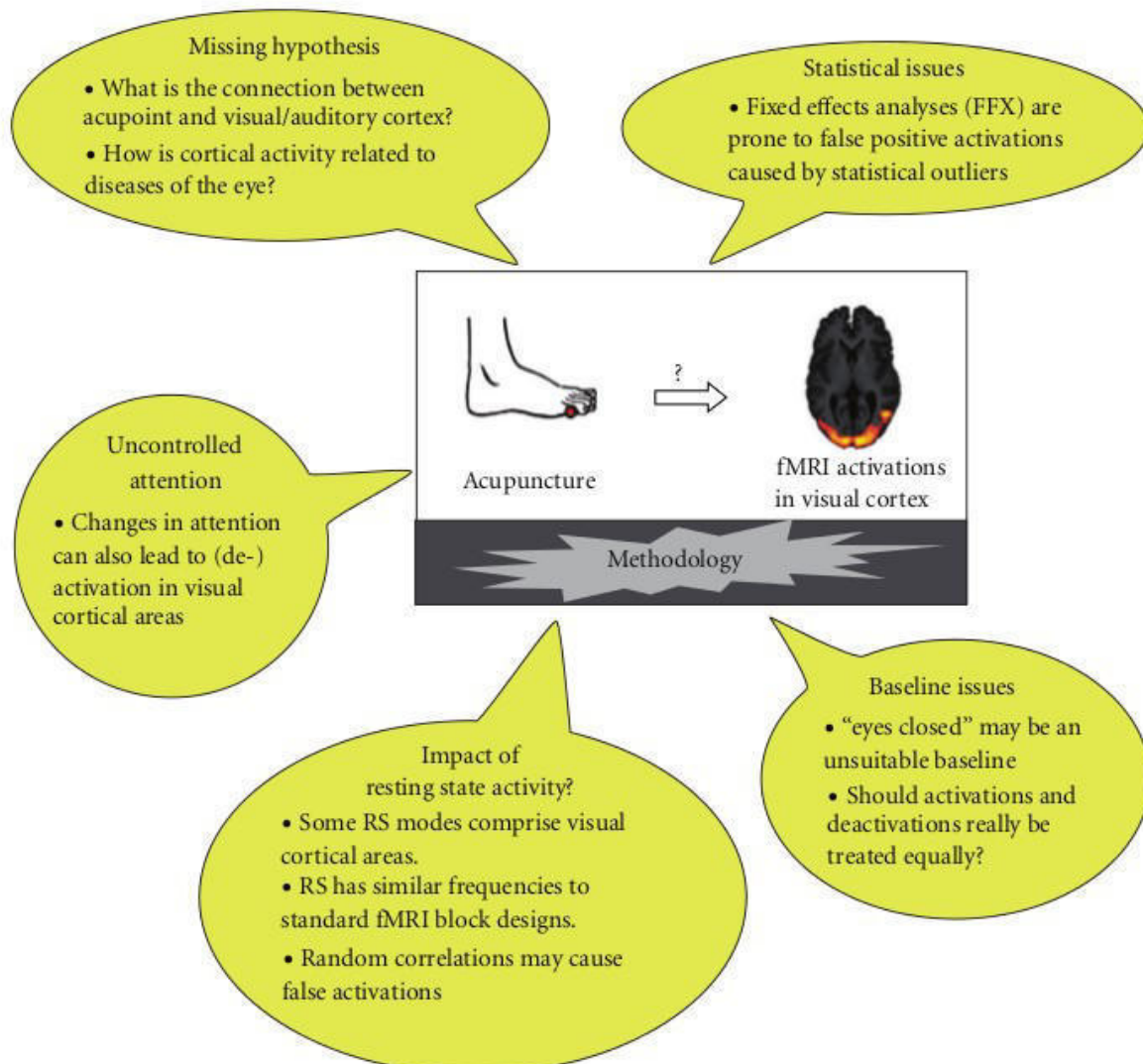


1.5. Beissner and Henke (14) – Methodological Problems in fMRI Studies on Acupuncture

Beissner and Henke investigated **methodological problems of acupuncture effects based on fMRI** (Functional magnetic resonance imaging).

According to the authors, **until 2009, more than 60 studies**, and several review articles have been published on the topic. But most of these studies didn't **adhere to the same standards, which would be necessary** for it to be useful. Those are **normal standards in other areas of the fMRI research**. Methodological problems can be caused by **bad choice of the baseline, bad interpretation of deactivations, attention control and implications of different group statistics**.

The following figure shows possible explanations used in acupuncture fMRI studies, which have nothing to do with specific acupuncture effects (14). More information on this topic: „Funktionelle Bildgebung des vegetativen Nervensystems, Neue Ansätze zur fMRT-Messung des menschlichen Hirnstamms “ by Beissner – download pdf.



2. Segmental Anatomy and Acupuncture

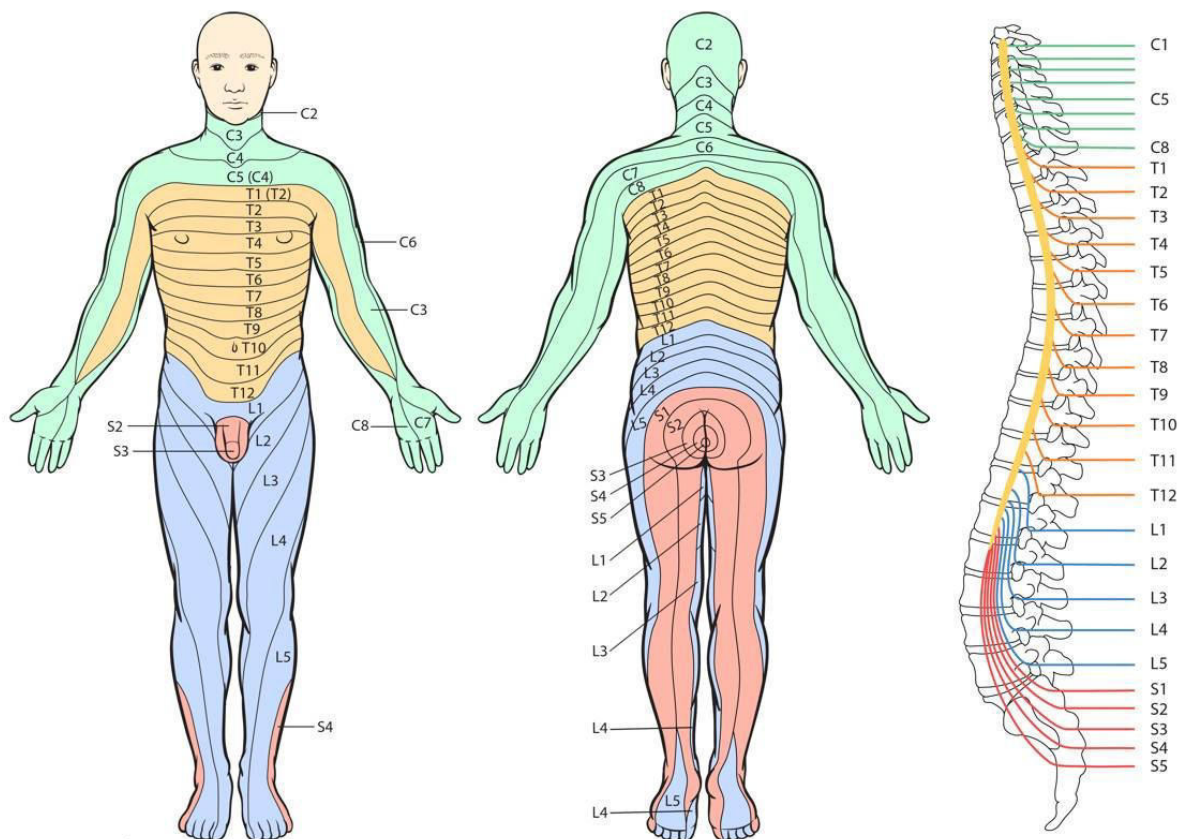
2.1. Segmental innervation areas:

Wancura differentiates the following areas in the body. They are **innervated via spinal nerves**, therefore they **can be connected together (4)**:

- the dermatome
- the myotome
- the sclerotome
- and the enterotom

2.1.1. The Dermatome

A dermatome (from Greek derma “skin” and tome “section”) is a part of the skin that is innervated by a specific spinal nerve. Therefore, different skin areas are innervated by different nerves. Even in adults, there is a segmental organisation. However, in reality, innervation overlaps between nerves



right next to each other. When a spinal nerve gets injured, sensitivity at the dermatome is not completely lost. The following figure shows the organisation of the dermatome.

(Source: <http://tlccrx.com/resources/printable-dermatome-chart>)

Some areas of the skin are innervated by one particular nerve exclusively, hence the name „autonomous region“. Damage to this nerve results in a total loss of sensitivity in its autonomous area.

Examples for autonomous areas:

Ulnar nerve: little finger.

Median nerve: end members of the index and middle fingers.

Radial nerve: above the metacarpal bone of the thumb.

Deep fibular nerve: first interdigital space.

Tibia nerve: sole and heel.

2.1.2. The Myotom

The term Myotom (from Greek mys “muscle” tomos “cut”) is used in embryology to characterize a muscle segment.

In general anatomy, a myotom is a muscle innervated by a spinal nerve.

Just as for the skin, every muscle of the limbs is innervated by several spinal nerves (**plural segmental innervation**). Therefore, failure of a single spinal nerve does not lead to total failure of the myotome, only partial paralysis (**paresis**) occurs. If several segments are affected, a complete paralysis will follow.

2.1.3. The Sklerotome

In embryology, the sclerotomes are the medioventral parts of embryonic somite's. This structure forms the elements of the axial skeleton (bone, cartilage and ligaments).

Analogous to the dermatome and myotome, to Wankura, sclerotomes are **those parts of a bone which are supplied by one particular nerve**.

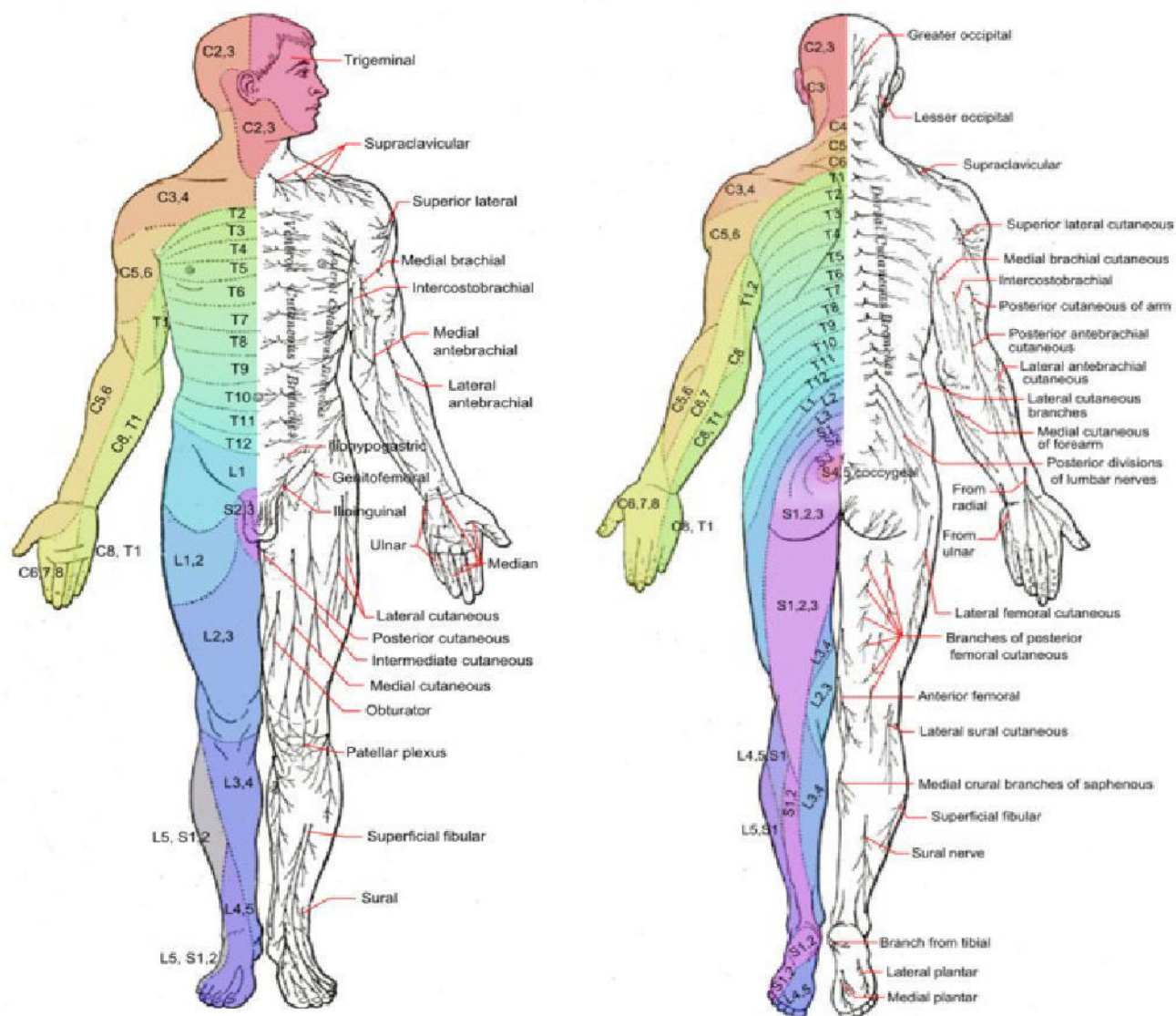
2.1.4. The Enterotome

An Enterotom is a region in the intestines, which is innervated by a spinal nerve.

2.2. Horizontal Organisation

Wancura differentiates between **horizontal and a vertical organization** of the derma-, myo, sklero and enterotome (4).

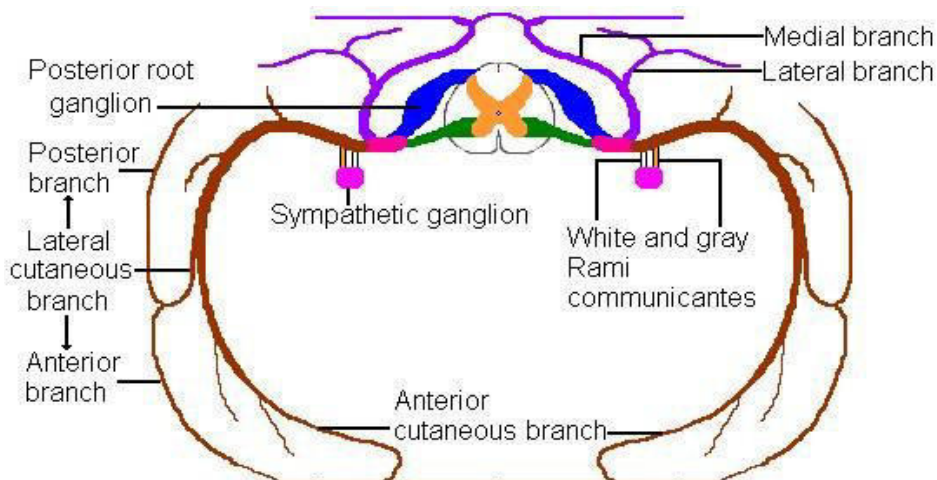
The **horizontal organisation is based on different nerves from the spine**. The following figure shows „horizontal“ organisation of the skin.



(Source: Wikipedia)

2.3. Vertical Organisation

A vertical arrangement based on the rami dorsalis, -ventralis and -lateralis exists in the skin. The following figure shows this vertical organisation. **On the torso, the spinal nerves either end in the ramus dorsalis, the ramus ventralis, or the ramus lateralis (4).**

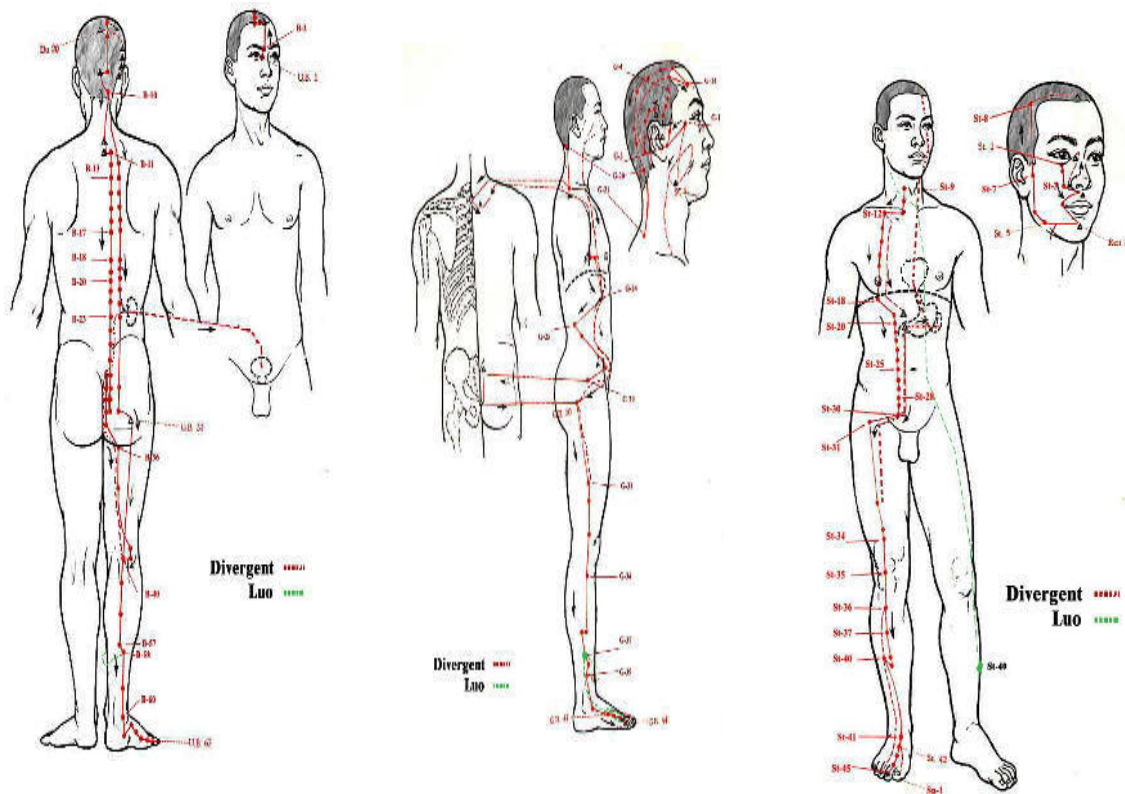


(Source: www.anatomy-physiotherapy.com)

According to Wancura, these three innervation areas on the torso correspond to the long YANG meridians. (4)

YANG-MING	Rami dorsalis	→	Bladder meridian
TAI-YANG	Rami lateralis	→	Gallbladder meridian
SHAO-YANG	Rami ventralis	→	Stomach meridian

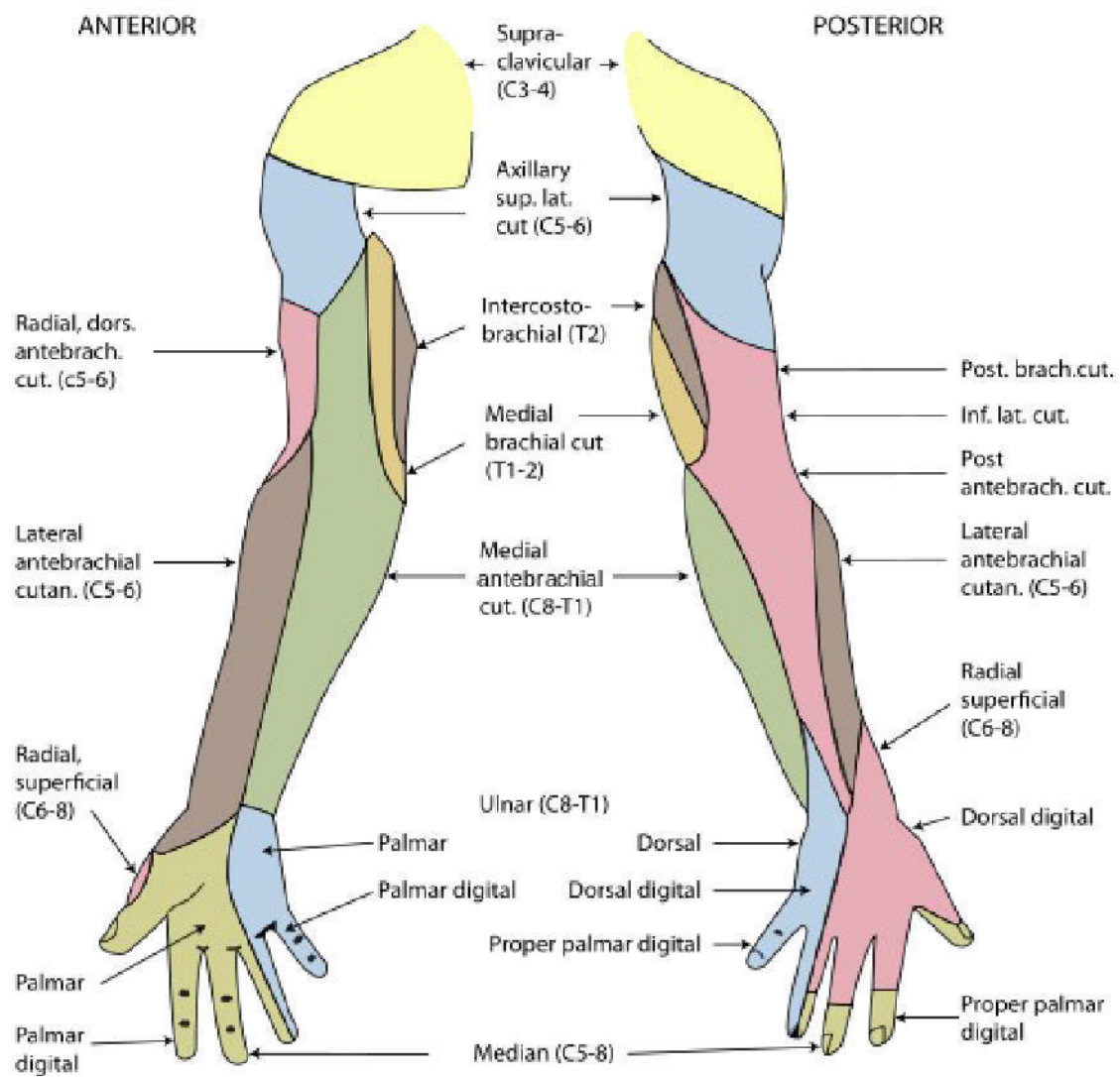
The following three pictures show those meridians (bladder, gallbladder and stomach).



(Source: www.kyusho.de/)

In the upper and lower limbs, the Rami lateralis innervates the extension muscles, covered by the skin. In the upper and lower limbs, the Rami ventralis innervates the flexion muscles and the ventral skin area on top. This area corresponds to the large intestine meridian in the upper extremity. On the torso, this area corresponds to the stomach meridian.

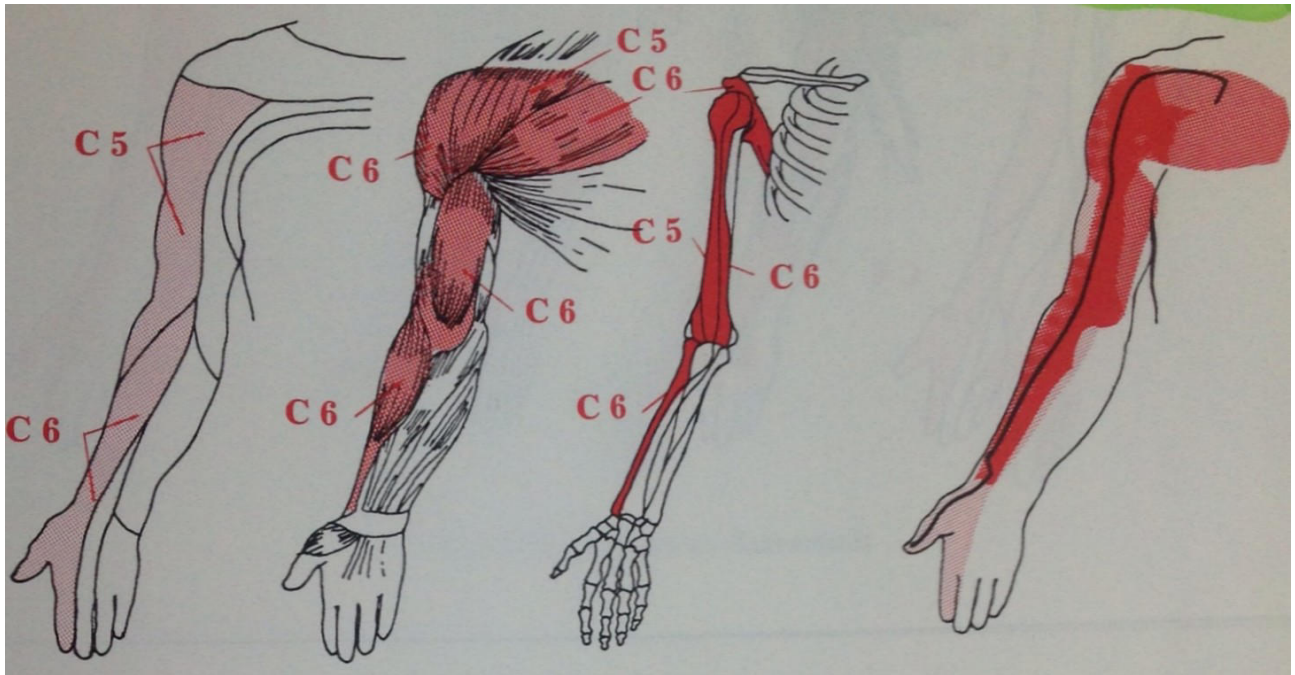
On the back, the Rami dorsales corresponds to the bladder meridian. (4) The following picture shows the skin of the arms and their segmental supply.



(Source: Wikipedia)

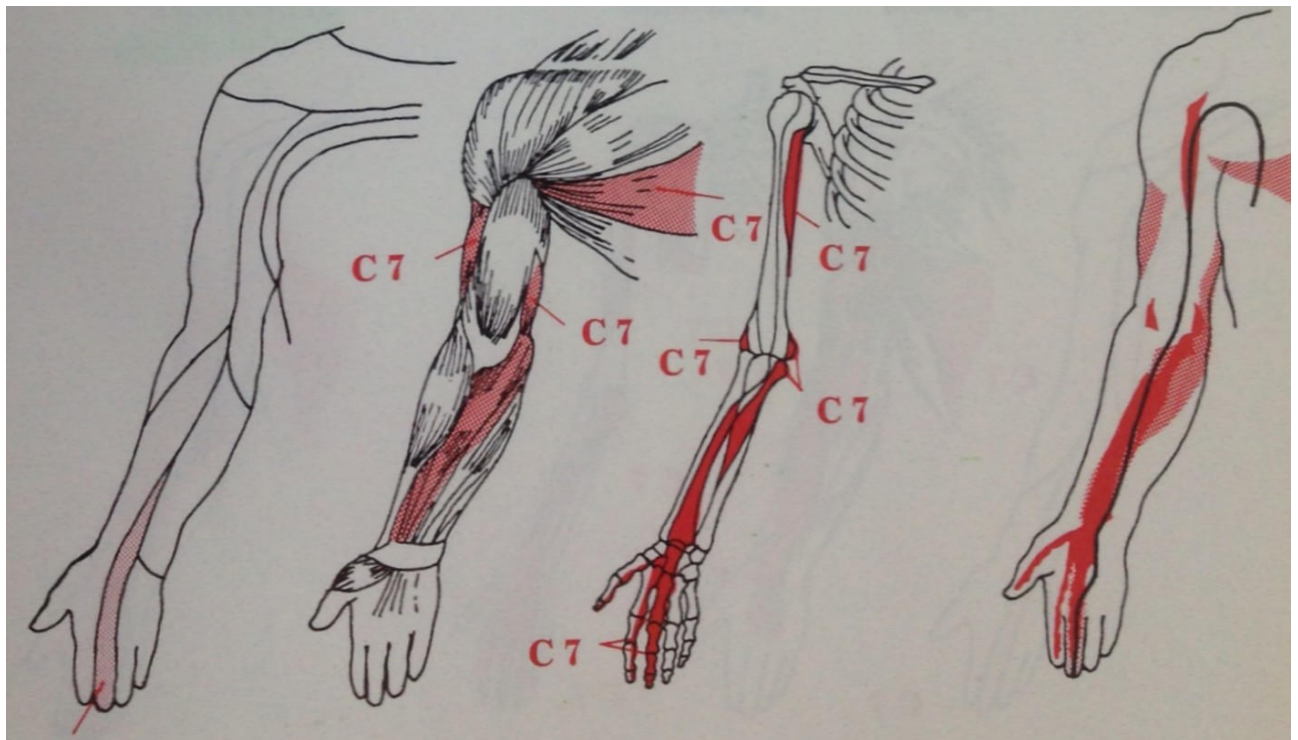
2.4. Dermatome, Myotome and Sklerotome and their connections to meridians

The following figures show **dermatome, myotome and sclerotomes from different spine regions**, as well as the **meridian**, which, according to Wancura and König, correlates with this spinal segment. Unfortunately, except for one image of the bladder meridian, their book contains no



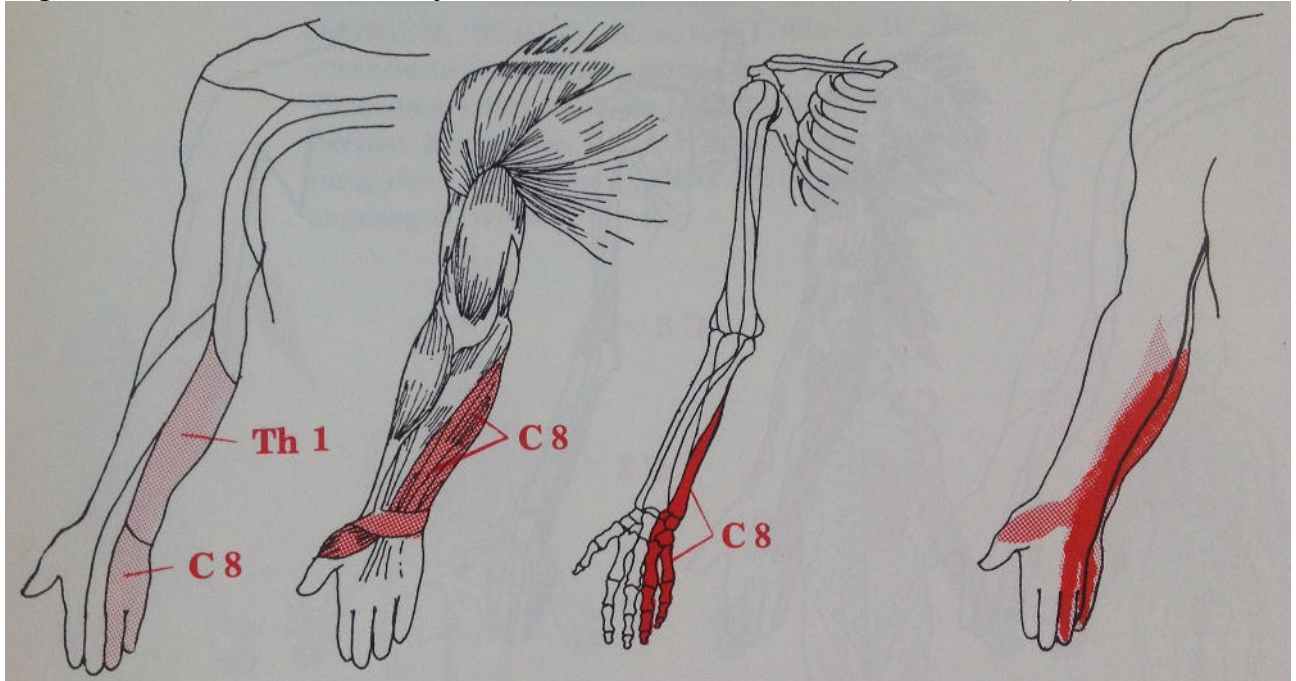
additional images of the lower limbs (5).

This figure shows the **dermatomes, myotomes and sclerotomes** of the lung-meridian. (Source: König and Wancura, 5)



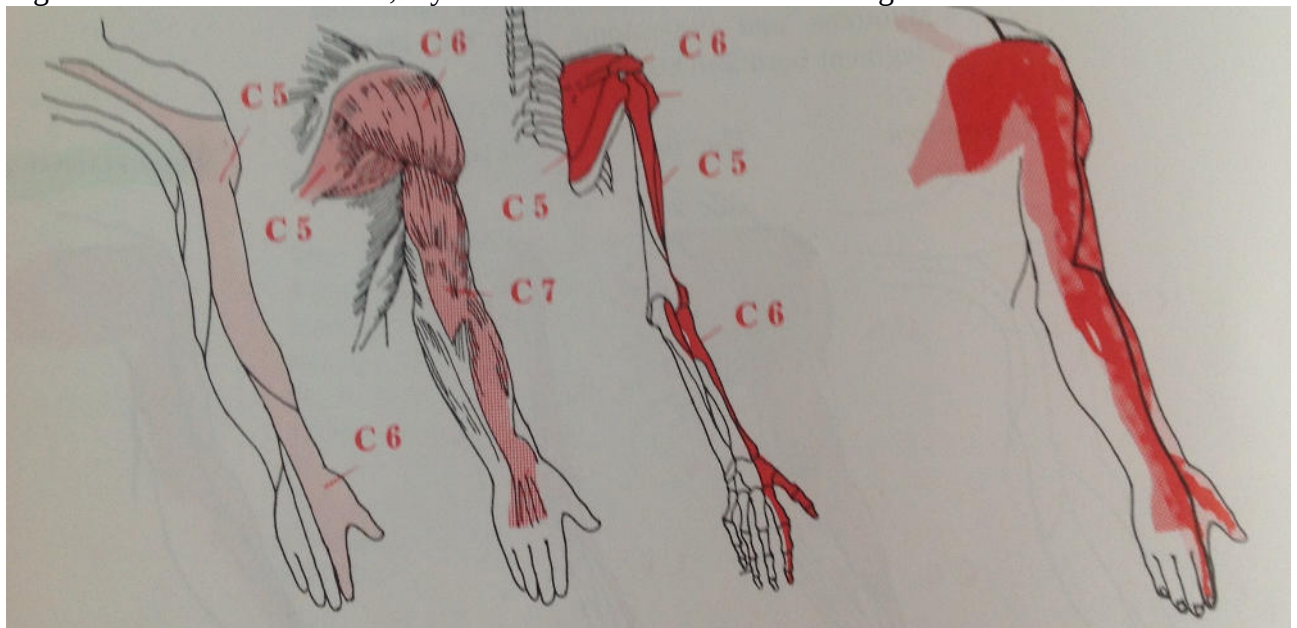
This figure shows the dermatome, myotomes and sklerotomes of the pericardium-meridian. (Source: König and Wancura, 5)

This figure shows the dermatomes, myotomes and sklerotomes of the heart-meridian. (Source:



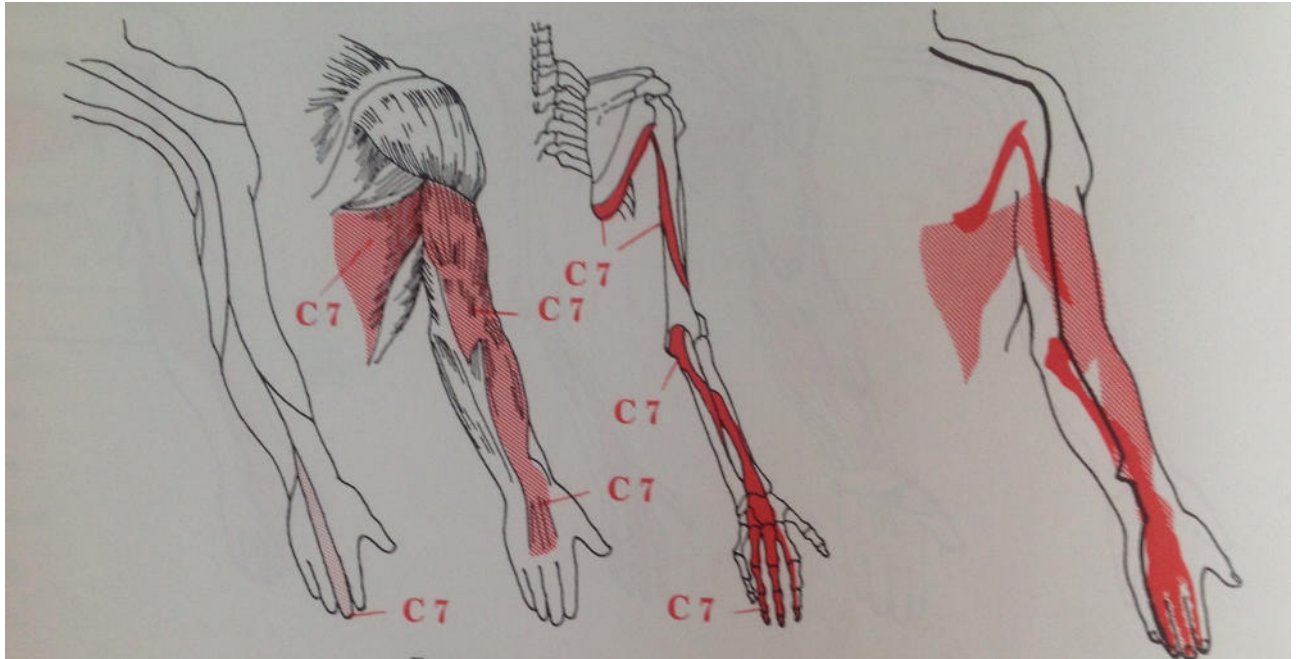
König and Wancura, 5)

This figure shows the dermatomes, myotomes and sklerotomes of the large intestine-meridian.

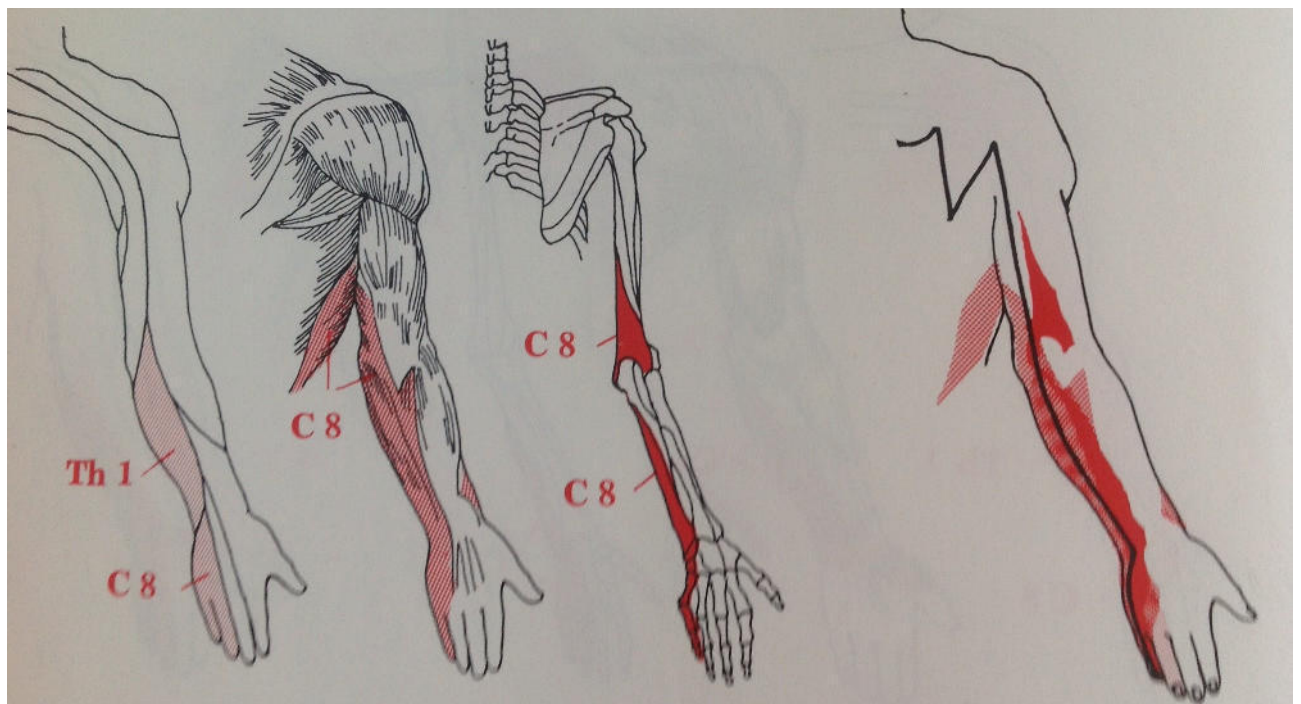


(Source: König and Wancura, 5)

This figure shows the dermatom, myotomes and sklerotoms of the triple energizer-meridian.

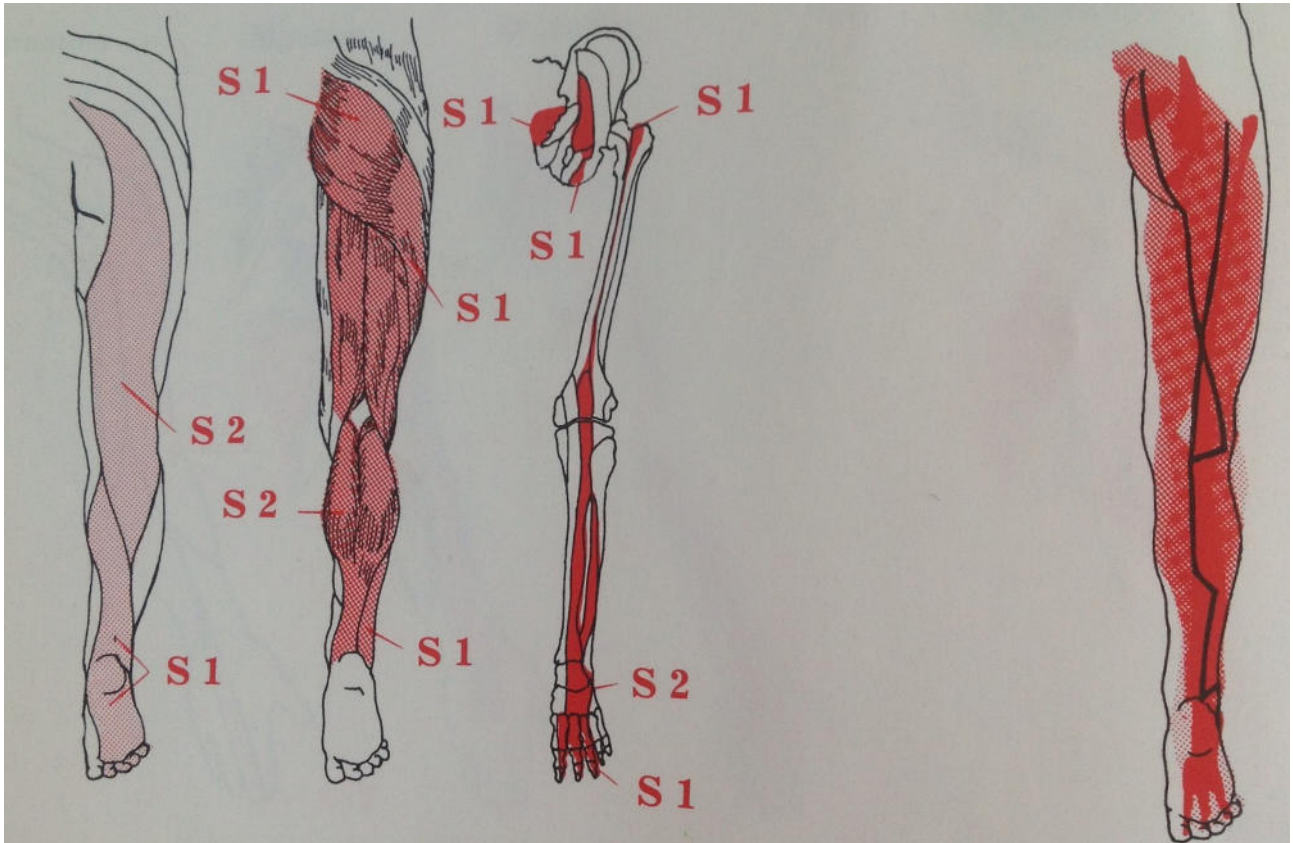


(Source: König and Wancura, 5)

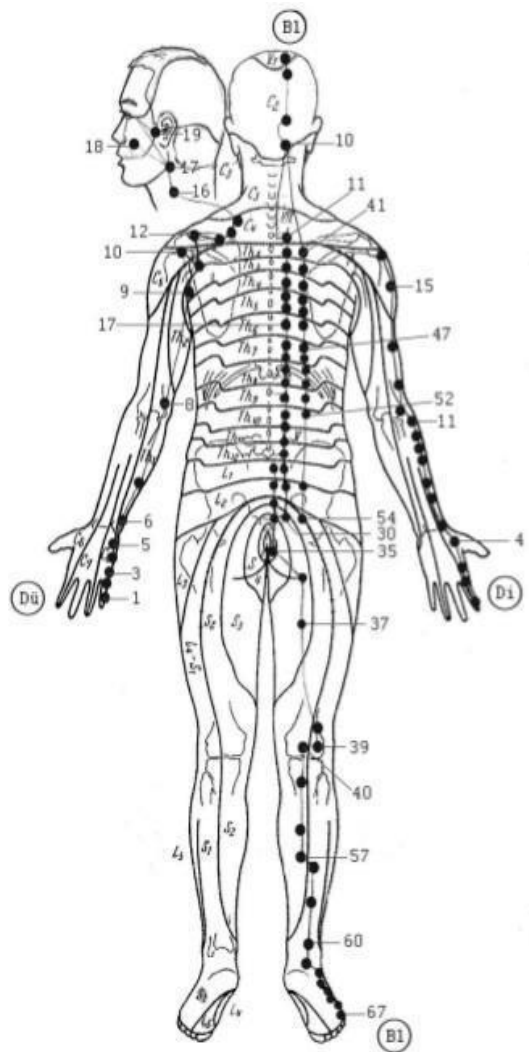
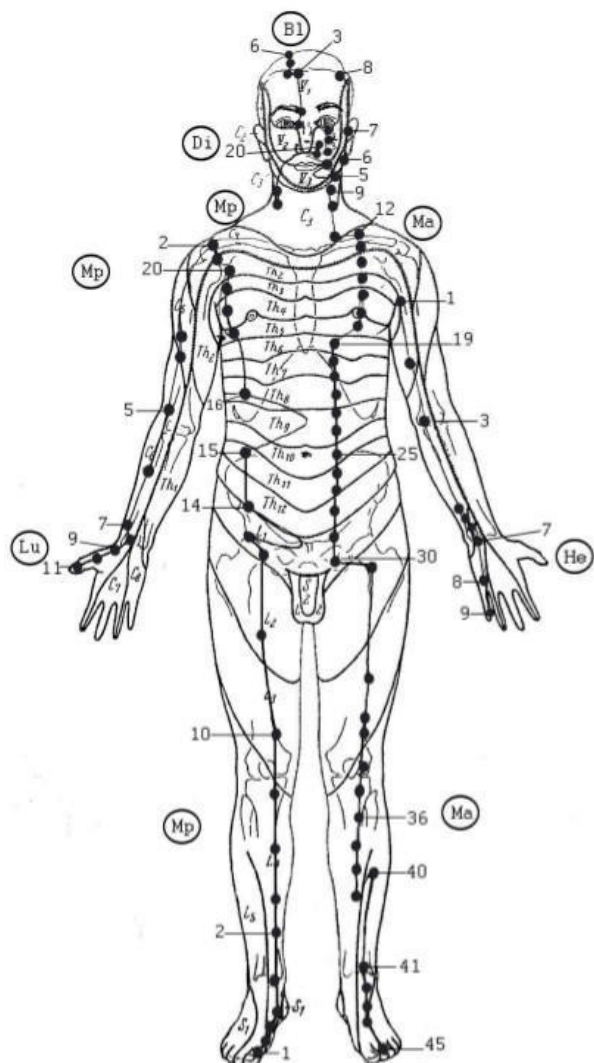


(Source: König and Wancura, 5)

This figure shows the dermatomes, myotomes and sklerotomes of the small intestine-meridian and

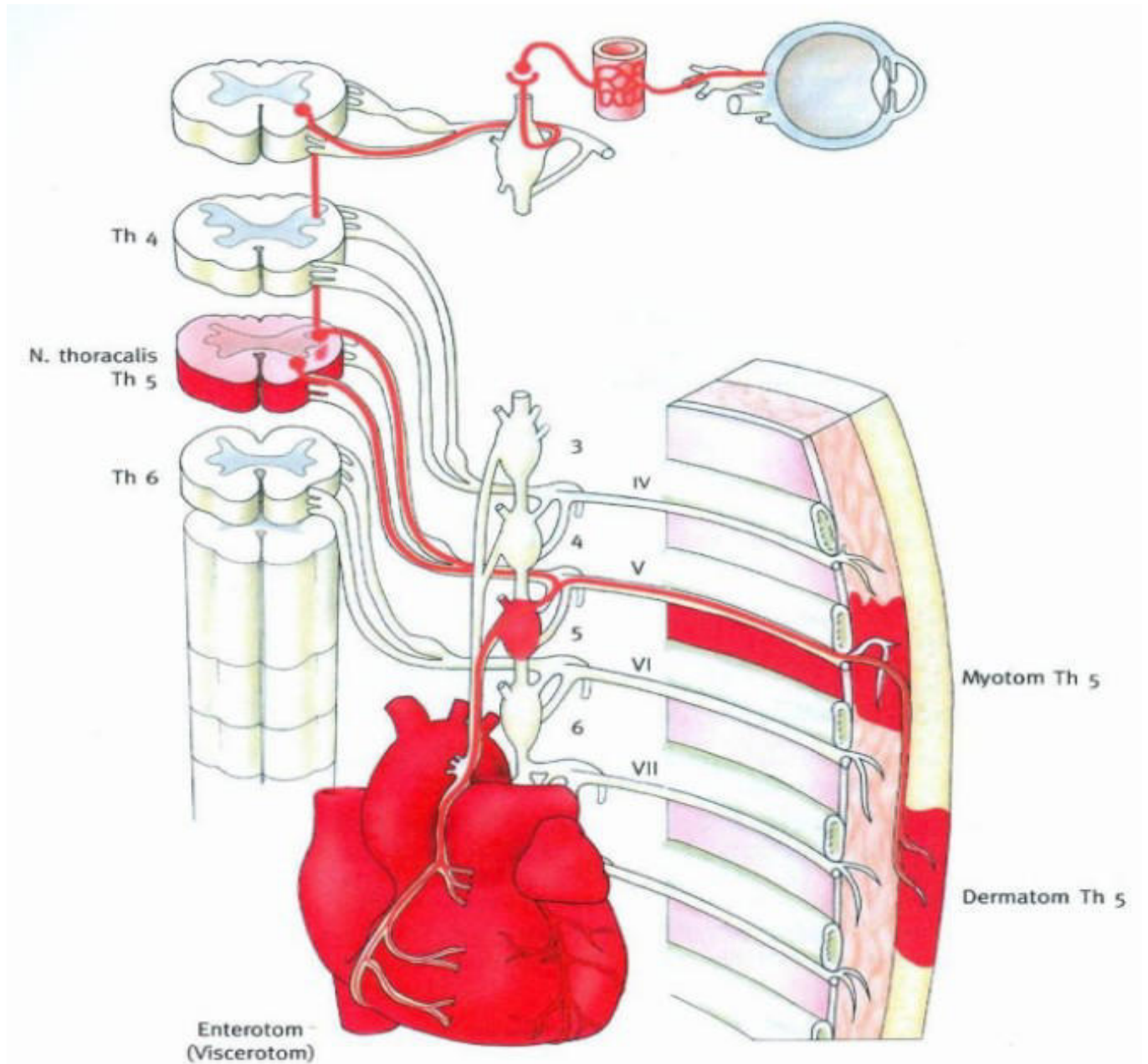


bladder-meridian. (Source: König and Wancura, 5)



2.5. The connection between Entero-, Myo- and Dermatome

The following figure shows the **connection between organs (in this case the heart), skin and muscles. The spinal cord provides the link for this connection.** This is why, during a heart attack, one feels sensations in the arms or the chest area.



(Source (6); original source: Hansen und Schliack)

By doing research on fish, Wernøe showed the **relationship between reactions on skin and visceral organ segments in 1925**. He showed that a **visceral irritation causes a cutaneous pigment reaction (and vasoconstriction)**. Even after local visceral irritation, this reaction always corresponds to several skin segments and occurs typically **only partially segmental**. When **unpaired organs** are stimulated, the corresponding skin zone **always react bilateral**. **Unilateral stimulation of paired organs** causes **unilateral cutaneous whitening zones**. Conversely, **cutaneous irritation causes visceral effects**, partly in the form of **visceral hyperaemia**, partly in

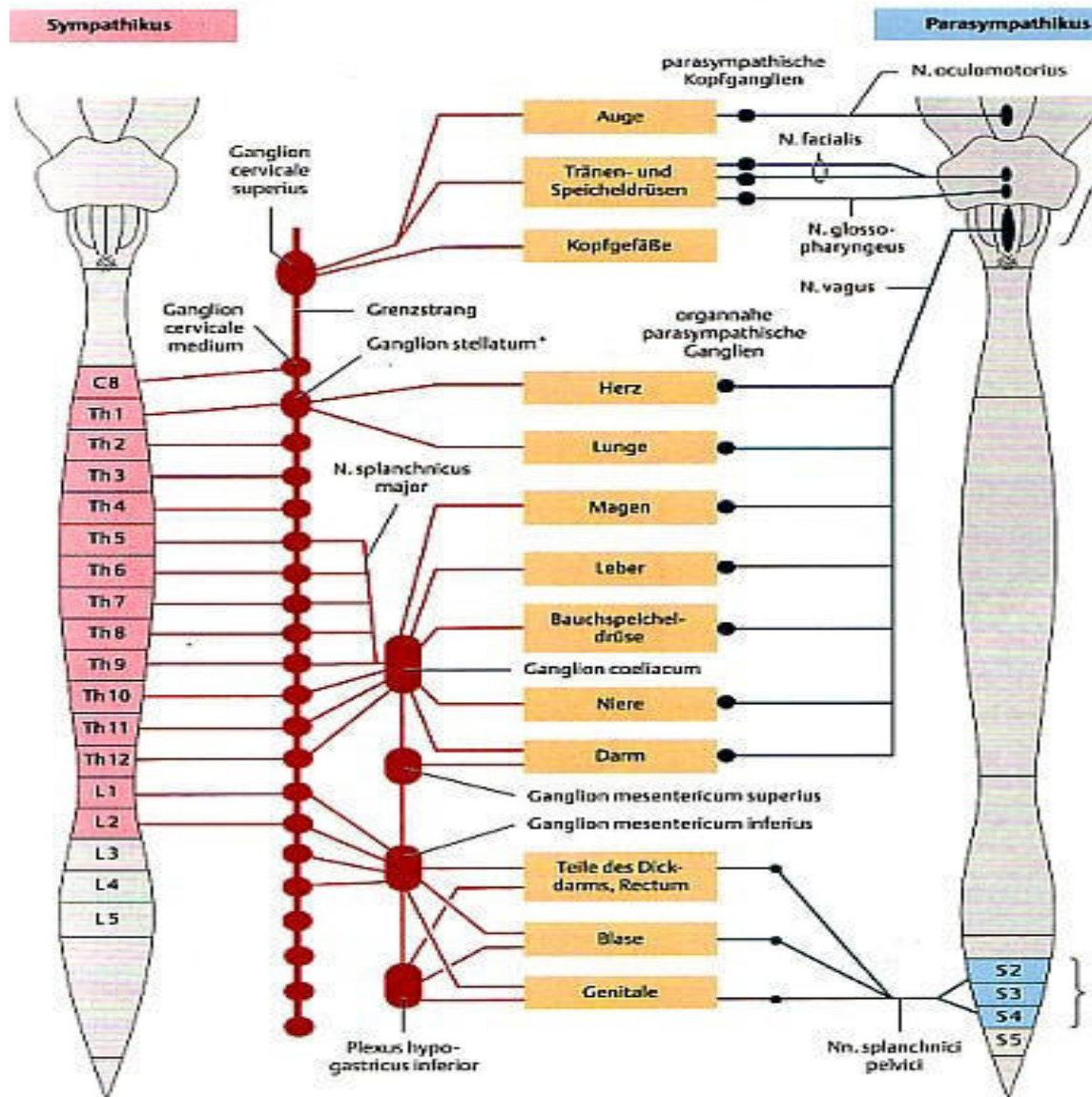
the form of **visceral ischemia**. The **dilatory visceral reflex** is a **spinal reflex**, that's why it can only be caused with the spinal cord intact.

The narrowing **visceral reflex**, however, is an **axon reflex**, and may be triggered even with a damaged spinal cord. Those experiments also show that unpaired visceral organs have bilateral, but also crossed, innervation. (16)

2.6. The Enterotome and whose connection to the spine – Sympathicus and Parasympathicus

The following figure shows the **sympathetic and parasympathetic nerves**. The parasympathetic has its origin in the medulla oblongata or pons (N. oculomotorius, vagus nerve, facial nerve, glossopharyngeal) and in the sacral lumbar section S2-S4 (Nn. Splanchnici pelvici).

The sympathetic nervous system forms the **sympathetic trunk**. The information passes, only via ganglions, to the spinal cord (afferents) or the organs (efferents) (Ganglion cervicale superius, Ganglion stellatum, Ganglion coeliacum...).



(Source: Prometheus, (7))

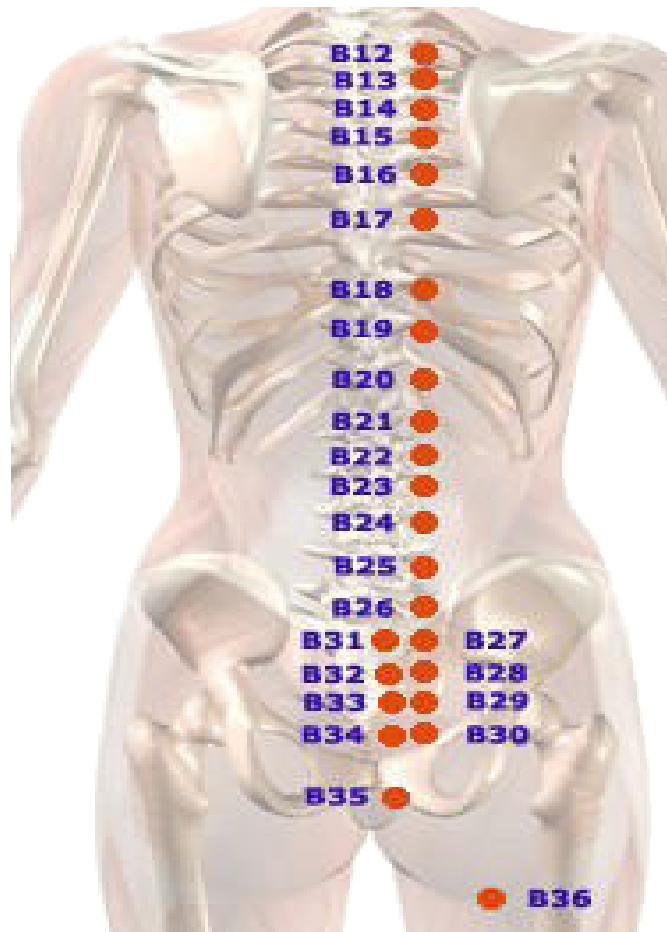
The following figure shows different organs and their corresponding spinal segment according to Wancura (4).

	Th 1	Th 2	Th 3	Th 4	Th 5	Th 6	Th 7	Th 8	Th 9	Th 10	Th 11	Th 12	L 1	L 2	L 3
Herz, Aorta asc.															
Bronchien, Lunge															
Ösophagus															
Magen															
Duodenum															
Pankreas															
Leber, Gallenblase															
Dünndarm, Colon asc.															
Ureter															
Niere															
Harnblase															
Colon desc., Rectum															
Hoden, Nebenhoden															
Ovarium, Uterus															

(Source: Wancura, 4)

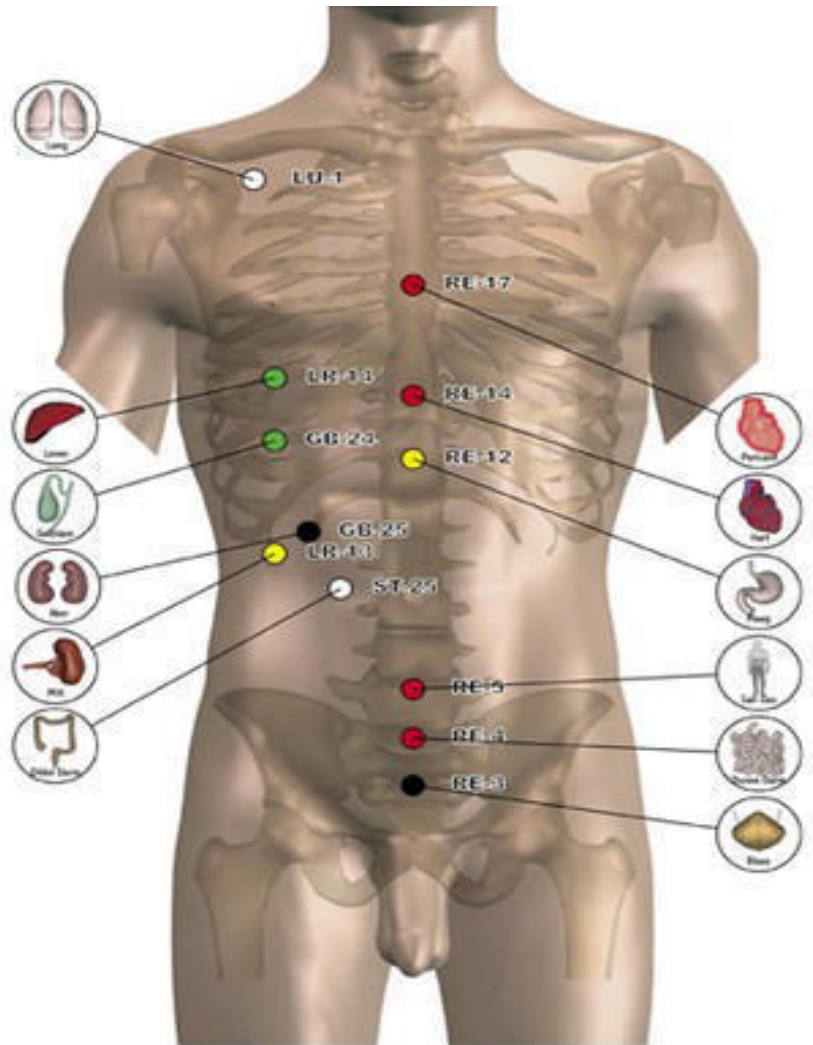
2.7. Head-Zones and MU and SHU points

Any **approval points (SHU points)** are located on the **back side of the body**, on the **inner branch of the bladder meridian** (between the 3rd thoracic vertebra and the 2nd sacral vertebra). Each organ system is associated with a SHU point.



(Source: akupunkturpunkte-finden.de/)

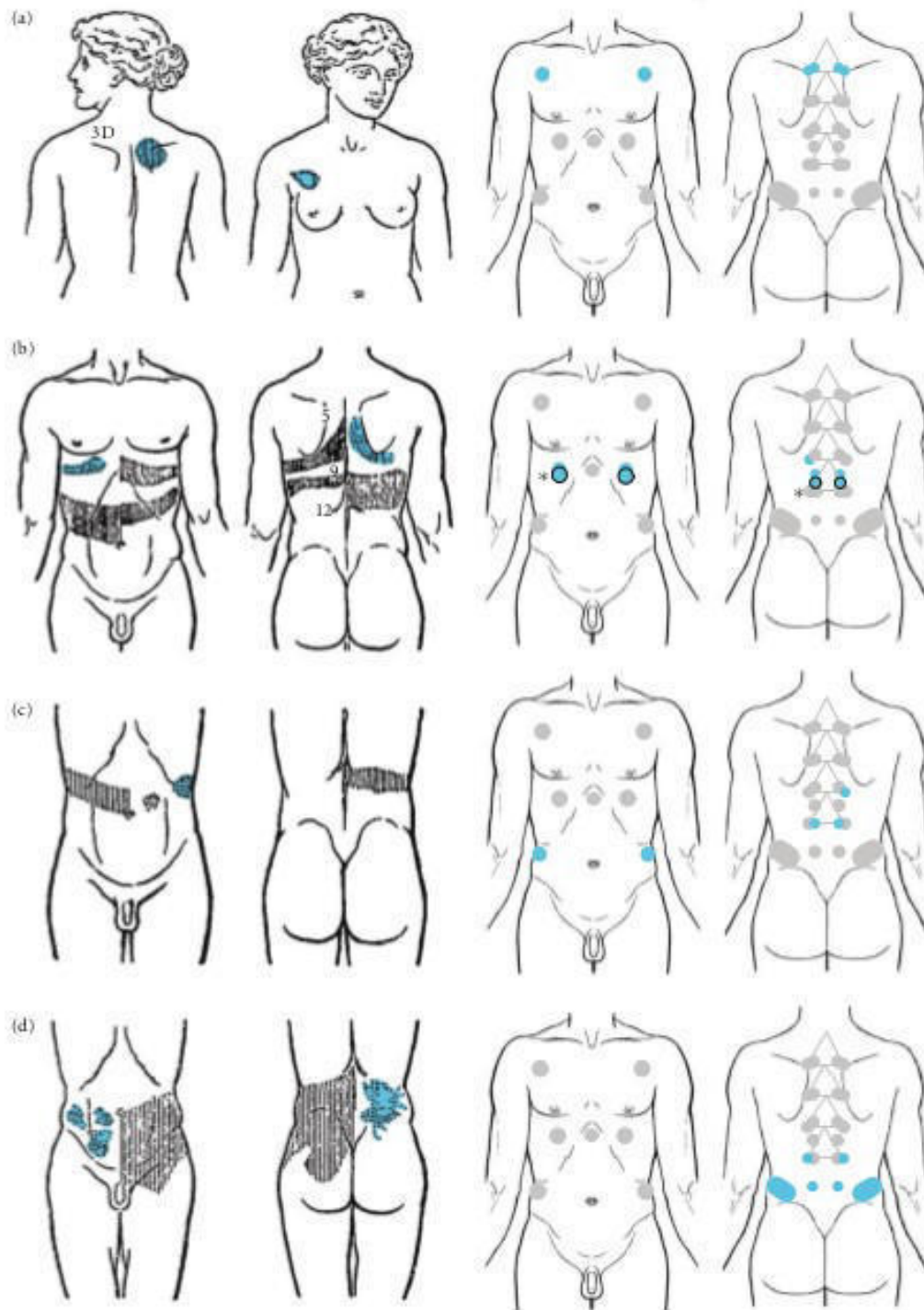
MU-points are also called **alarm points**. They are **located on the front side of the body**, in the chest and stomach area. Similar to the Shu Points, the MU-points **activate Qi and XUE** (the blood) from the associated organ systems, and, they too are used for **diagnosis and treatment**. In contrast to the SHU points which are correlated to the YANG, the MU points are correlated to the YIN. (8)



This figure shows the location of the MU points. (Source: www.screendesign.com)

In the article „Forgotten Features of Head Zones and their relation to Diagnostically Relevant Acupuncture Points“ Beissner et al. describe the **correlation between Head Zones and the MU and SHU points** . (8)

This correlation can be found in the following figure. (a) Shows the Head Zones of the lung on the back and front of the torso. The left side shows the Mu points (on the front) and the SHU points (on the back). This is also shown in this figure for the (b) liver, (c) stomach and (d) kidney/ureter.



This figure shows the Head areas (left side) and the MU and SHU points of the TCM (right side).
(a) Lung, (b) Liver, (c) Stomach, (d) Kidney/Ureter (source: Beissner et al., 8)

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VII.

Structure and Diagnosis of Acupuncture

The following chapter is an incomplete and very short summary of the book by König and Wancura volume 1, (Praxis und Theorie der neuen chinesischen Akupunktur) and should not be construed as a critical scientific examination of acupuncture (1). Unless otherwise stated, the figures in this chapter are taken from this book. It should only give a brief overview of basic principles for diagnosis and treatment in acupuncture from the perspective of TCM. Explanations and justifications for the guidelines of TCM given by the authors are not the main focus of this summary. That way it is possible to display the structure and diagnosis of acupuncture theory in short form. Please refer to the book for a detailed discussion on this topic.

QI refers always two opposite poles. For example, too little or too much, hypo- or hyper function (2.). In medicine there are many examples where this principle can be applied. Also in the “western medicine” diagnoses are categorized and data is quantified. In a blood count, parameters are also characterized as too low, too high or in the normal range. Such categorization can be found in all cultures, because as soon as we evaluate something we automatically categorizes it. But QI is more abstract and variable in the application and its focus lies more on correlation. Ultimately, it is a “general quantification possibility”.

König and Wancura specify four stages in applying acupuncture (3.). According to these stages, prophylactic and constitutional therapy are the best methods. Of course, this can only be referred to the majority but not all diseases. In some diseases there is only a little or no prophylactic possibility or it is simple too late for prevention.

According to Wancura and König, for good results through acupuncture a good disease history and the application of TCM rules are important (3.). If meaningful studies on acupuncture should be designed, the opportunity to treat according to TCM criteria has to be offered. Of course, the practitioner must be able to diagnose the disease by TCM criteria. Fixed acupuncture treatment regimen (= predetermined fixed point combinations) are not within the meaning of TCM. If acupuncture effects according to TCM should be determined in scientific studies, variability or „holistic“ thinking should be included, because this is the most important aspect of TCM.

In TCM there is a distinction between body surface and body inside and there are connections between them: “outside acts to inside” and “internal acts on the outside”. These reactions can be seen as palpable or visible changes on the body surface. According to the chapter „Viscero cutaneous reflex – MU- and SHU-Points“ there is scientific evidence for this kind of correlations in the area of MU and SHU-points.

The outside is exposed to the so-called external causes of illness (cold, draft, moisture, heat, and drought) and pathogens (viruses, bacteria and parasites). These external factors can reach the inner body through meridians. The meridian system connects the body surface and the “inner body”.

From a rational and analytical perspective, the meridian system can be understood as a construct to allow relations between different systems (e.g. inside and outside) or relationships in the nervous system. In ancient China there was little knowledge about the nervous system, blood vessels and the immune system and so they created as a link, the meridian system. As you can see in the chapter “East Asian and Western thinking”, Chinese thinking puts a focus on these relationships. Only by aid of the concept of the meridian system these relationships could be created. Furthermore, in order

to explain externally observable reactions from the sympathetic and parasympathetic nervous system, the development of the meridian system in ancient China was necessary. According to König and Wancura, there are great similarities between the structure of the sympathetic and parasympathetic nervous system and the meridian system. More on this topic can be found in the chapter: „Segmental Anatomy and Acupuncture“.

According to the meridian system, the body is divided into six vertical stripes (meridians). Six meridians from the upper body and six meridians from the lower body are building a couple. Therefore, a meridian from the arm is connected with a meridian from the leg (5.).

From the perspective of TCM, the body is divided into a YANG and a YIN area (6.).

A connection exists between the YANG and YIN meridians of the hands and the YANG and YIN meridians of the feet (insides-outside rule = YIN-YANG-rule) (7.).

Also the head and the torso are divided into three strips (meridians); a front, a lateral and a back side (8.). In the mid line of the body there are the two “medium vessels“, the DU MAI and the REN MAI (9.).

According to TCM, there are two different types of internal organs. One type includes the five so-called preserver organs (heart, lung, liver, spleen, and kidney). The function of these organs is to preserve blood-XUE, QI-vitality and “activity”. The other type of internal organs includes the six so-called collectors (small intestine, large intestine, gall bladder, stomach, bladder and the “triple heater”). These organs have the function of food digestion and excretion. (11.)

Every internal preserver organ is correlated with a sensory organ (heart with tongue, lung with nose, spleen with mouth, liver with eye, kidney with ear). (12.)

Furthermore, every internal collector organ has a relationship with a specific disease and emotion (joy with heart, sadness with lung, anxiety with spleen, anger with liver, and fear with kidney). (13.)

The acupuncture points are located on the meridians. These acupuncture points are divided into different groups depending on their effects. (14.)

Environmental factors play an important role in the concept of TCM.

For example, cold is associated with the kidney and is also connected with the bladder according to the insides outside-rule. The word cold in this context subsumes various phenomena which are connected with coldness. Cold drafts, a cold drink, feeling cold during an infection, shivers according to fear, frozen movements etc. (15.1.)

The other environmental factors are heat, moisture, dryness and wind. (15.2-15.5.) However, these factors are connected with a lot of different phenomena.

According to TCM, a distinction is made between the two factors „emptiness“ and „fullness“. „Emptiness“ means “too little”, little Qi, weakness, empty, hypo function, hypotension, anemia, missing resilience etc., and „fullness“ means “too much”, much Qi, strength, hyper function, hypertension, hyperemia, understood, normal resilience etc. (16.). These distinctions are also used for classifying the patient’s condition and constitution and the character of diseases. (16.2.-16.3.)

The following aspects are the basis for TCM diagnosis.

- With all this Emptiness-XU-type / fullness-SHI-type
- duration and severity of illness
- constitution type: leptosome or muscular

- constitution type: patient weakened or strong, speaking with a low or loud voice
- types of diseases: chronic or acute illness, difficultly or precisely locatable
- pain: moderate or strong
- pain and pressure: improvement or decrease of pain by pressure
- duration of pain: long or short history
- main symptoms: skin color, feces, urine, mental state etc.
- tongue diagnosis
- pulse diagnosis
- musculoskeletal pain: pain increase or decrease after rest, pain increase or decrease through exercise

It is important to understand that these aspects are only the basis of diagnosis and treatment in TCM. As explained in chapter „Diagnosis and Treatment of Headache from the Viewpoint of TCM“, in TCM more detailed and subtle concepts for different diseases were developed, which include the basic aspects as well.

Generally, the basis of TCM includes a lot of different aspects and provides a very holistic view.

In this thesis, however, the following question is of main interest: How effective is acupuncture and how large are verum- and placebo-effects? And further, there are scientific explanations for acupuncture?

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1. What is acupuncture?

Acupuncture is the right stimulus-type, the right stimulus strength and the proper stimulus-site and a stimulus therapy over especially sensitive points (König – Wancura 1972).

2. What is Qi?

According to the authors, Qi should not be translated as energy. In China Qi is understood mainly as function. E.g. **hypo function** means **too little Qi**. A **spasm** of the stomach accordingly is interpreted as **too much Qi**.

In matter, or substrate either too little or too much blood, fluid, weight, fat, etc.

In function, or tone of vessels: too little (hypotension) or too much (hypertension) **In skeleton**, muscles: too little (weakness) or too much (cramps, tension) **The tone of the hollow organs**: too little (atony) or too much (spasm, colic, etc)

3. Four different stages of applied acupuncture

König and Wancura specify four stages in applying acupuncture, in which every stage is providing better treatment results.

Level 0

Only “locus dolendi” points are prick is.

Level 1

Rigid point’s recipes are applied.

Level 2

Diagnostic rules according to TCM are applied. In the center of this level stands a good disease history.

Level 3

Prophylactic and constitutional therapy.

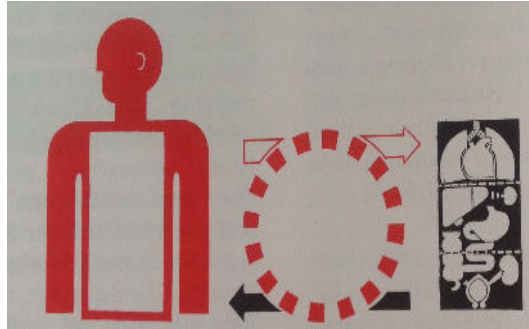
4. "The four pairs of opposites" or "the eight principles"

1) BIAO – LI = body surface – body inside

BIAO refers to structures such as skin, muscles, skeletal system with ligaments, tendons, bones, brain spinal cord and nerves. The meridians are also associated to BIAO.

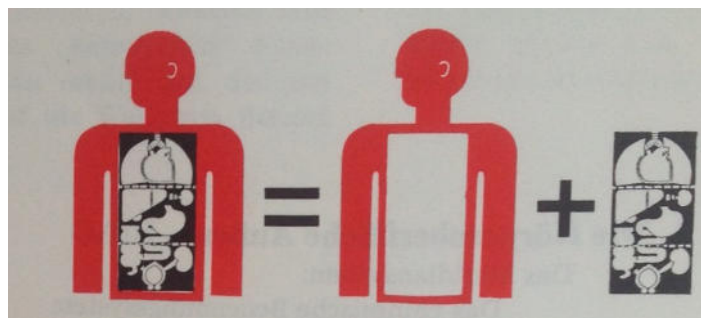
LI refers to the internal organs, all located in the body cavity.

It acts "**outside to inside**" and "**internal acts on the outside**" as a palpable or visible changes.

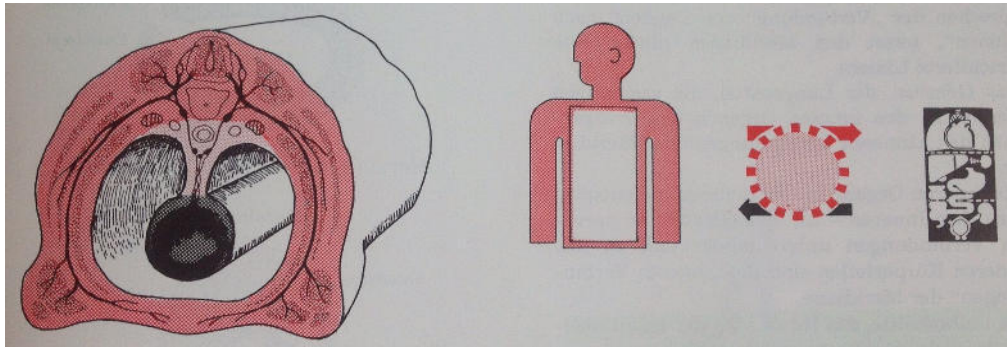


The whole body consists of inside (LI) and outside (BIAO).

BIAO is especially exposed to the so-called external causes of illness (cold, draft, moisture, heat, and drought) and pathogens (viruses, bacteria, parasites). These external factors can reach the inner body (LI) through the meridians. LI can however also cause changes on BIAO. Acupuncture points indicate changes of LI and BIAO. These points are important for diagnosis and therapy.



The whole body consist of inside (LI) and outside (BIAO).

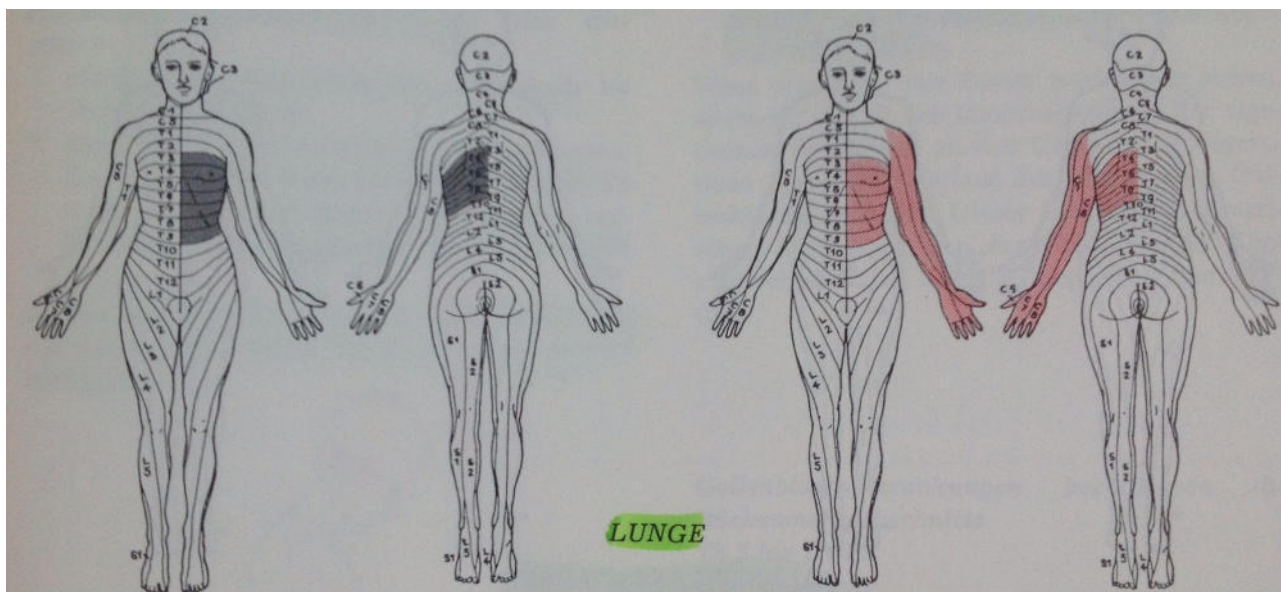


The meridian system (JING LUO) connecting the body surface (BIAO) and the inner body (LI). From the perspective of embryonic development BIAO corresponds to the ectoderm and mesoderm and LI to the endoderm.

5. The Meridian System – JING LUO

LUO stands for “reticulated connection”. **JING** means way, path or channel.

Every meridian is associated with an analgesia (dark) and a vegetative zone (red), as shown in this figure based on the lung meridian. Disorders of the internal organs can cause changes in the analgesia zone. The sympathetic nervous system appears in the vegetative zone of the skin. Reactions of the sympathetic system may occur on the skin. Piloerection of the hair, constriction of blood vessels or sweat production can occur.

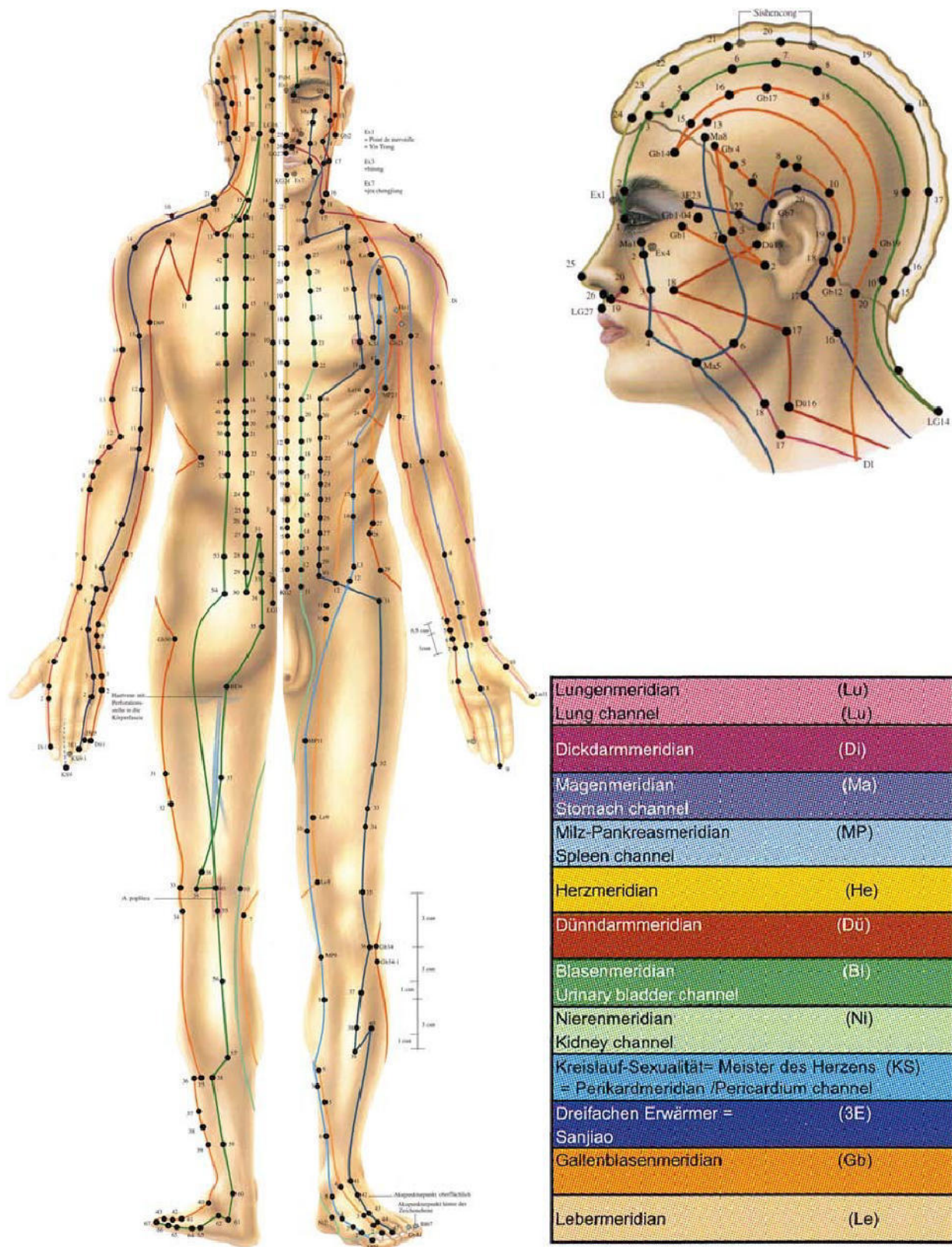


The body is divided into **six vertical stripes**. Thus, **six meridian couples are created**, in which each couple consists of a **meridian from the arm** and a **meridian from the leg**.

The **12 meridians** are termed as follows:

- LU** – Lung
- LI** - Large Intestine
- ST** – Stomach
- SP** – Spleen
- HT** – Heart
- SI** - Small Intestine
- BL** – Bladder
- KI** – Kidney
- PC** - Pericardium
- TE** - Triple Energizer
- GB** – Gallbladder
- LV** - Liver

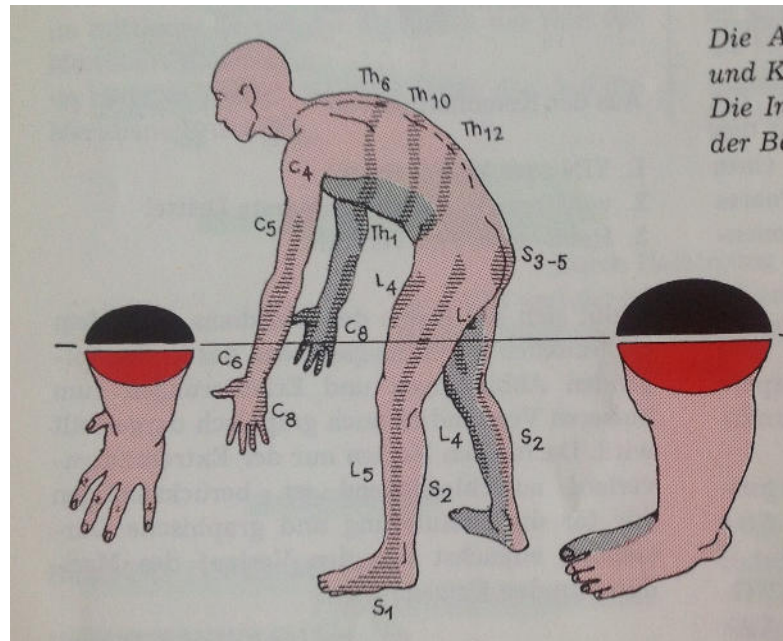
This illustration shows the course of all meridians. On the left side the posterior meridians and on the right side the anterior meridians are shown.



6. The organisation of the arms and legs

From the perspective of TCM, the **body is divided** into a **YANG** and a **YIN area**. The **hands and feet** are **divided into an outer side (YANG, red)** and an **inner side (YIN, black)**.

The **YANG side** is described as the region on which the **sun shines**, whereas the **YIN area** is in the **shade**

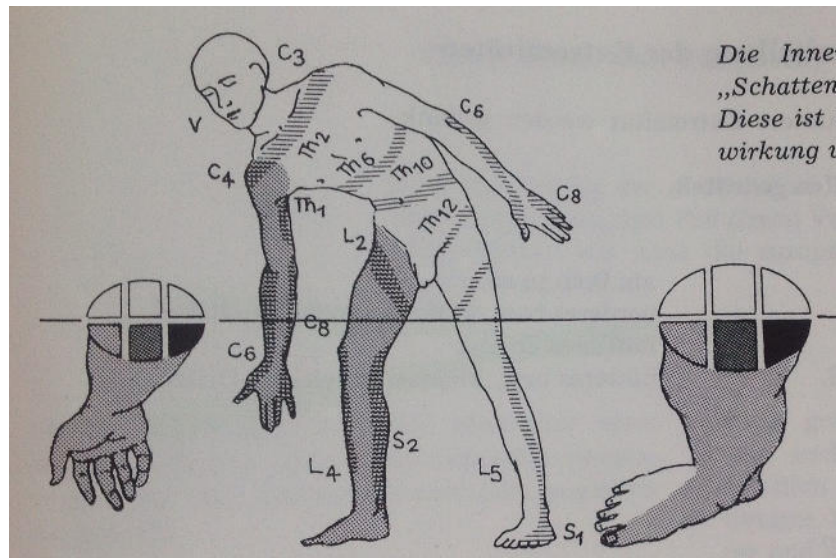


Three inside located YIN strips:

An anterior third – TAI YIN are the meridian pairs **LU** and **SP**.

A middle third – JUE YIN are the meridian pairs **PC** and **LV**.

A posterior third – SHAO YIN are the meridian pairs **HT** and **KI**.



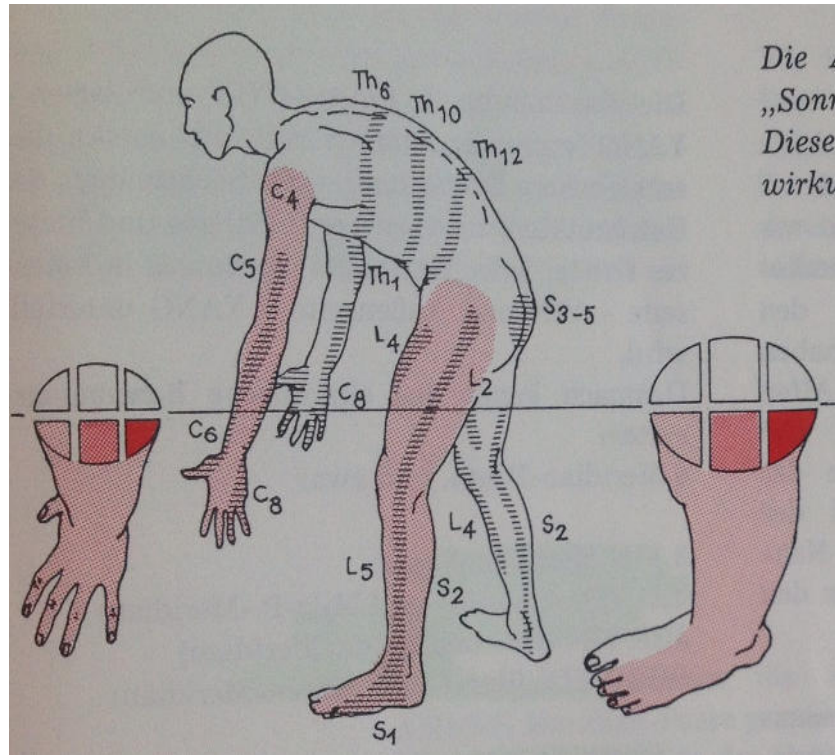
This figure shows the three inner (YIN) meridian localizations of the hands and legs.

Three outside located YANG strips:

An anterior third – YANG MING are the meridian pairs **LI** and **ST**

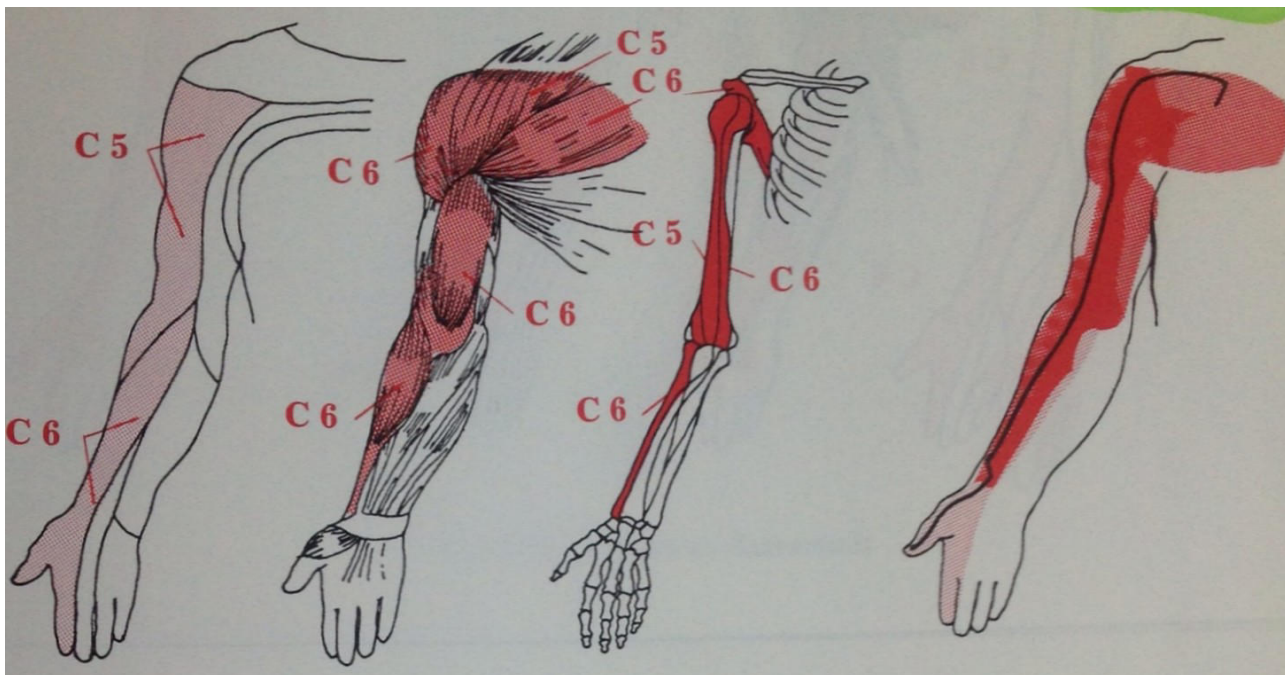
A middle third – SHAO YANG are the meridian pairs **TE** and **GB**.

A posterior third – TAI YANG are the meridian pairs **SI** and **BL**.



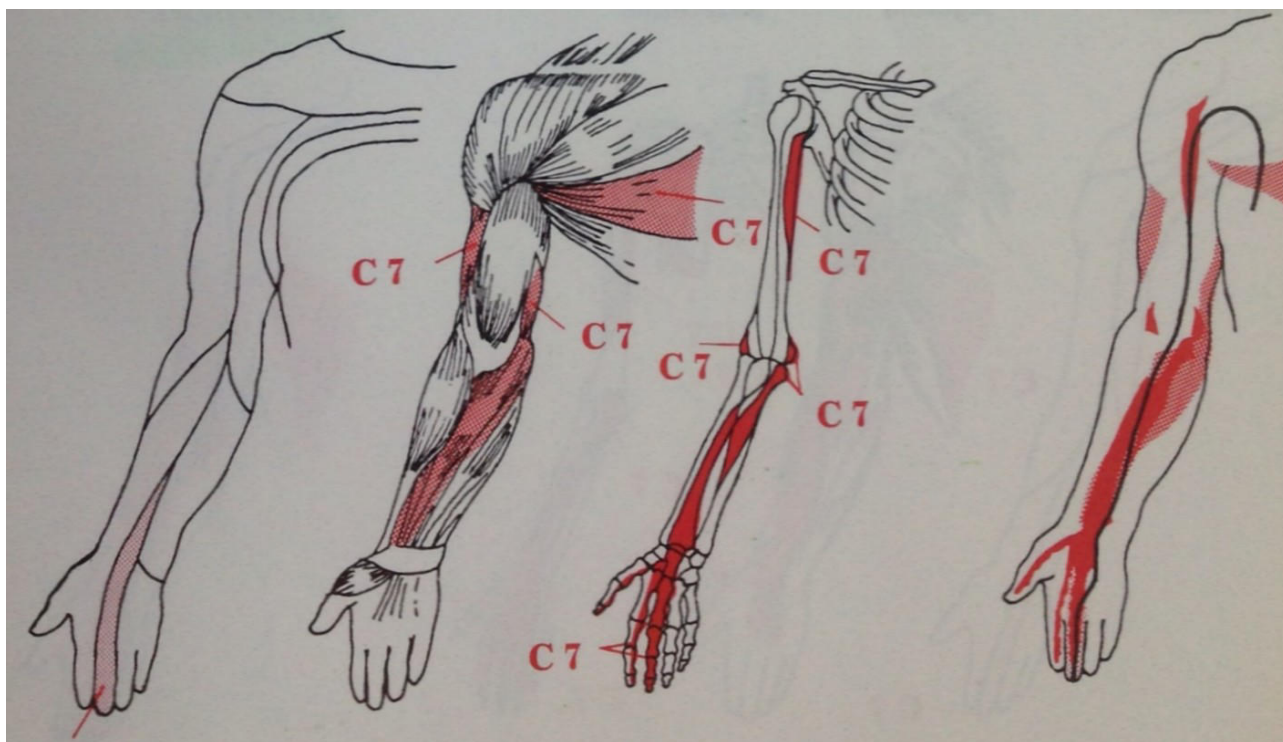
This figure shows the three outer (YANG) meridian localizations of the hands and legs.

The anterior third, TAI YIN, are the meridian pairs LU and SP.



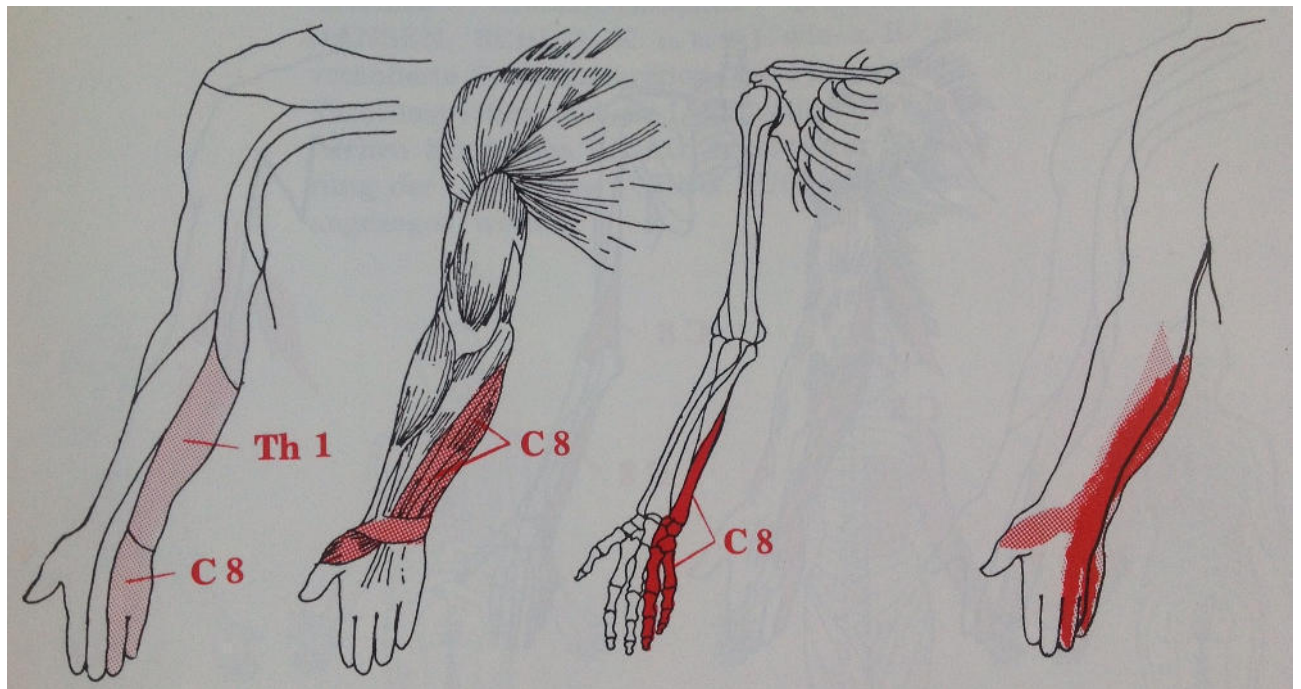
This figure shows the **dermatomes, myotomes and sclerotomes** of the lung-meridian.

The middle third – JUE YIN, are the meridian pairs PC and LV.



This figure shows the dermatome, myotomes and sklerotomes of the pericardium-meridian.

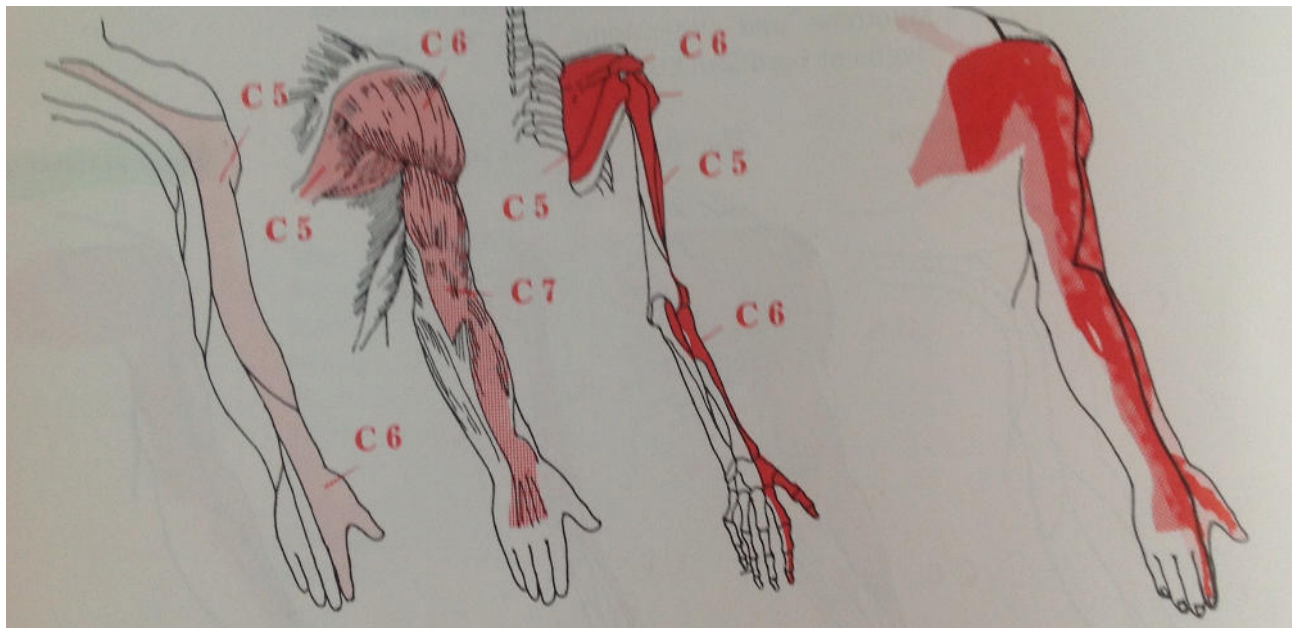
The posterior thirds – SHAO YIN, are the meridian pairs HT and KI.



This figure shows the dermatomes, myotomes and sklerotomes of the heart-meridian.

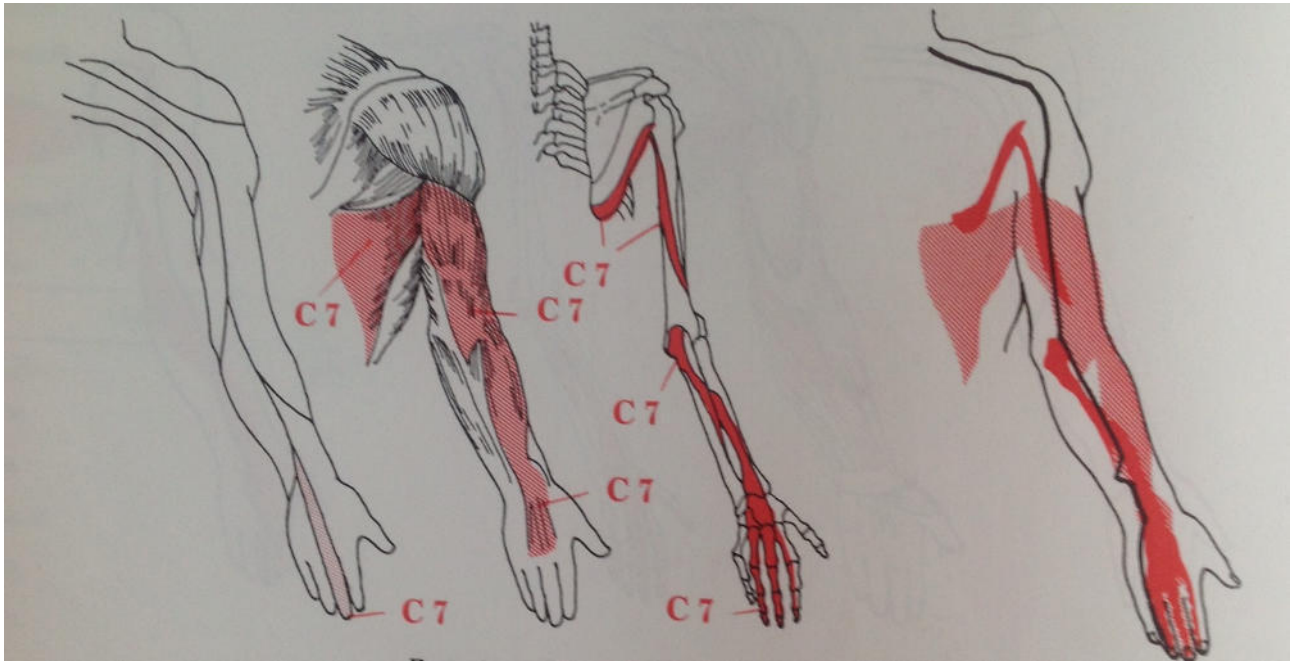
There are three **outside** located **YANG** strips:

An anterior third – YANG MING, are the meridian pairs **LI** and **ST**.



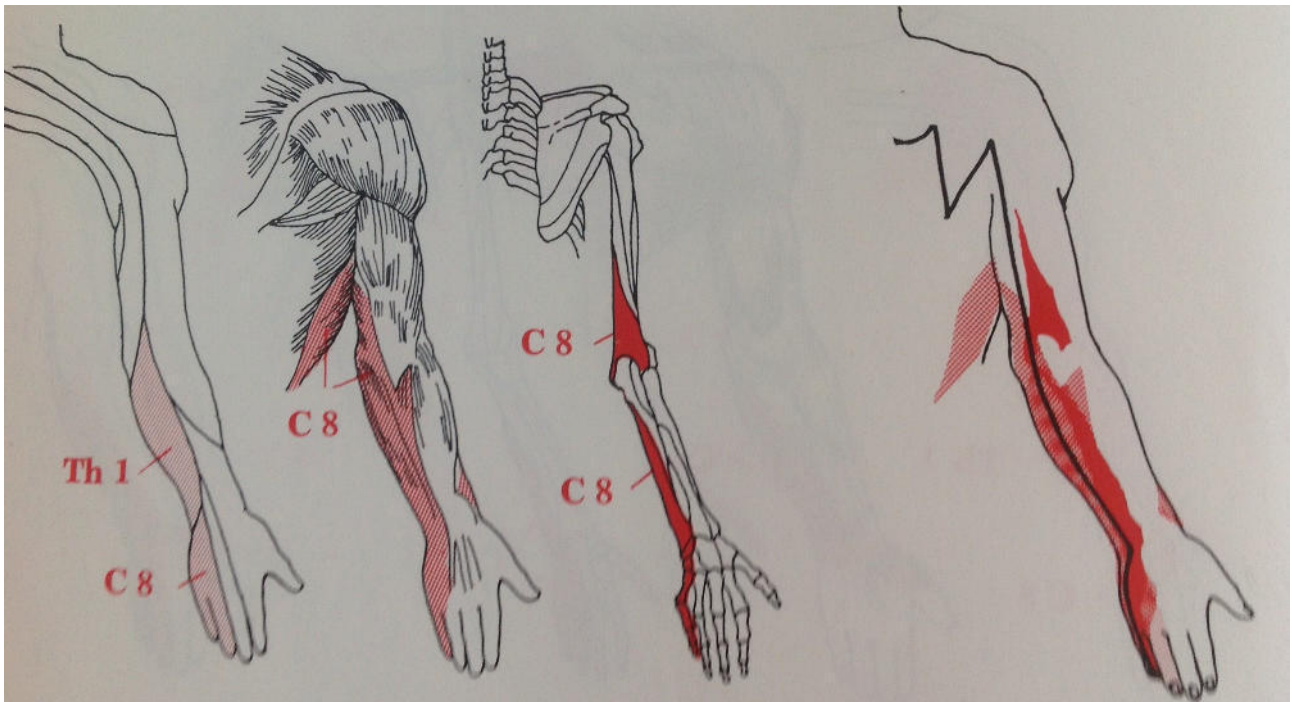
This figure shows the dermatomes, myotomes and sklerotomes of the large intestine-meridian.

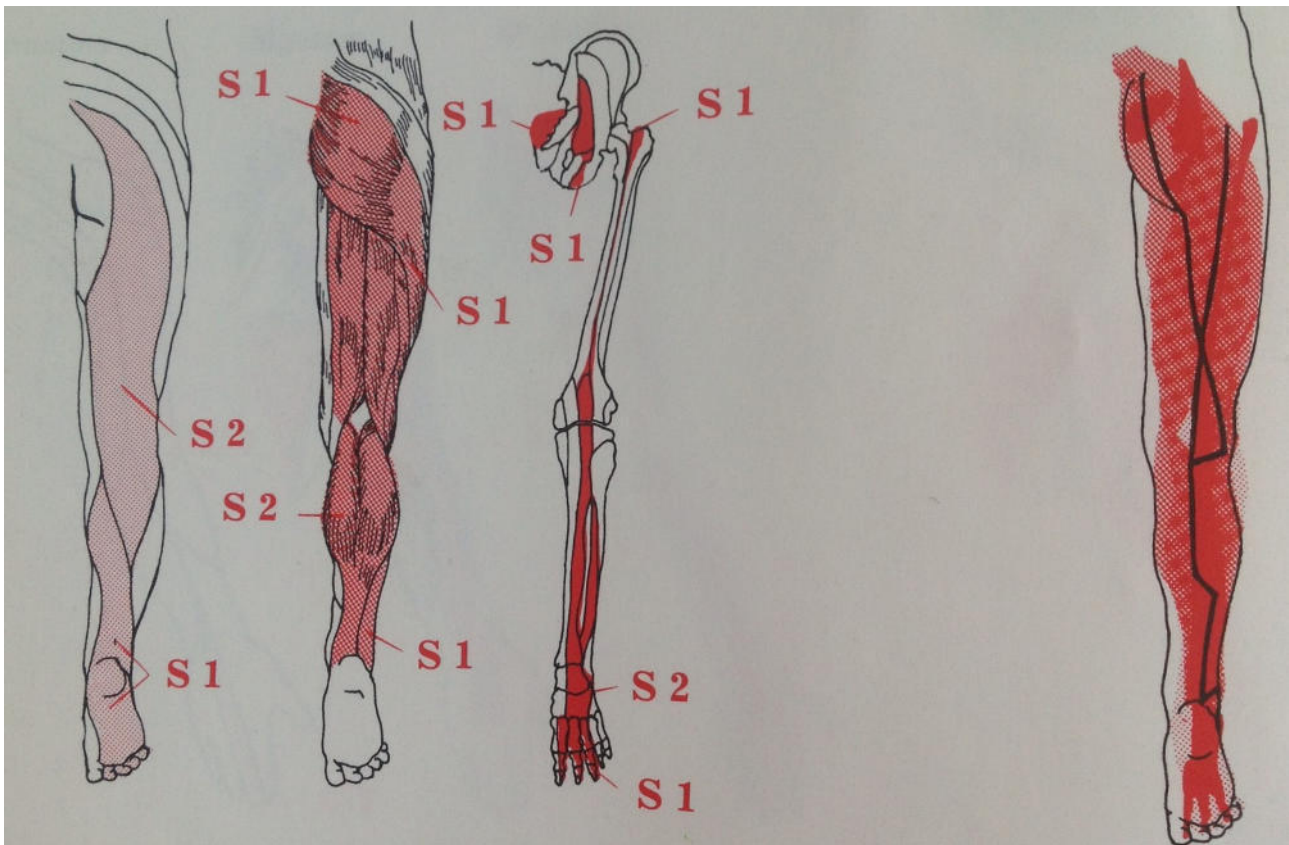
A middle third – SHAO YANG, are the meridian pairs TE and GB.



This figure shows the dermatome, myotomes and sklerotoms of the triple energizer-meridian.

A posterior third – TAI YANG, are the meridian pairs SI and BL.

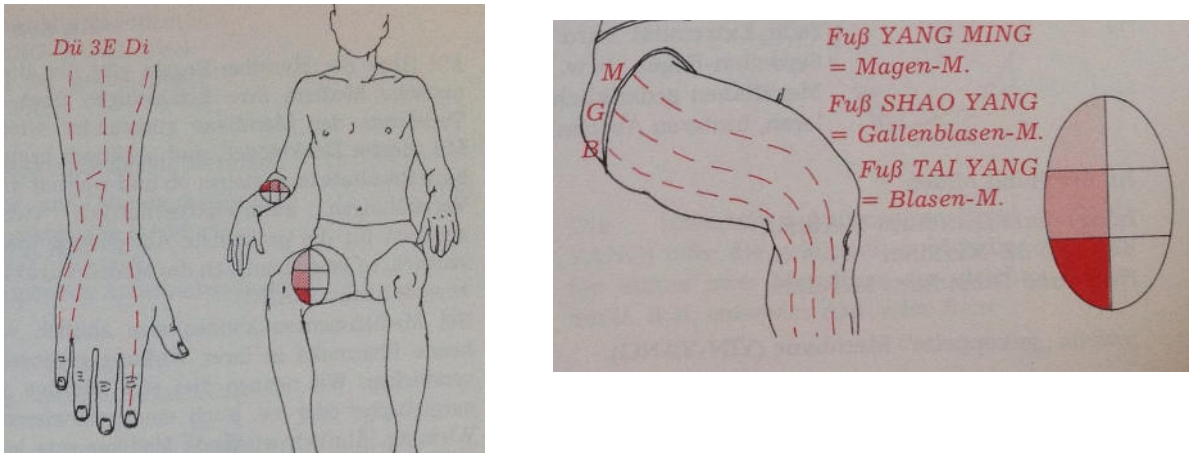




This figure shows the dermatomes, myotomes and sklerotomes of the small intestine-meridian and bladder-meridian.

7. The two most important meridian rules

The relationship between the meridian pairs of the hands and feet are called „**top-down**“ rule. Also named as **YIN-YIN** or **YANG-YANG** rule. The **insides-outside** rule, is also called **YIN-YANG**-rule.



Each upper third is associated with the corresponding lower third. This figure is based on the so called „top-down-rule“.

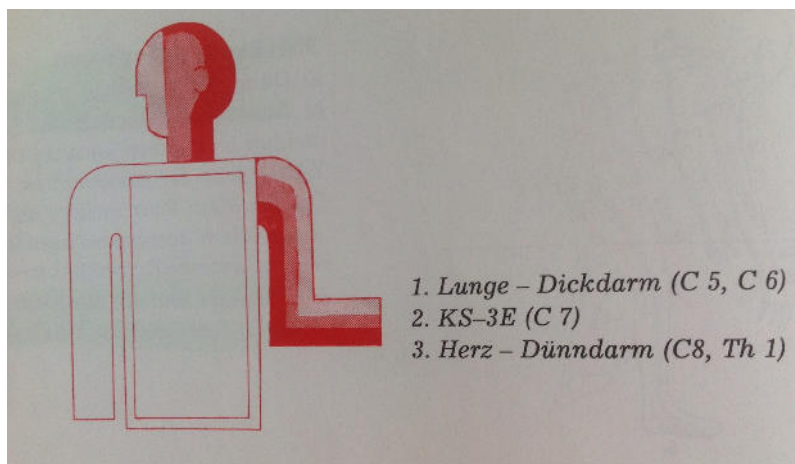
8. The organisation of the head and torso

The head is associated with the YANG and divided into three different parts.

A front third, the face – YANG MING – corresponds to the Yang Ming pair LI and ST.

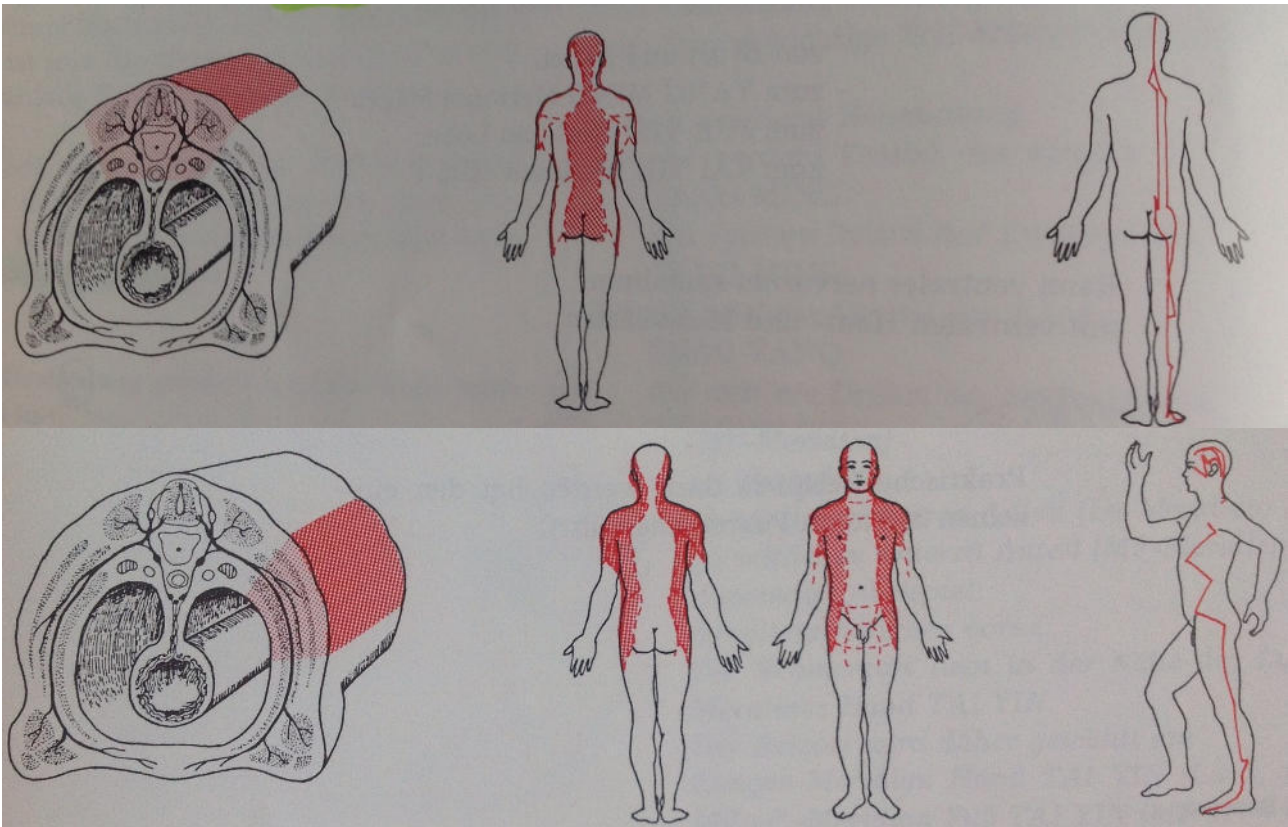
A lateral third, the temple part – SHAO YANG – corresponds to the SHAO YANG pair TE and GB.

A posterior third, the mind – TAI YANG – corresponding to the TAI YANG pair SI and B.



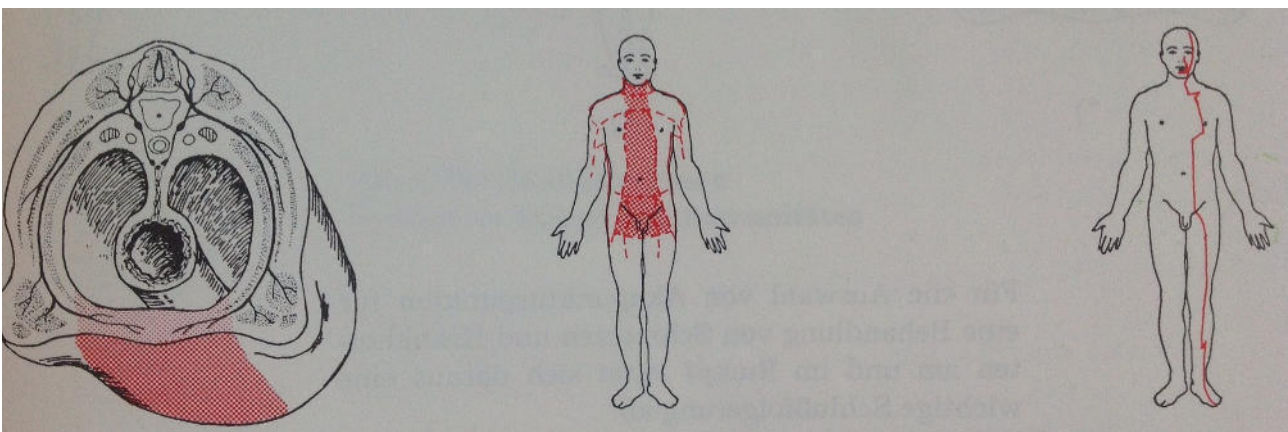
The head is divided into three areas, all are YANG.

As well as the head, the torso is divided in a **front** side, a **lateral** side and a **back** side.

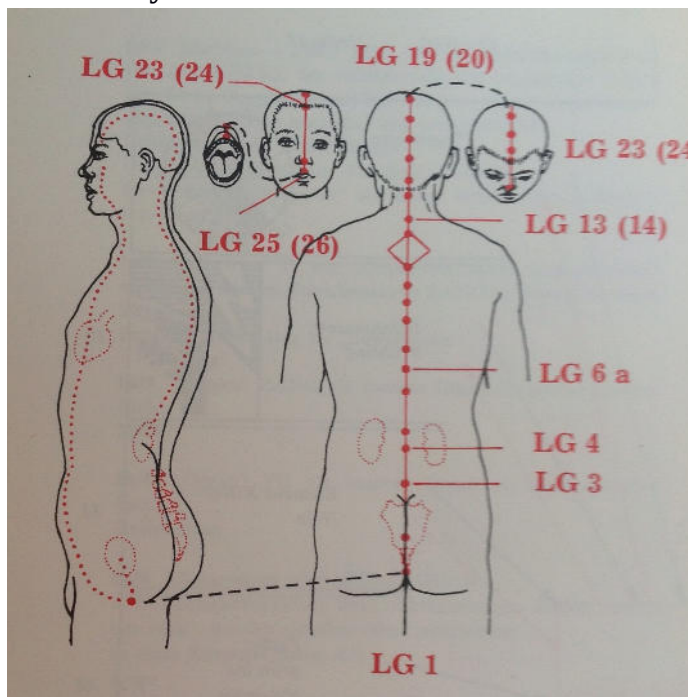


YIN and YANG meridians pass the chest and abdomen. On the front side pass the meridians ST, SP and LV. Laterally pass the meridians GB and LV. At the back the meridians SI and B.

Based on spinal nerve segments, the torso can be divided in a ramus posterior (= ramus dorsalis) and a ramus anterior. The **ramus posterior corresponds to the back side**, the **ramus anterior to the front and lateral side of the torso** (compare chapter: Segmental Anatomy and Acupuncture).

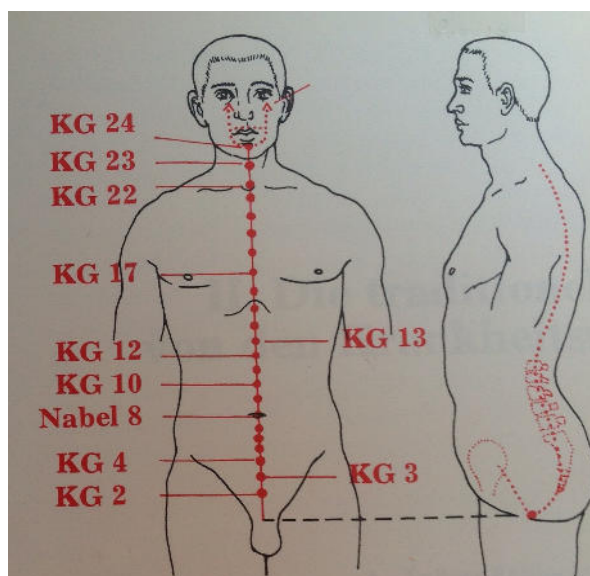


9. In the midline of the body cross the two “medium vessels”



Governing Vessel – DU MAI – GV

Conception Vessel – REN MAI – CV



10. The five layers of the body

According to the TCM, the **body surface** BIAO can be divided in five layers.

1. The **skin** with its adnexa.
2. The **sub cutis** with their vessels and nerves.
3. The **muscles**.
4. The **tendons** which include also nails.
5. **Bones** which include also the joints and articular cartilage.

Each layer of the body surface-BIAO is related to an internal organ-LI: **Skin – Lung-FEI**, for breathing and excretion.

1. **Sub cutis - Heart-XIN** for circulation and distribution of nutrients.
2. **Muscles - Spleen-PI** for food absorption and utilization.
3. **Tendons - Liver-GAN** for metabolism and storage.
4. **Bone - Kidney-SHEN** for the vitality and the excretion of fluids.

Depending on which layer is affected the needle should be inserted so deep that it reaches the affected structure.



11. The theory of ZANG-FU

According to TCM teaching there are two different types of internal organs:

The 5 preserver-ZANG

Heart – XIN

Lung – FEI

Liver – GAN

Spleen – PI

Kidney – SHEN

The function of this organs are: **preserve of blood-XUE, QI-vitality, activity** etc..

The 6 collectors-FU

Small intestine – XIAO CHANG

Large intestine – DA CHANG

Gall bladder – DAN

Stomach – WEI

Bladder – PANG GUANG

Tripple heater – SAN JIAO

The function of this organs are **digestion and excretion**.

According to the „inner-outside rule“, the ZANG and FU organs are connected together.

12. The correlation of a sensory organ to an internal organ ZANG

The **heart – XIN** has a relationship to the **tongue**.

The **lunge – FEI** has a relationship to the **nose**.

The **spleen – PI** has a relationship to the **mouth**.

The **liver – GAN** has a relationship to the **eye**.

The **kidney – SHEN** has a relationship to the **ear**.

13.The relationship of specific causes of disease and emotions to an internal organ ZANG

TCM distinguishes 5 emotions: **joy-XI**, **sadness-BEI**, **anxiety-SI**, **anger-NU** and **fear -KUNG**.

Joy and **warmth** is correlated to the **cardiac** and vascular system.

Sadness and **dryness** to the **lungs**.

Anxiety and **moisture** to the **spleen** and digestive tract.

Anger and **wind** to the **liver**.

Fear and **coldness** to the **kidney** and the **urogenital tract** and vitality.

14. The points on the meridians

YUAN-source point:

According to the authors Yuan points are the **most important and most effective points**. Together with the YU points they are often used to treat diseases of the ZANG organs.

LUO-Passage Point:

This points are usually **chosen by the coupled** meridian according to the insides-outside rule (YIN-YANG-rule).

XI-border point:

This points are often used in **acute diseases**.

MU-alarm point:

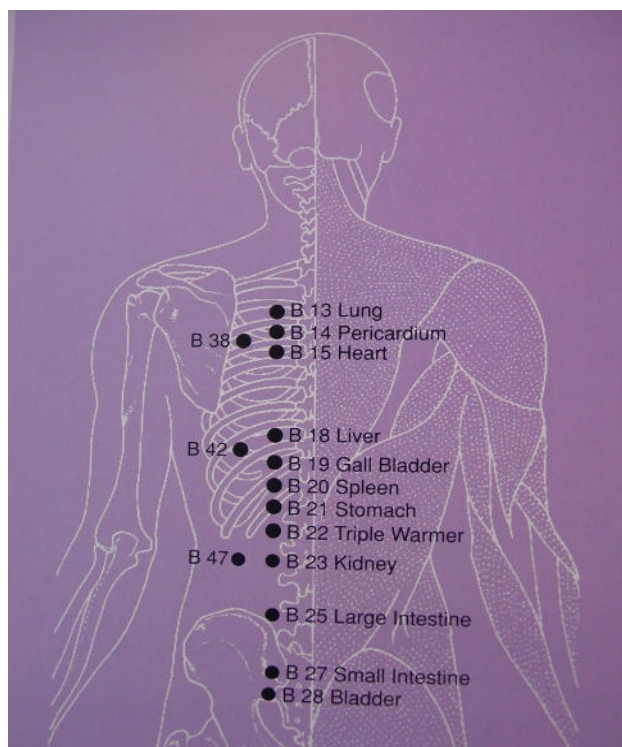
They are located anteriorly in the chest and stomach and they are used together with the lower He point to treat diseases of the FU organs.

Lower He Point

This point are always on the lower extremity. Only YANG meridians have a HE-point.

The YU-Approval points:

These points are located on both sides of the spine on the inner branch of the bladder meridian. In disease of the internal organs, the corresponding points usually show a tenderness and this points therefore are important for diagnostic.



(Source: www.acupressure.com)

Examples of this different points based on the LU meridian:

YUAN point: LU 9

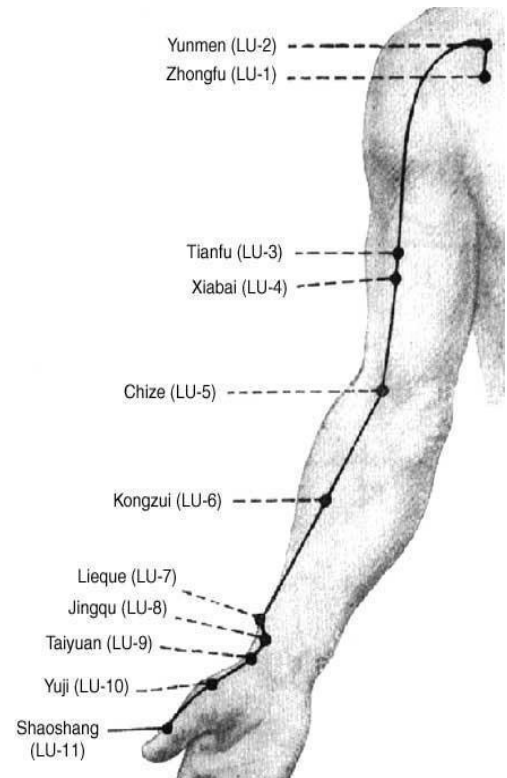
LUO point: LU 7

XI point: LU 6

MU point: LU 1

YU point: BL 13

(Source: www.seattleacupunctureandcoaching.com/)



15.Environmental factors as causes of disease from the perspective of TCM

15.1. Environmental factor cold-HAN as a cause for diseases

The **cold-HAN** is associated with the **kidney function circuit** and according to the insides outside-rule (Yin-Yang-rule) connected with the **bladder**. In the meaning of TCM the **kidneys** are connected with **sexuality, cold and fear**. Cold-HAN symptoms are **YIN symptoms** and are associated to **calm, cold and inactivity**. If HAN enters the body, the **pain “rests” at the entry point** (e.g. back pain). A typical sign for HAN is a “heavy feeling „and a lack of energy.

During a **chill**, a temperature increase is often associated with a **subjective sensation of coldness and a lack of sweating**. Both are **cold-HAN symptoms**.

For example, a **cough** caused together **with cold air** can be interpreted according to TCM as: “cold goes to the **lungs**” and for example, a **cold food** can be interpreted as “**cold reaches the stomach**”.

A **gaunt quiet man with slow awkward movements, anxious, unsociable** and a **low voice** is according to the TCM a **cold-HAN type**. This type has a tendency for hypertension, anaemia and disorders of the urogenital tract.

Heat applications such as moxibustion are good treatment options for HAN diseases and for this diseases points from the bladder and the kidney meridian are often used.

15.2. Environmental factor heat-RE as a cause for disease

Hotness-HUO develops according to an **increase of heat-RE**. According to TCM, factors such as drafts, cold or moisture **can converted in the body to heat-RE**. The personality traits of a **RE-type** is **performance-oriented, mental and physically very agile, speaks quickly and loudly and is very sociable**.

But RE-types often react with **elevated blood pressure** and elevated pulse and tend to cardiac and circulatory disorders, sleep disorders and hyperthyroidism.

In heat-RE types, three types can be distinguished:

- 1) RE with relation to TAI YANG (SI and BL) and to the body surface.
- 2) RE with relation to YANG MING (LI and ST) and to the muscles.
- 3) RE with relation to the Shao-YANG (3H and GB) and to the inside of the body.

15.3. Environmental factor moisture-SHI as a cause for diseases

Diseases with a **tendency to oedema, bloating, flatulence, and paraesthesia** a counted to the type **moisture-SHI**. According to their personality structure, SHI is correlated to the **sorrow-SI**. SHI and SI correspond to the functional circuit **spleen and stomach**. According to TCM, spleen is responsible for digestion and digestive function and fluid balance. The patients experiences feelings

like **“bloated” and powerless**. Relatable diseases are, for example, **leg oedema or ascites**. SHI symptoms have a **tendency to sink into the periphery**. In contrast to SHI, heat-RE „rises“.

SHI types have **pale skin, poor circulation, a puffy face, a tired apathetic facial expression and slow sluggish movements**. It is very **similar to the phlegmatic type**. These type is susceptible to **indigestion, hypotension, hypothyroidism, oedema and varices**. SHI is associated with YIN because of „moisture in the shadow of a mountain“.

15.4. Environmental factor dryness-CAO as a cause for diseases

CAO is correlated to the „sunny side of a mountain „and therefore **correlated to YANG**. Therefore, CAO can be **caused by a lack of fluid/water**. Dryness-CAO is associated with the **lung-FEI** and the emotion **sorrow**. From the perspective of TCM, there is a connection between the lung-FEI and the **skin**. For example, a **dry mouth, a dry cough, a hard faecal or a dry skin are CAO symptoms**. If dryness-CAO is too strong, QI cannot circulate properly (the function of organs), and blood-XUE is disturbed. CAO is also associated with **sad, humourless, miserly, slim and large physique and awkward persons**.

The dryness-CAO is also related to the kidneys and the liver.

15.5. Environmental factor wind-draft-FENG as a cause for diseases

FENG is associated with the **liver** and **gallbladder**. According to TCM, wind-FENG is correlated with the **anger-NU** and this persons deemed as “dogged”, **choleric**, but also as **courage and assertiveness**. Suddenly occurring pain such as **neuralgia, myalgia and colic** are associated diseases to FENG. This **diseases start suddenly and quickly**. FENG spreads in the body „**upward**“. Therefore, diseases such as **headaches, colds and dizziness** corresponds to the term FENG. **Infectious diseases** are also associated with FENG. These diseases are **felt subjectively in the head**. The physique of a FENG type is **athletic**. The wind-FENG type tend to **hypertension, colic and acute joint pain**.

From the TCM perspective, **FENG can be linked with all other diseases**:

1) FENG-SHI – draft-moisture

For example, rheumatic diseases.

2) FENG-HAN – drafts cold

An example for FENG-HAN are flu infections (“colds”).

3) FENG-SHI-RE – draft-moisture-heat

A good treatment for FENG-drafts diseases are cupping applications followed by needling.

Summarized, psychological factors associated to the following organs and climatic factors:

joy XI	-	heart – XIN	–	heat – RE
grief – BEI	-	lung – FEI	–	dryness – CAO
worry – SI	-	spleen – PI	–	moisture – SHI
anger – NU	-	liver – GAN	–	wind – FENG
fear – KUNG	-	kidney – SHEN	–	cold – HAN

Characteristics of the external factors

Heat – RE – burning, heat

Dryness – CAO

Moisture – SHI – remains in an area, falls down.

Wind – FENG – change direction, starts suddenly.

Cold – HAN – penetrating, piercing pain, astringent

16. Emptiness – XU and Fullness – SHI

In TCM, a distinction is made between the two factors: **emptiness -XU** and **fullness-SHI**.

- 1) **emptiness-XU** means “**too little**”, **little Qi, weakness, empty, hypo function, hypotension, anaemia, missing resilience...**
- 2) **fullness-SHI** means “**too much**”, **much Qi, strength, hyper function, hypertension, hyper anaemia, understood, normal resilience...**

It is important to give **weakened patients only weak stimuli** (BU). The “fullness-SHI” type should, however, stimulated intense (XIE).

Emptiness corresponds to YIN and fullness to YANG. But according to TCM, there is a further differentiation in a **XU-YIN** and a **XU-YANG** as well as a **SHI-YIN** and a **SHI-YANG** type.

Long lasting or intensive emptiness-XU-YIN leads to a fullness-SHI-YANG. An excess of YANG leads to an emptiness-XU-YIN.

16.1. Constitution

According to TCM, constitution is the condition of the patient before the disease has started. There are also a distinction between an emptiness-XU and a fullness-SHI constitution. It is important that acupuncture treatments are based on this patient's constitutions. The nature of the disease is only secondary.

XU type: leptosome, weak, delicate, little resistance, sensitive, low defences, suffer greatly from everyday stresses.

SHI-type: athletic, robust, strong, resilient, “normal” healthy person, is sick only in massive external influences.

16.2. Condition

XU-type patient: weak or weakened, thin, limp, speaking in a low voice, often elderly people.

SHI-type patient: strong, well-fed, robust, agile, speaks with a loud voice, often younger people.

At the beginning of a flu, the patient can be a SHI-type and as the disease progresses, he can convert to a XU type. Therefore, a XU-type can convert to a SHI-type.

16.3. The character of diseases

Emptiness-XU-type diseases: these **include longer-lasting**, debilitating, consuming illnesses, such as chronic degenerative diseases, arthritis, ulcer diseases, tuberculosis...

Fullness-SHI-type-illness: These **include short duration**, acute (1-5 days) violent diseases, suddenly starting. E.g. stiff neck, lumbago, neuralgia acute, muscle cramps, colic, apoplexy...

18. Tongues Diagnosis

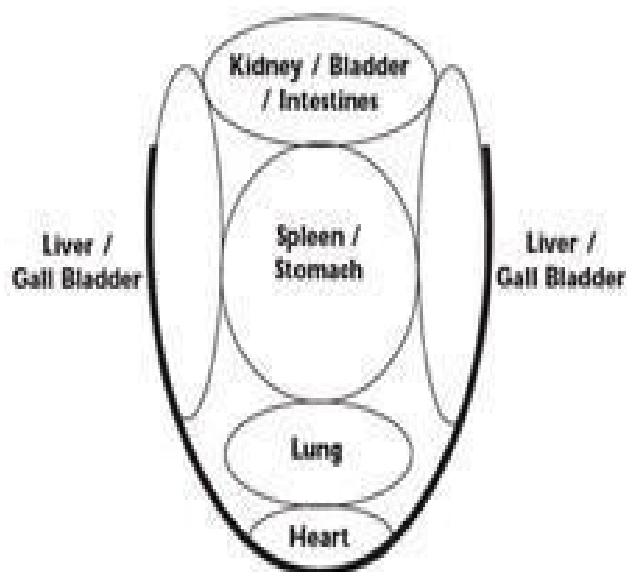
In TCM, tongue diagnosis is based on the characteristics on the coating of the tongue and on the „body“ of the tongue.

Tongue coating:

- a) A white and thin coating is correlated to an emptiness-XU type.
- b) A yellowish and thick coat is correlated to a fullness-SHI type.

Tongue body:

- a) The pale tongue corresponds to an empty-XU type.
- b) A well blood perfused tongue or a red flushed tongue is correlated to a fullness-SHI type.



(Source: <http://www.lifegate.com.au/chinese-medicine-willunga/tongue-diagnosis.html>)

19. Pulse Diagnosis

The soft, weak, thread-like and easily suppressible pulse corresponding to an **emptiness-XU type**.

The powerful, tense and difficult suppressible pulse corresponds to a **fullness-SHI type**.

20. Diagnosis – Overview

Emptiness-XU-type / fullness-SHI-type

Long/short duration and severity of illness

Condition type: leptosome / muscular

Condition type: patient weakened / strong, speaking with a low / loud voice
Types of diseases: chronic / acute illness, difficult / precisely locatable

Pain: pain moderate / strong
Pain and pressure: improvement / decrease by pressure
Duration of pain: long / short history

Main symptoms: skin colour, faecal, urine, mental state, Tongues diagnosis

Pulse Diagnosis

Musculoskeletal pain: pain increase / decrease after rest, pain increase / decrease through exercise

From the perspective of TCM (as well as in modern medicine), the prognosis of chronic diseases are not as good as well as for acute diseases. In this case, a fullness-SHI disease can change into an emptiness-XU disease.

XU-type: should be treated with weaker and superficial stimuli. This type is often treated with moxa, mainly local points are used, less needles are used, mainly homo lateral points are used, mainly YIN meridians be chosen, 5-7 days should lie between treatments, the patient should only feel a slight De-qi.

SHI-type: should be treated with strong, up and down and rotating movement of the acupuncture needle, more needles should be chosen, no moxa should be used, mainly far and contralateral points should be used, YANG meridians should be used, 1-3 days should lie between treatments, the patient should feel a strong De-Qi.

According to the authors, depending on the intense of stimulation, **almost from each acupuncture point, an strengthening or debilitating impact on the patient can be achieved.** An exception of this are the following points. This points have **only a strengthening or a debilitating effect:**

Strengthening-BU: ST 36, CV 6 and 5, BL 23

Debilitating-XIE: New Point 86, BL 54, LU 5

According to the authors, an exacerbation of symptoms are based on a misjudgement of the factors emptiness-XU and/or fullness-SHI.

The De-qi sensation is an indicator for needling intensity (FA). **A weak stimulation BU-FA is characterized by a local De-Qi sensation. This sensation occurs only in the surrounding of the needle. A strong stimulus means a wide radiating De-Qi sensation.** Moxibustion is in general a strengthening treatment. And as already mentioned, **a strong stimulus is usually caused by peripheral points and a weak stimulus by local points.** In case of treatment doubts, a strong irritation should be avoided. Especially with systemic diseases such as multiple sclerosis or diseases with positive rheumatoid factors (emptiness-XU types), should be considered if acupuncture is ever a treatment option.

21. A practical example for diagnosis:

A 72 year old patient with a very long disease history has a variety of complaints: pain in the neck, at the shoulder, in the back and in the leg. She has a feeling of coldness and heaviness, especially in the lumbar region. She has cold feet and hands. She has pale skin, a pale body tongue with a thin white coat.

Therefore, according to TCM this person is an emptiness-XU type. The patient corresponds also to cold-HAN symptoms. Cold-HAN corresponds to the kidney and there coupled meridian is the bladder meridian. Therefore the points BL 23 (YU-point of the kidney) and Bl 54 (HE-point of the bladder) can / should be selected. Because it is an emptiness-XU type, only these two points are used. On each needle a moxa is used and the needles are not irritated to stimulate only weak.

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VIII.

De-Qi Sensation and Acupuncture

Summary and Conclusion of this Chapter:

According to many acupuncturists, a De-Qi sensation is important for a successful acupuncture treatment (1.).

When an acupuncture needle is rotated, connective tissue winds around the needle (2.1.). This effect can be easily tested. The more the needle is rotated, the more resistance can be felt due to the connective tissue that wraps around it. Additional rotation further enhances the De-Qi feeling (2.3.) and after several rotations this can be painful. The De-Qi sensation also occurs in” non-acupuncture points“(2.2.) because there is also connective tissue. However, acupuncture points are usually very sensitive areas. Hence, a slightly stronger sensation at these points is self-evident. Furthermore, when a needle is inserted deeper than superficial, a stronger sensation occurs.

Even without an external stimulation people can feel a De-Qi sensation (2.4.). By “mentally focusing” on a particular body region a De-Qi can be felt without needling.

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1. What is a De-Qi Sensation?

De-Qi sensation generally occurs during needling and with a possible manipulation of the needle. According to the TCM, this feeling is different from a pure piercing pain and can be described with adjectives like dull-oppressive, electrifying-tingling, tense, heavy and warm. (8)

De-Qi (arrival of Qi) may have been first mentioned in the Huangdi Neijing (~100 B.C.) This is one of the oldest standard works of Chinese medicine. In this work the following explanations for De-Qi were made: “For successful acupuncture, the Qi must arrive. “ “The acupuncturist should devote all his/her concentration to the needle, keep the needle on the surface and move it gently, until the Qi has arrived. “ (9)

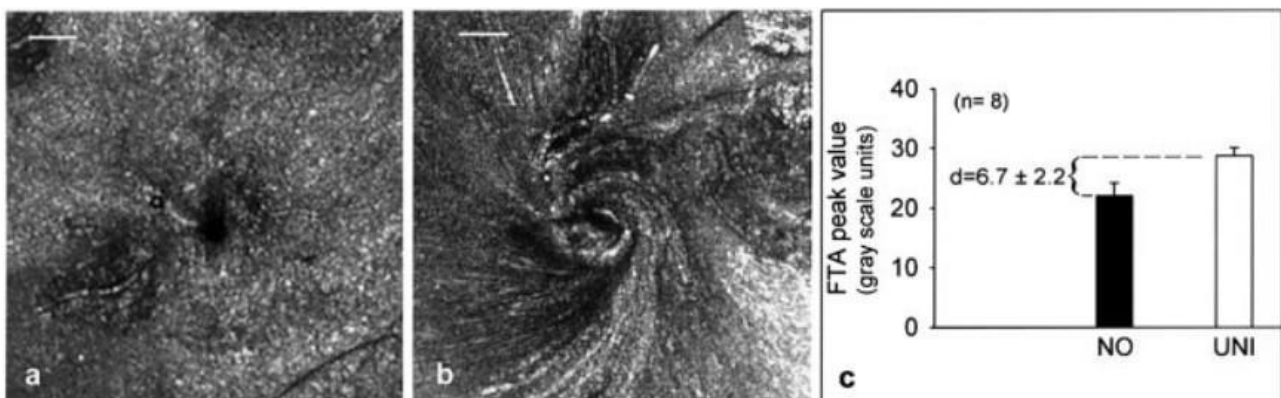
According to the Huangdi Neijing, the De-Qi sensation occurs **along meridians** (PSM) or channels (9).

Triggering this De-Qi-feeling is seen as a **condition for successful treatment** by many acupuncturists and in TCM in general.

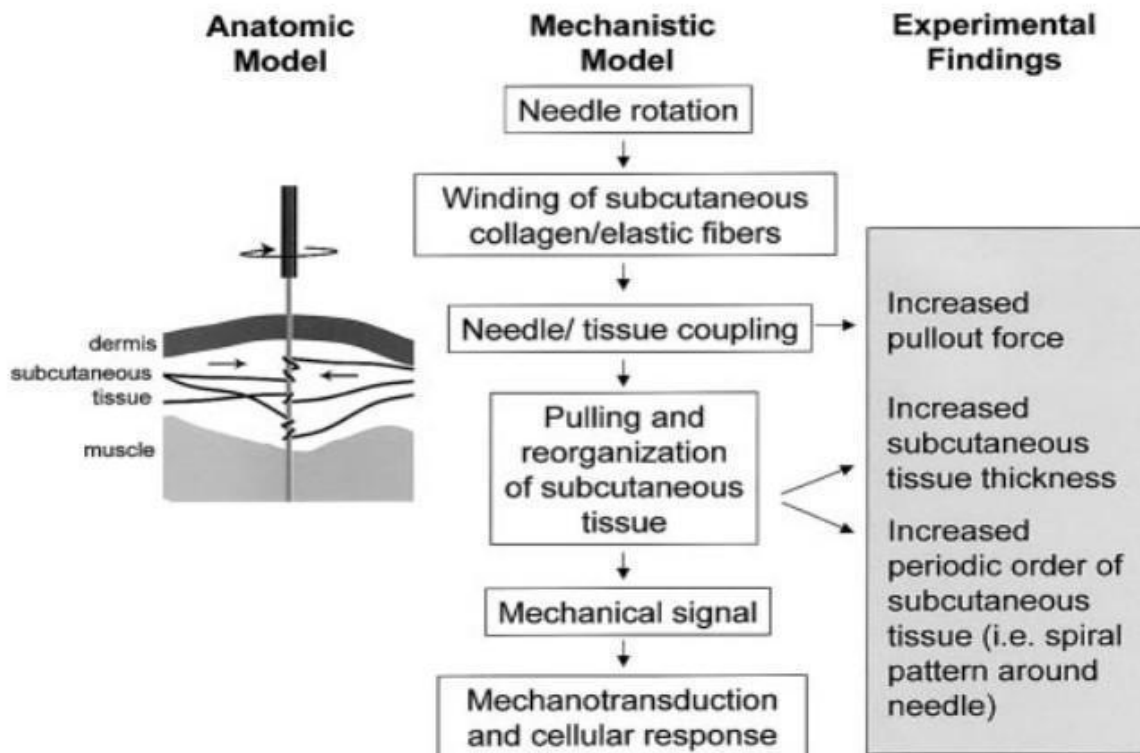
2. Studies pertained to De-Qi

2.1. Langevin et al. (9) – Connective Tissue Involvement in Acupuncture

Langevin et al. investigated the **effects of needle rotation** and its impact on the affected tissue. The following figure shows an ultrasound scanning acoustic microscopy image of subcutaneous tissue from a rat. In a) no needle rotation was applied, b) displays the tissue after unidirectional needle rotation. The **winding of connective tissue around the needle** can be clearly seen.

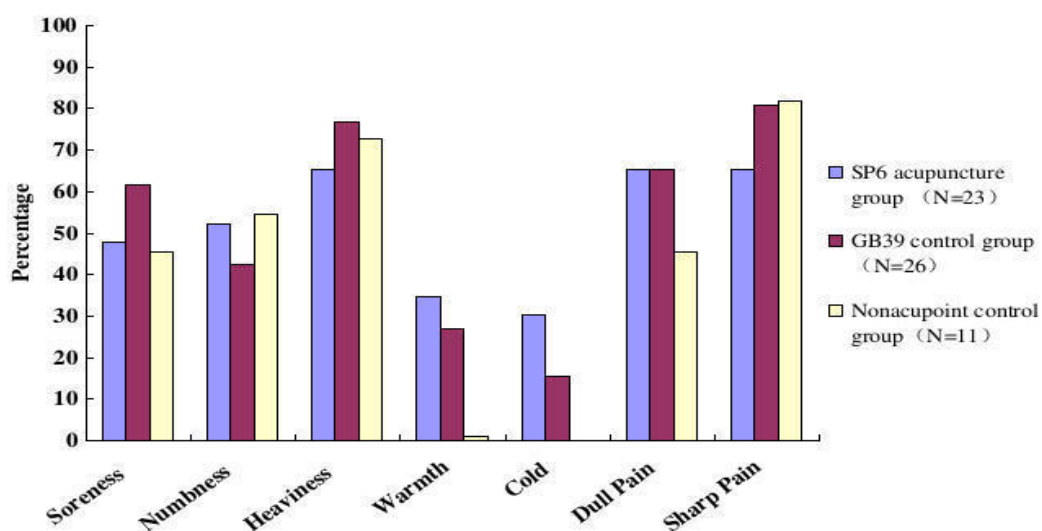


The following illustration shows the summary of results from Langevin et al. The collagen and elastic fibres wind around the needle. This winding leads to cellular responses of the affected cells.



2.2. Shi et al. (1) – De-Qi sensation on acupuncture and non-acupuncture points

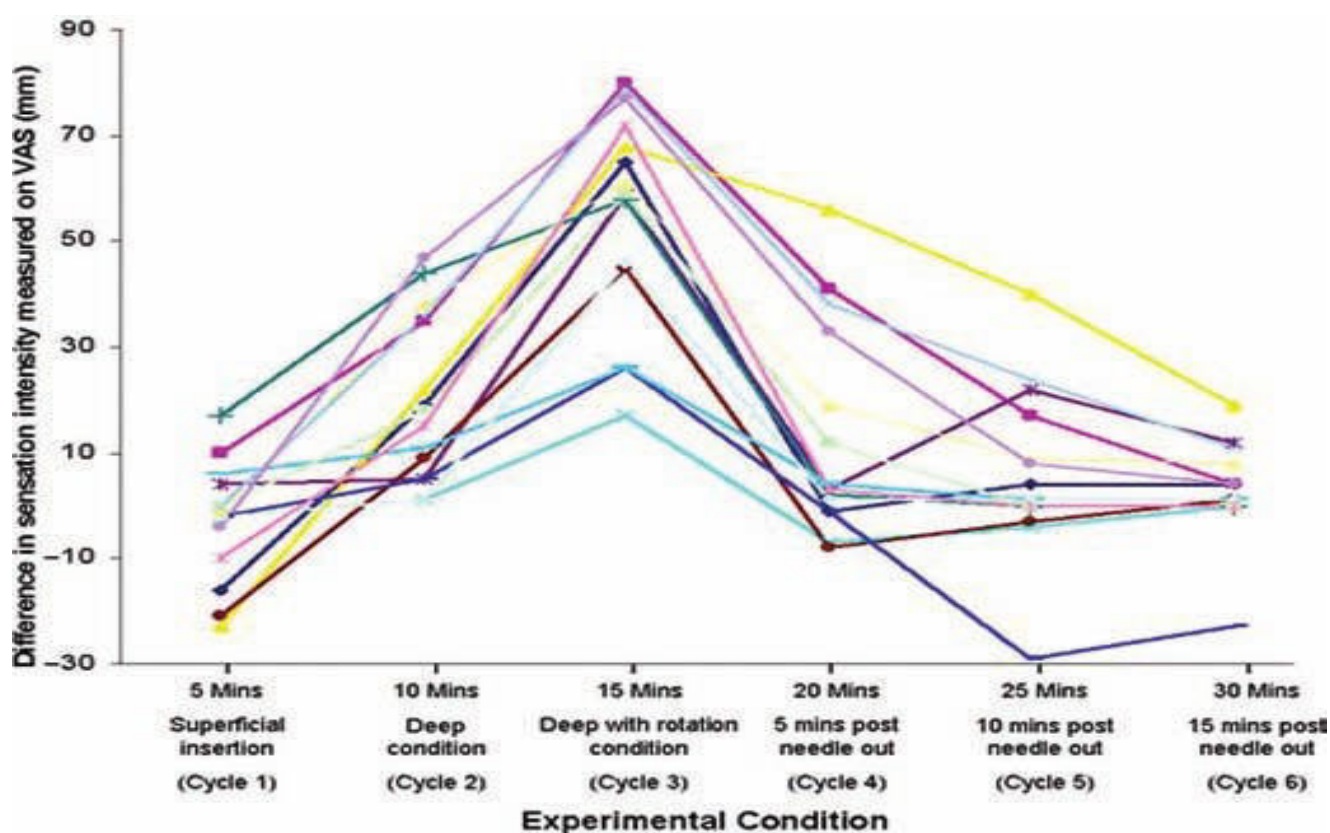
In this study by Shi et al. 60 dysmenorrhea patients were included. The patients were randomly assigned to one of three treatment groups. In the first group **acupuncture point SP6, in the second GB39 and in the third a non-acupuncture point were used**. To rate De-Qi sensations, the Massachusetts General Hospital Acupuncture Sensation Scales (MASS) with minor modifications was used. The authors found **no statistical difference among these three groups based on the intensity of De-Qi feeling or the type of sensation**. The following figure shows the type of sensation and their percentage distribution in the three treatment groups.



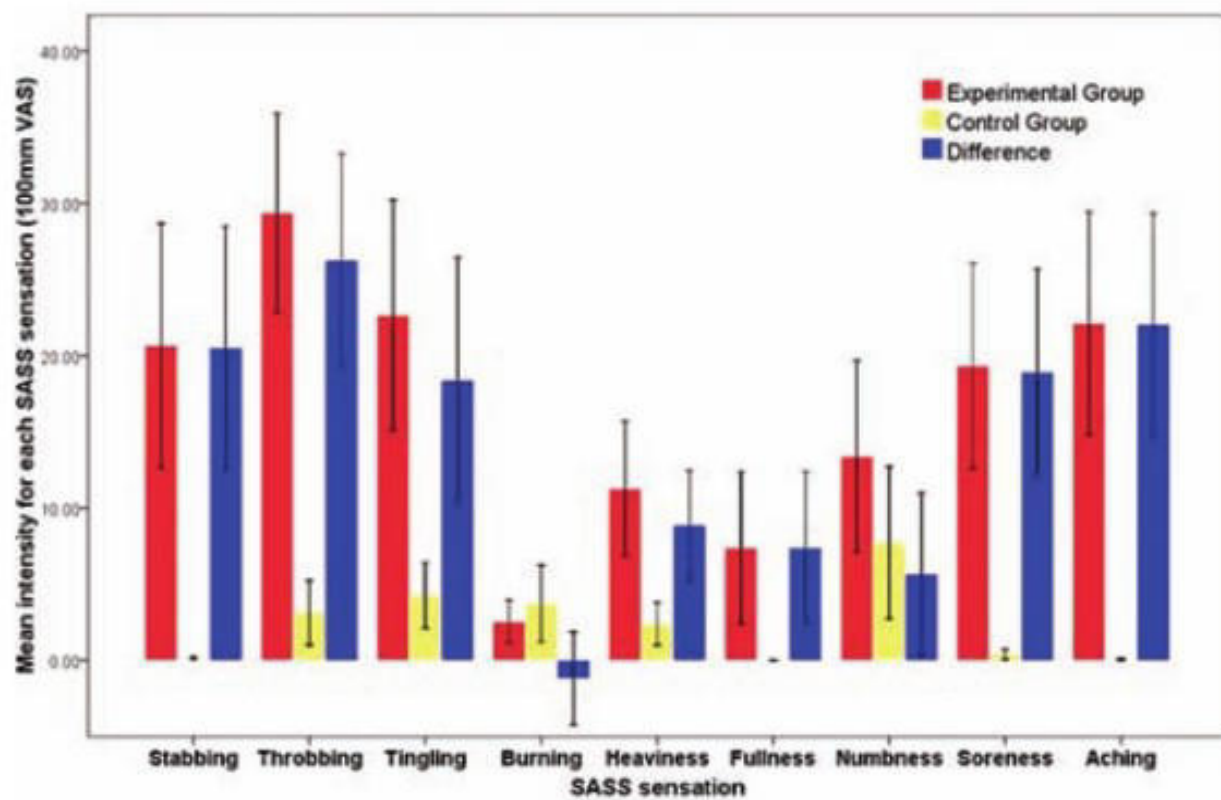
2.3. Benham et al. (4) – An experimental study on the self-report of acupuncture needle sensation during deep needling with bi-directional rotation

Benham et al. investigated **self-reported needle sensation during deep and bi-directional rotated needling** in 15 healthy volunteers. For each patient, first a superficial needling was performed (cycle 1). Then it was needled deeply (cycle 2) and in a third step a bi-directional rotation was performed (cycle 3). The placebo group received a superficial needling, followed by sham deep needling and then sham bi-directional rotation. The sensation was measured using the Visual Analogue Scale (VAS).

The following figure shows the difference in sensation according to the different cycles. **Deep needling enhances the sensation compared to superficial needling. Additional rotation further enhances this sensation** ($p=0.0002$).

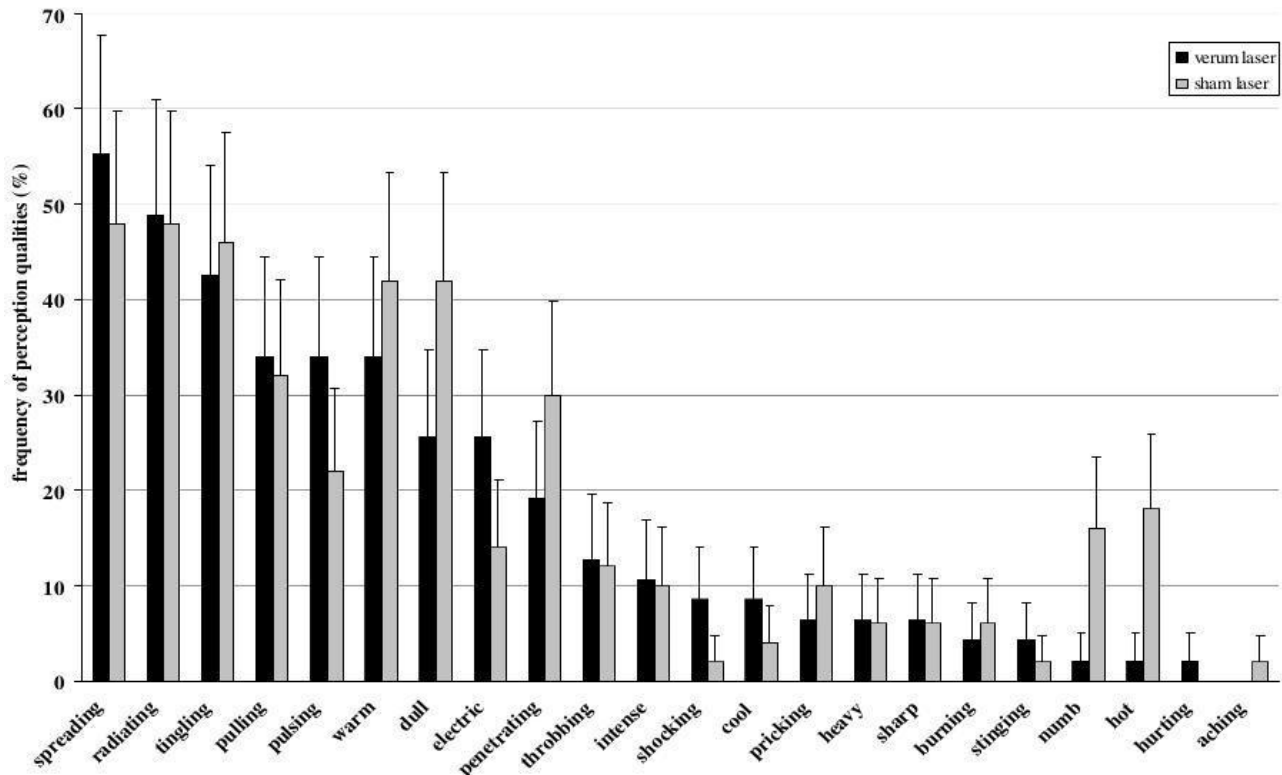


The following figure shows the differences measured according to the VAS and the deep and superficial scores for each subject during the rotation condition (cycle 3). The maximum values have a size of 30 mm. The VAS scores during deep needling with bi-directional rotation were higher than those during superficial needling with sham bi-directional rotation ($p<0.0001$).



2.4. Salih et al. (6) – De-Qi sensations without cutaneous sensory input

Sahli et al. conducted a **double-blind** study with **laser acupuncture**, involving 34 subjects. The subjects received either verum or sham laser treatment at three acupuncture points (LI4, LU7, and LR3). The frequency, intensity (evaluated according to VAS) and quality of the sensations were measured. **Both groups showed similar results** regarding to frequency (p-value = 0.67), intensity (p-value = 0.71) and quality (p-values between 0.15 – 0.98). The following figure shows the frequency of perception qualities in the verum and sham group.



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IX.

Viscero cutaneous reflex – MU- and SHU-Points

Summary and Conclusion of this Chapter:

Visceral and somatic afferent input is processed in the spinal cord on the same neurons (1.1., 1.2.), therefore „misinterpretation“ can occur (1.3.). This can lead to hyperalgesia of the skin, but also other reactions, like vegetative changes in the blood vessels or sweat glands, or, oedema and trophic changes in the skin (1.3.).

Head described these relationships over 100 years ago, using the term „referred pain“(2.1.). Therefore, reactions in the skin are also called „Head zones“. His conclusions was based on careful observations of the correlation between diseases of the internal organs and reactions on the skin in patients (2.3.).

Fish-based experiments by Wernøe (1925) indicate that organs influence the skin. In reverse, changes in the skin can affect organs (2.2.).

In TCM SHU-points are located on the back side of the body. Each point is correlated to a specific organ system (3.). In contrast, MU-points are located on the front side. They are correlated to organ systems (4.). In TCM MU- and SHU-points play an important role for diagnosis and treatment.

Head zones, MU and SHU points are highly correlated to each other (5.).

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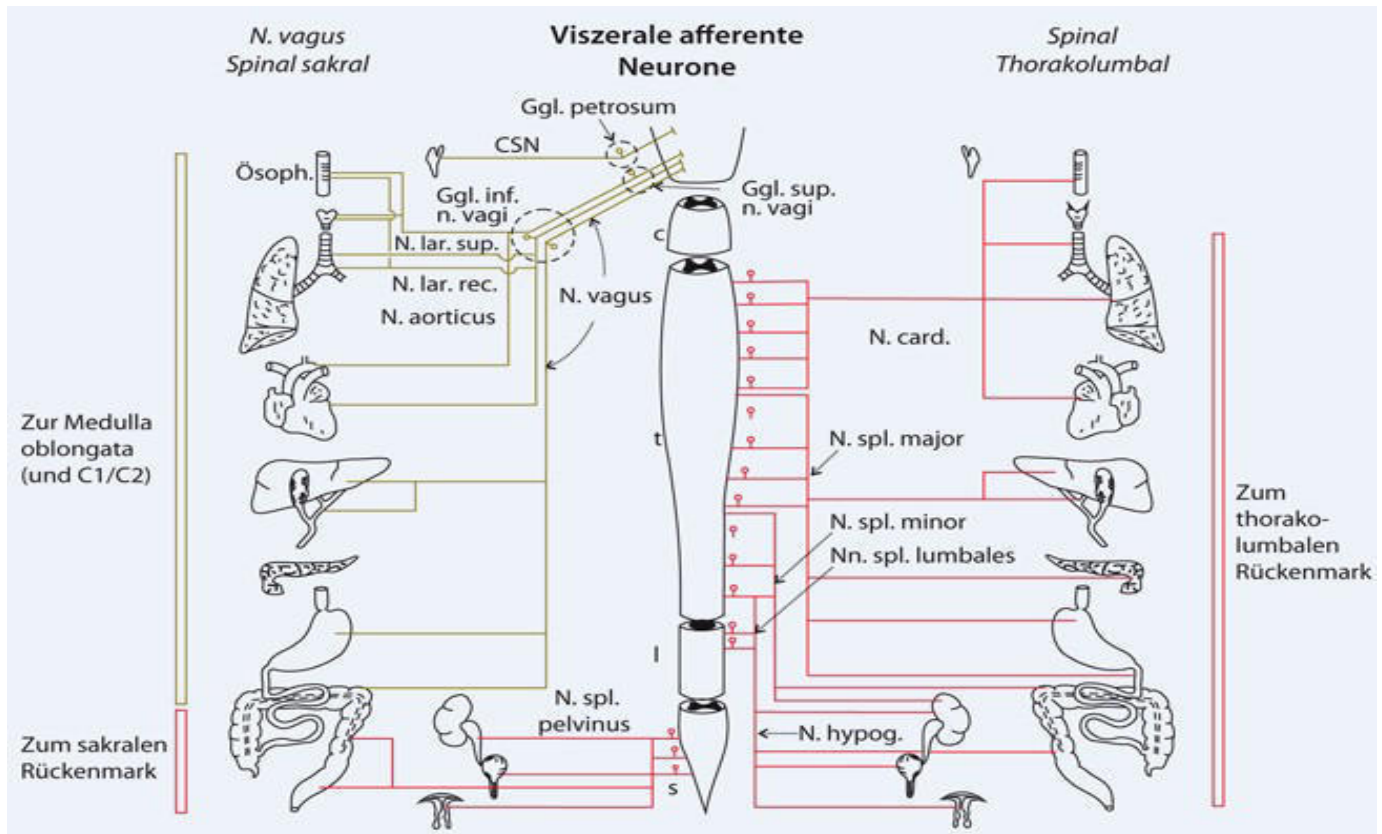
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1. Neurobiological basics for visceral pain

Neurovisceral pain, somatic pain, and body sensations are all assigned to **interoception**. (6)

Interoception means that the sources of information are internal body parts, rather than the external world. Spinal visceral afferents are poly modal and can be activated by mechanical and chemical stimuli. (6)

Neurovisceral sensation caused for example by local inflammation, reach higher brain centres and can therefore be perceived consciously.



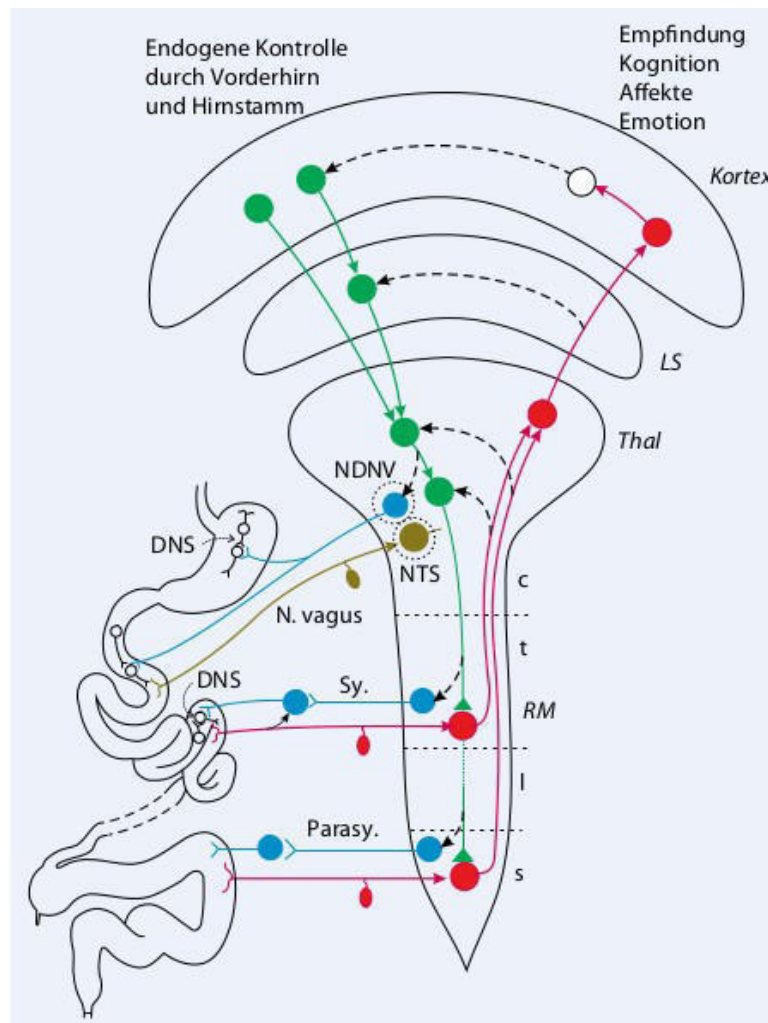
1.1. Sympathic and parasympathic processing

Information from the viscera passes through three connected neurons in the cerebrum.

The cell bodies of **1st order neurons** are located in the dorsal column (spinal ganglion / somatic afferents), the sacral plexus, and the ganglion nodosum (parasympathetic afferents). **Somatic and visceral afferents converge in spinal ganglions**, giving rise to a **viscerosomatic projection**. **2Nd order neurons** of the spinal and sympathetic afferents are projecting from the **dorsal column** of the spinal cord to the **thalamus** and to the **formation retikularis** in the brainstem. From the thalamus **3rd order neurons reach the cortex**.

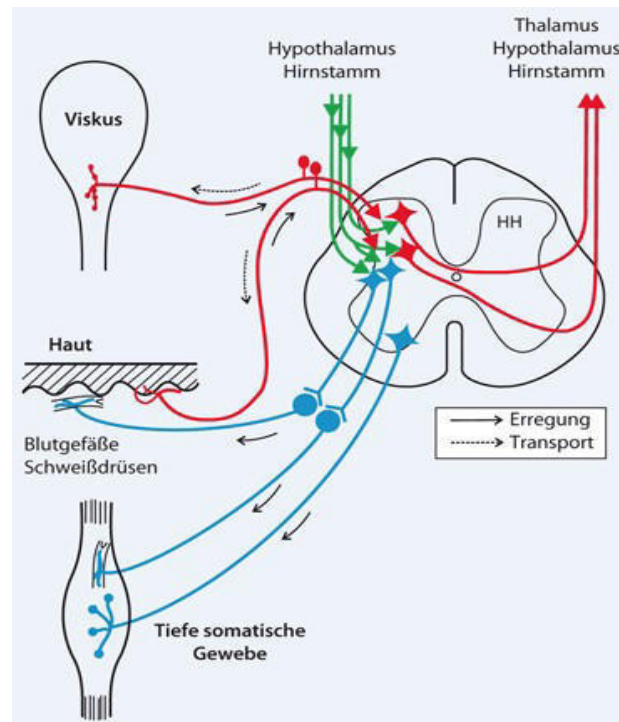
1.2. Vagal nerve processing

The **vagal nerves** project by the **ganglion nodosum** (Ganglion inferius nervi vagi) in the **brainstem**. Information of this **2nd order neuron will be forwarded to 3rd order neurons**. On the one hand, 2nd order neurons are connected to the autonomic nervous system, like the satiety center, blood pressure regulation, etc., on the other hand **3rd order neurons project** to the **limbic system** (responsible for emotional processing) and the **sensory cortex**. These projections can influence the heart rate, the appetite, and emotions in response to visceral stimuli. (7)



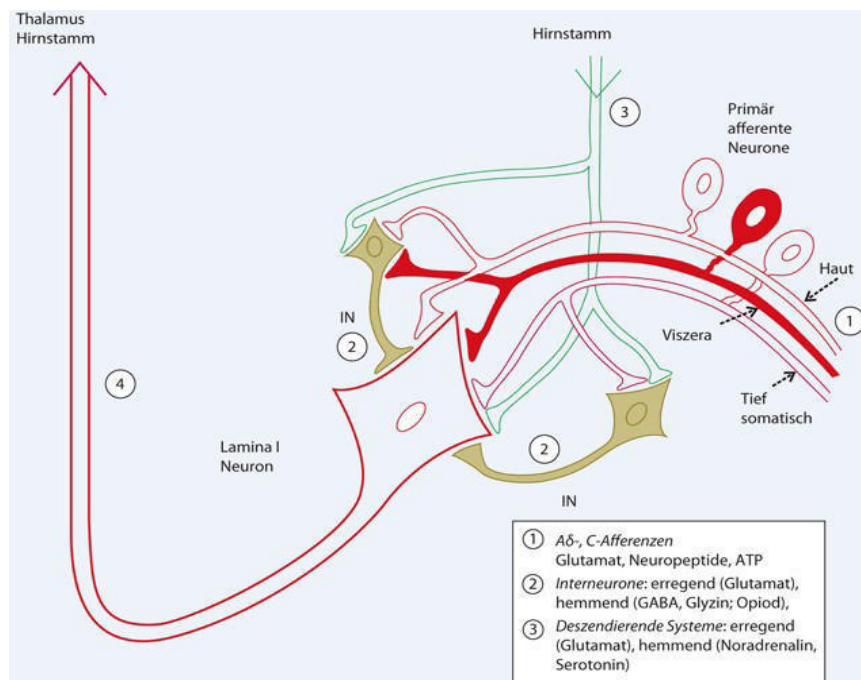
1.3. Misinterpretation

The following figure illustrates the processing of pain from visceral organs. **In the spinal cord visceral and somatic afferents are often connected to the same neuron**, which further send information to the brain. This can cause “**misinterpretation**” of visceral information in somatic areas. One can speak of a “**transfer**” of visceral pain to other areas, causing **hyperalgesia of the skin** for example. (6)



This leads to **vegetative changes** in the **blood vessels or sweat glands, increase in muscle tension in corresponding areas, but also oedema and trophic changes in the skin can occur.** (6)

The following image shows the **processing of information in the Lamina 1**. This neuron (marked with number 4) sends information to the thalamus. It **receives input from different sources**: the viscera, somatic information, input from the derma and efferents from the brainstem. The **combination of this input** to the lamina 1 neuron (4) can cause excitation of the neuron. **The thalamus does not distinguish between the different sources of information.**



2. Head-zones and their relation to MU and SHU points

2.1. Head-zones

Sir Henry Head (1861-1940) discovered the viscerocutaneous reflex more than 100 years ago in the west (2-4). He showed, on the **basis of hundreds of clinical cases**, the **relationship between visceral disease and cutaneous tenderness**, a sensation of pain or discomfort in the skin. (1)

The reason for this reflex is not precisely known, but probably pain from dermatomes (somatic pain forwarded by the somatic nervous system) and pain from internal organs (visceral pain forwarded by the autonomic nervous system) are processed by the same neurons in the spinal cord, so the brain can't separate the sources.

This is also called **“referred pain”**, because this pain typically **projects from specific organs to specific dermatomes** (called **Head-zones**).

For example, an irritation of the diaphragm, caused by an inflammation of the gallbladder, causes pain in the area of the clavicle. The reason for this is, that the phrenic nerve, which supplies the diaphragm, processes information at the same height on the spinal cord, as well as the nerve, that innervates the skin around the clavicle. But it is not clear why the pain dermatomes produce no „referred pain“ in internal organs.

Because of these processing, it is now believed that the positions of Head zones are associated with dermatomes. (1)

2.2. Wernøe – reaction on skin and visceral organ segments

Doing research on fish, Wernøe described in 1925 the **relationship between reactions on skin and visceral organs**. He showed that a **visceral irritation causes a cutaneous pigment reaction** (and **vasoconstriction**). These reactions always – even after local visceral irritation – correspond to several skin segments and occur typically **only partially segmental**. When **unpaired organs** are stimulated, the corresponding skin zone always reacts **bilateral**. **Unilateral stimulation of paired organs** causes **unilateral cutaneous whitening zones**. Conversely, **cutaneous irritation causes visceral reactions**, partly in the form of **visceral hyperaemia**, partly in the form of **visceral ischemia**. The **dilatatory visceral reflex** is a **spinal reflex**, therefore it can only be caused with the spinal cord intact.

The contractive **visceral reflex**, however, is an **axon reflex**, and may be triggered even after the spinal cord is not functional. These experiments also show that unpaired visceral organs, have bilateral and crossed innervation. (5)

2.3. Head and his observations

Back to the work of Head. It is very interesting to know how Head discovered these relationships by simple observation. An example from his work, involving a patient who was suffering from nephrolithiasis with a single ureter stone, will show this: “It is interesting to note that this case showed a rather wider distribution downwards [11th and 12th dorsal] than is usual in cases of renal calculus [. . .]” but clearly points out a point of maximum intensity: “The tenderness is especially marked over the tip of the twelfth rib [. . .]” (1)

Head described how maximum pain areas on the skin were correlated to internal illness.

According to the work of Beißner et al. (1) they can be found in the original paper of Head:

„(a) “Every such area of cutaneous tenderness has one or more maximum points, the position of which is exceedingly important, for it is to the situation of these maxima that the patient refers his pain”. Head [2, page 6]

(b) “There is great cutaneous tenderness [. . .] yet firm deep pressure relieves, rather than aggravates, his pain”. Head [2, page 71]

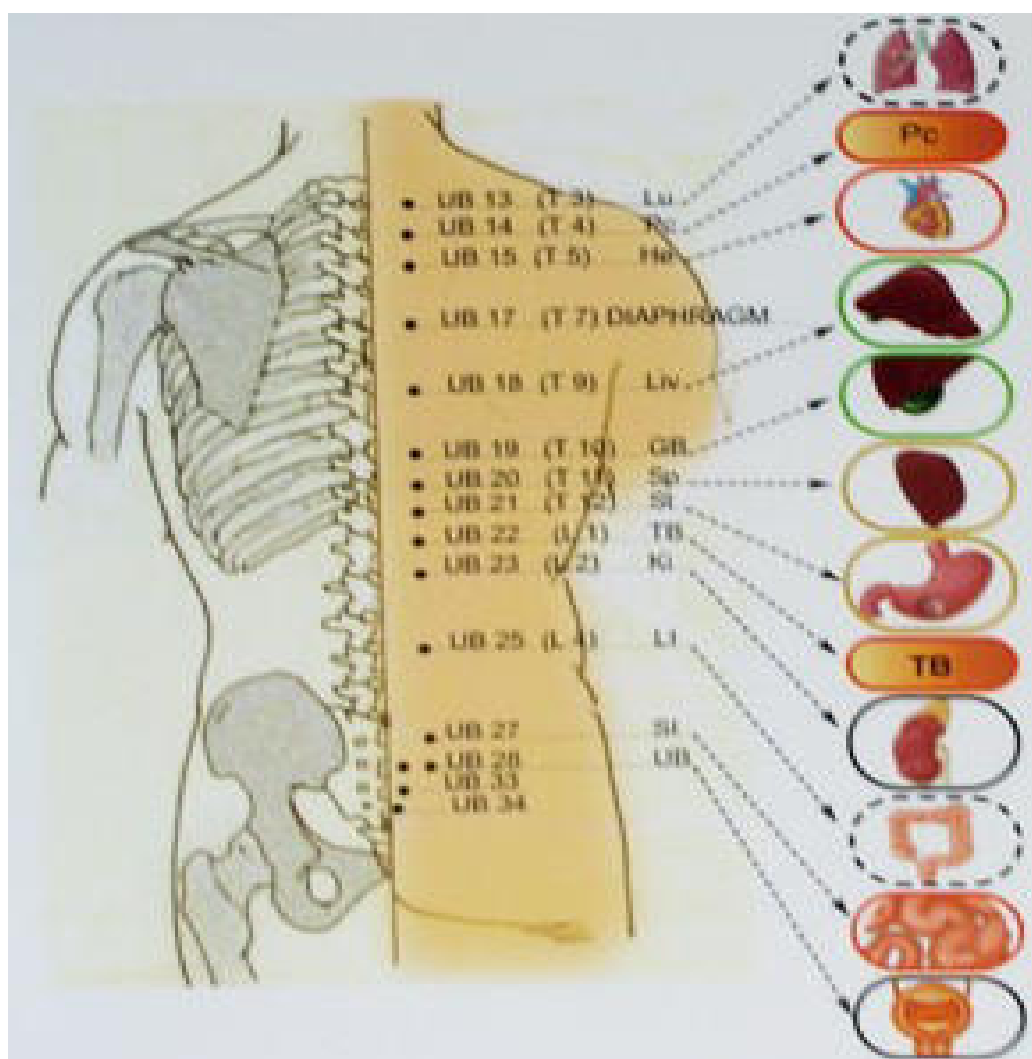
(c) “Thus, mustard leaves applied to the maximum spots of the affected areas of the chest or back, [. . .] will remove the nausea and vomiting in this mild and purely reflex type of gastric disturbance”. Head [2, page 261] „ (1)

3. Approval-points / SHU points

All **approval points** are located on the **back side of the body**, on the **inner branch of the bladder meridian** (between the 3rd thoracic vertebra and the 2nd sacral vertebra). Each **organ system** is **associated with a SHU Point**.

According to TCM, SHU points **activate the Qi and XUE (blood) in associated organ systems** and functional areas, hence the name “**influence points**”. These points are **sensitive to failures in the corresponding internal organ systems**. They are important for **diagnosis and therapy**. The SHU-points are connected to YANG. (8)

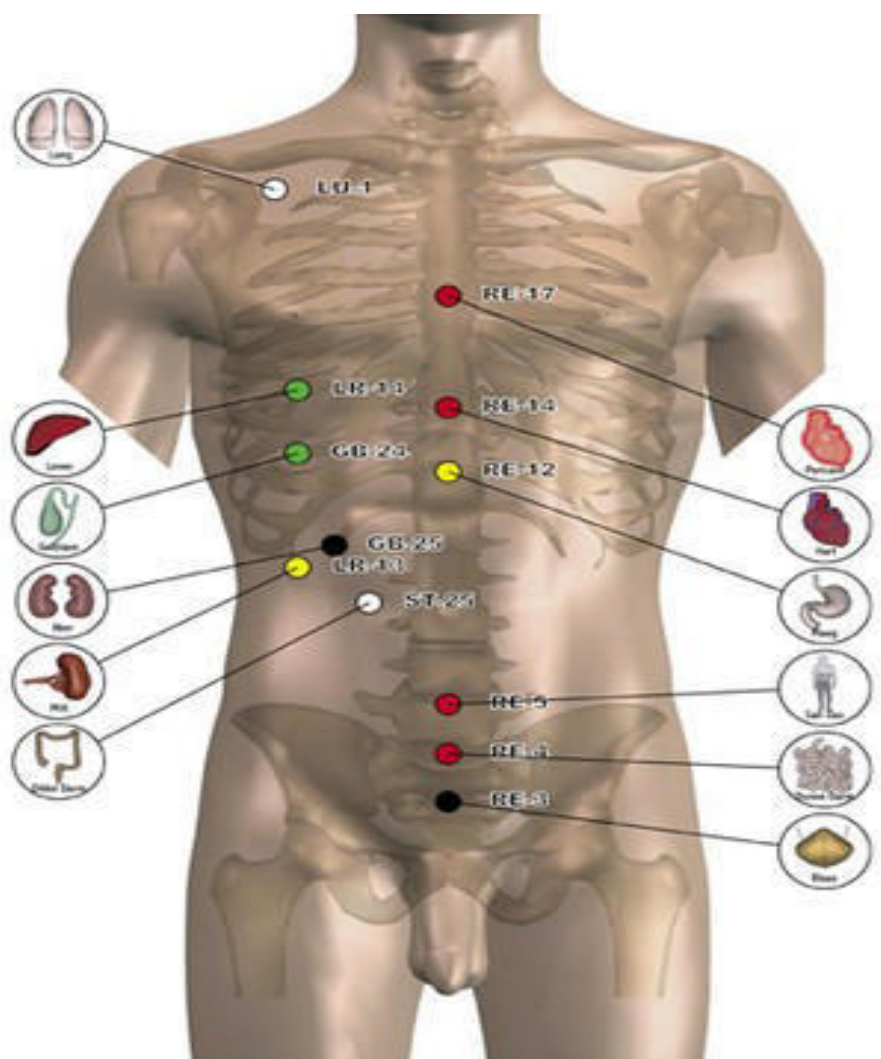
SHU-points	Organcircle	Location
Bl13	Lung	Th 3 (Thoracal)
Bl14	Pericard	Th 4
Bl15	Heart	Th 5
Bl18	Liver	Th 9
Bl19	Gallbladder	Th 10
Bl20	Milz-Pancreas	Th 11
Bl21	Stomach	Th 12
Bl22	Tripple Heater	L 1 (Lumbal)
Bl23	Kidney	L 2
Bl25	Large Interstine	L 4
Bl27	Small Interstine	S 1 (Sacral)
Bl28	Bladder	S 2



This figure shows the location of different SHU points. (Source: www.reflexologyusa.com)

4. Alarm-points / MU points

MU-points are also called **alarm points**. They are **located on the front side of the body**, in the chest and stomach area. Similar to the SHU Points, the MU-points **activate Qi and XUE** (the blood) from the associated organ systems. They too are used for **diagnosis and treatment**. Compared to SHU points, which are correlated according to TCM with YANG, the MU points are correlated to YIN. (8)

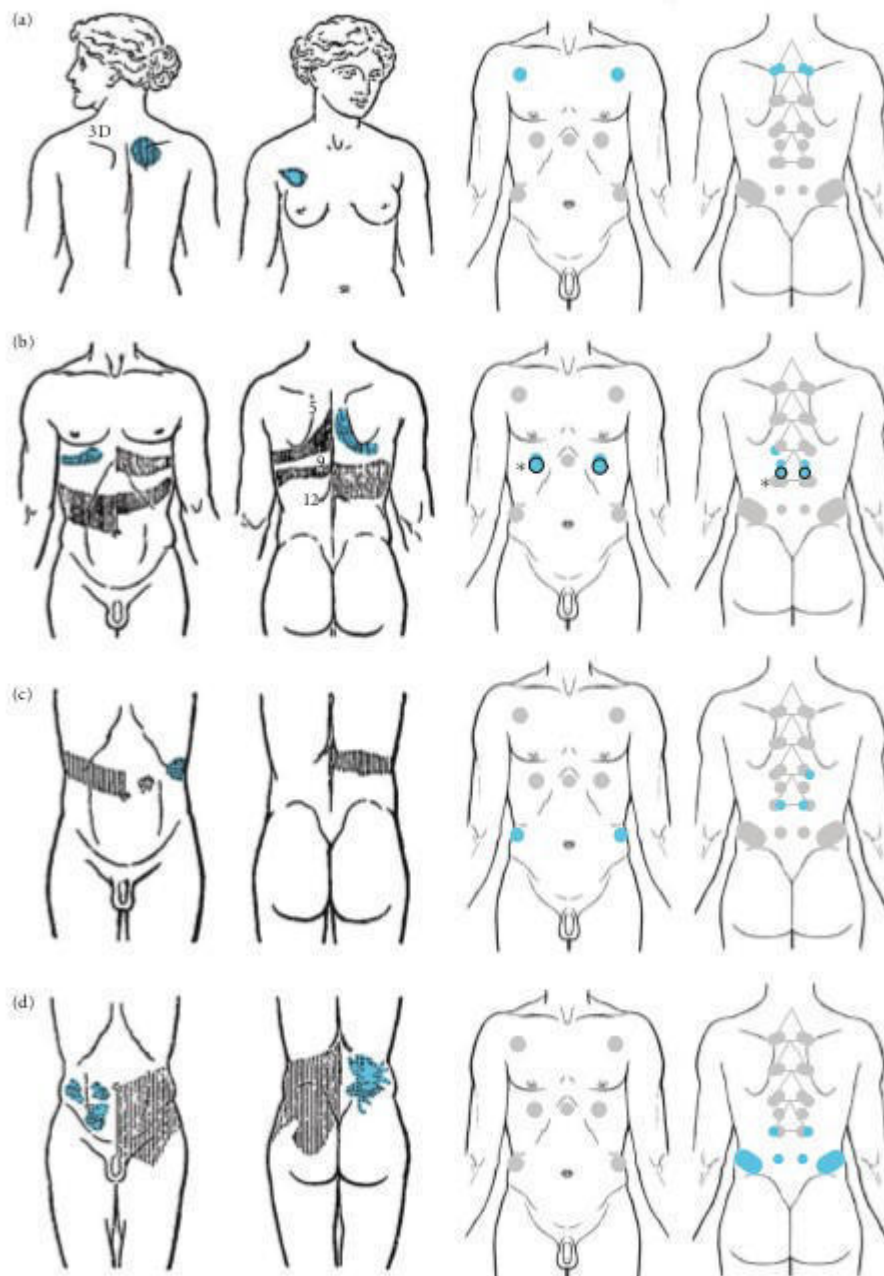


This figure shows the location of different MU points. (Source: www.screendesign.com)

5. Correlations between the Head-Zones with MU and SHU points

In the article „Forgotten Features of Head Zones and their relation to Diagnostically Relevant Acupuncture Points“ Beissner et al. described the **correlation between Head Zones and MU and SHU points**. (1)

This correlation is illustrated in the following figure. (a) shows the lung area there corresponding Head-Zones on the back and front side. MU points (front side) and SHU points (back side) are shown on the left. (b), (c) and (d) show the same for the liver, the stomach, and the kidney/ureter.



This figure shows a comparison between head areas (left side) and MU SHU points of the TCM (right side). (a) Lung, (b) Liver, (c) Stomach, (d) Kidney/Ureter

6. Bibliography

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X.

Trustworthiness of Studies

Summary and Conclusion of this Chapter:

Before attempting to clarify the available data of a particular scientific area, of course, the question arises how reliable are these data. Questions such as: What are the effects specified? In papers significant results are given, but often these effects are minimal (for example, NNT (number needed to treat) 1: 300). If the statistical analysis and data collection carried out properly? Exist conflicts of interest? Institutions such as universities are on the search for investors. High impact publications are in the researcher's interest....

A publication bias can occur, because of the pressure on scientists on positive results and high impact articles (1.). Therefor an overestimation of treatment effects can occur in meta-analysis.

A funnel plot can show the publication bias, but therefor enough studies must exist (1.).

The literature search in context of this whole work showed, that for the most medical indication in acupuncture, there are not enough studies for funnel plots.

In single studies, the „excluding bias“ should be avoided. For this, the right baseline including criteria are important (2.).

A lot of countries produce nearly only positive results in studies, and this not only in the field of acupuncture (3.). If result are fixed before, studies are wasted time. 100% positive results contradict the principles of science. Therefore, the results of such studies should be handled with special care.

In general, studies in medicine are thought to be financially independent only in about one quarter. (4).

It would be interesting, to know the diffent outcomes between dependent and independent studies. Unfortunately, I found not study in this area.

But in general, it is a big problem that nowadays studies will be done in a dependent environment. Science and industry should in many areas (certainly not all) act independently. Currently the opposite trend can be found.

There exists a big pressure for a lot of scientists to publishing good scientific data (5). Good scientific work usually needs a portion of calm and not pressure, then good results can rise.

In general scientific data should be examined on their trustworthiness. Which applies to acupuncture, but also to other scientific fields.

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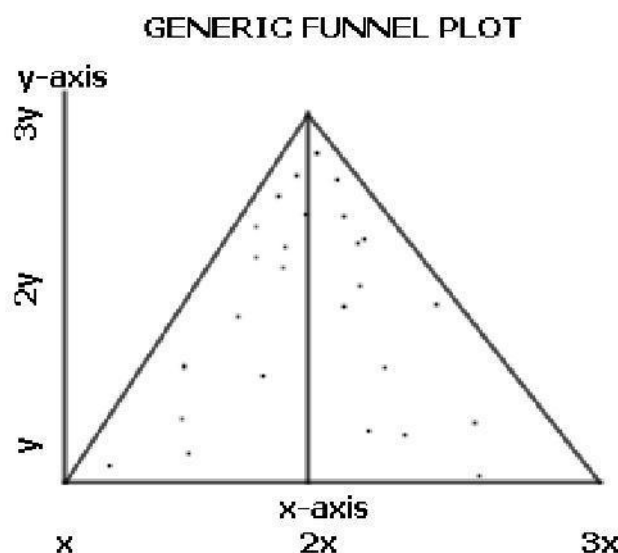
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1. Bias

Bias is the statistically distorted display of data available in scientific journals as a result of the **preferred publication** of studies with “positive” and significant results. It was discovered in 1959 by the statistician **Theodore Sterling**. **Positive results are easier to publish** than those with “negative” or non-significant results and are also more often published in journals with **high impact factor**. Due to the increased frequency of positive results, in meta-analyses an **overestimated effect can occur**. This is particularly relevant when **treatment recommendations** are based on meta-analyses. The suspicion of publication bias may be reinforced by creating a Funnel plots.

A **funnel plot** is a graph that allows to check a suspected bias in the context of a meta-analysis. But for a funnel plot, **enough studies must be available**.

The usual presentation for a funnel plot is a scatter plot in a rectangular coordinate system. The **treatment effect** is plotted on the **x-axis** against the **study size** on the **y-axis**. Already by simply viewing a funnel plot can be evaluated: a **symmetrical shape** arises from a **balanced study publication**, which reflects the results in the context of **natural statistical variation**. Therefore larger studies should achieve more accurate results that are closer to the average of all study results. If in the image a **lot of small studies are on one side**, the probability of a bias is increased. (German wiki: funnel plot)



(Source: German wiki – funnel plot)

Also **conflicts of interest** may lead to publication bias, especially when economic interests play an important role.

2. „Excluding Bias“

Another example, for a bias within a study are explained in the paper by Meissner and Linde (6). This error occurs by a **distortion of the basis values**. An example in the field of migraine study will explain this: In this trials frequently they exclude patients who have less than 2 migraine attacks in a four-week baseline phase. Even patients who have actually average at least 2 attacks per month can, by chance suffer in some months only one attack or even remain attack free. If these patients are systematically excluded, the **average frequency** of attacks in the patients included is

overestimated. If in the following months in the study the **frequency of attacks is determined, without any intervention** it also comes to **attack free months or months with only one attack.** Therefore, the corresponding average is **below the baseline** period. (27) To avoid the occurrence of regression to the mean, the **height of a measured value at baseline should not be a criterion for inclusion.** (6)

3. Differences in positive results in different countries

A very interesting study presented Vickers et al. 1998. (1) It should be investigated **how often positive results** were published in **acupuncture studies of different countries** in the last few years. As database was used MEDLINE. The abstracts of studies were collected. Finally 252 abstracts fulfilled the inclusion criteria. Of this 252 studies 171 (68%) show the result “acupuncture superior to control” and 80 (32%) found “acupuncture equal or inferior to control”. The following figure shows the number of studies that have been evaluated for each country. Furthermore, the number of positive studies and their percentage on the total amount are shown in the following figure.

Country	Total Trials Analyzed	Favoring Test Treatment	
		Number	Percentage
USA	47	25	53
China	36	36	100
Sweden	27	16	59
UK	20	12	60
Denmark	16	8	50
Germany	16	10	63
Canada	11	3	27
Russia/USSR	11	10	91
Austria	9	8	89
Italy	9	8	89
Australia	6	1	17
France	6	5	83
Taiwan	6	6	100
Japan	5	5	100
Finland	4	2	50
Hong Kong	3	3	100
Netherlands	3	1	33
New Zealand	3	2	67
Poland	3	2	67
Switzerland	3	1	33
Bulgaria	2	2	100
Brazil	1	1	100
Croatia	1	1	100
Israel	1	1	100
Nigeria	1	1	100
Sri Lanka	1	0	0
Vietnam	1	1	100
Total	252	171	68

In countries with more than 10 evaluated studies **USA, Sweden, UK, Denmark, Germany, Canada** ranged from **27-63%**. **China** produce **100% positive results**. Even in **Russia** were **10 of the 11** studies positive. In countries such as **Taiwan, Hong Kong and Japan** the studies were **100%** positive. In these three countries, a total of 14 studies were evaluated.

To see if the almost exclusively positive results in some countries is an “**acupuncture specific problem**”, the authors studied 1100 abstracts from other areas of medicine. 414 met the inclusion criteria ultimately. The following figure shows the results of this evaluation.

Country of Publication	Abstracts Screened	Abstracts Included	Favoring Test Treatment	
			Number	Percentage
China	196	109	108	99
England	329	107	80	75
Japan	317	120	107	89
Russia/USSR	180	29	28	97
Taiwan	78	40	38	95
Total	1100	405	361	89

So, it turned out that in countries such as China and Russia in general almost exclusively positive results were published.

According to this study, **some countries provide extremely high numbers of positive results.**

According to the authors, data from these countries should be handled with **special care**. The data used for this study are now 20 years old. Unfortunately, the literature search for this chapter brought no more recent review.

4. Conflict of interests

In scientific studies, the people are involved should not dependent on positive results. Florence et al. (2010) received in a Meta-analysis the opposite result. (2) They found that **drug trials** were carried out at **63% by industry, 14% of government resources** and **23% of non-profit organizations**. This means that only **one quarter is financially independent**.

5. The Chrysalis Effect

The economist O'Boyle led the term for **scientific misconduct**: selective publishing or **Chrysalis Effect** (Entpuppungseffekt). When he compared promotion writings with the magazine articles in which the results are later published, he made a surprising discovery: **In every fifth publication** significant results were presented, which did not quite occurred in the respective dissertations. From an unsightly caterpillar (=the doctoral thesis with **weak but true results**) suddenly, there was a beautiful butterfly. In other words: publication with great results. The title of his article is: The Chrysalis effect: how ugly initial results metamorphose into beautiful articles.

The author brought in his work following comparison, which can also be one of the reasons for the corruption of data. “If science were a game and publications the prize, then the dominant rule would probably be to collect results are statistically significant”. (3) The resulting **pressure** to deliver as a scientist successful data tempted to manipulate and falsify these.

O'Boyle et al. ponted out in their work different ways how data can be manipulated. In the following lines, important points are summarized from the work of O'Boyle.

5 ways to manipulate data:

Deletion or addition of data after hypothesis tests.

Especially if results are near a significance level, scientists seem to be in greater temptation to manipulate data. In the work of O'Boyle about 10% **of the scientists added subjects and 20% let subjects disappear.**

Altering the data after hypothesis testing.

One third of the works showed changes in the means, standard deviations, inter-relations of the included variables or selective deletion or addition of variables.

Reversing the direction or reframing hypotheses to support data.

Post hoc dropping or adding of hypotheses.

Fanelli represented 2009 the first meta-analysis in terms of interviews with scientists about their experiences regarding misconduct. 2% of the scientist's reported that they have changed results. (4) One-third acknowledged that they dropped data points and changed the design. Methodology or results of a study is a response to pressures from a founding source. 72% of respondent's reported that they had observed questionable methods by colleagues.

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XI.

Clinical Trials for Acupuncture

Summary and Conclusion of this Chapter:

The aim of the STRICTA working group was to create a checklist for acupuncture studies. With this list, studies in the field of acupuncture should become more transparent, reproducible and the results better interpretable. (1.)

The point selection is a key aspect in many acupuncture studies. If TCM criteria are the basis of acupuncture studies, the practitioner should have the possibility to treat according to these criteria. There are different recommendations for the treatment of different diseases in TCM and fixed treatment procedures (= predetermined fixed point combinations) are not within the meaning of TCM. (2.4.)

There is a moderate or even wide level of inter-rater reliability in TCM diagnoses and treatments between acupuncture practitioners. In scientific studies it should be ensured that this subjectivity is reduced as much as possible. However, the holistic framework of TCM should not be lost and that should be taken into account in the study design. (2.4.)

Treatment effects in studies can always be divided in verum, placebo and other effects. Other effects are for example spontaneous improvement, statistical artefacts (regression to the mean) and co-interventions. In order to quantify these three types of effects, three arm studies are required. (3. 4.) This does not mean that it makes sense to carry out any study with three arms. The structure of studies depends on the scientific question. But if you want quantify verum, placebo and other effects, three armed trials are the best method.

However, it is important to understand that three arm studies are only the first step in a medical science process. Answering the question if the effectiveness of a treatment is scientifically proven by randomized controlled studies, supply studies, health supply studies and economic studies is the next step in the scientific process. Medical act should not be founded solely on the results of randomized controlled trials. Supply studies and economic studies should enhance the scientific basis and allow a relationship to practice. (5.)

One important factor which should be eliminated as much as possible in studies is social desirability, because it might produce incorrect results. Personal patient surveys are naturally very susceptible to this influence. It is important that the subjects in surveys are unaffected according to their statements. (7.)

In studies which aim to differentiate between verum and placebo effect, a good blinding of patients and clinicians is a big challenge. In placebo group studies, two approaches for needle blinding are usually applied. Either the acupuncture needles are inserted at non-acupuncture points or non-penetrating needles are used.

All studies discussed in this chapter, in which non-penetrating placebo needles were used, showed that blinding with the placebo needle works for naïve patients. However, this blinding is at least partially cancelled if the patients have got real acupuncture experience. (8.)

Birch (14) believes that placebo acupuncture with non-penetrating needles is not a placebo treatment. He justified that statement by the fact that non-penetrating needles touch the skin and this leads to verum effects. Yet, this argument does not make sense from a biological perspective. Generally, humans are constantly exposed to tactile stimuli. For example if one goes barefoot across a meadow, the pressure stimuli are significantly greater than in the non-penetrating acupuncture. Hence, from a physiological point of view it does not make sense to assume that biological systems which are stimulated by such a slight pressure would undergo significant changes leading to verum effects. Such sensitive systems would not be able to survive in this world. (8.5.)

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1. STRICTA: Extending the CONSORT Statement

STRICTA is an acronym for “Revised Standards for Reporting Interventions in Clinical Trials of Acupuncture“. The STRICTA criteria were developed for the implementation on control trials in the field of acupuncture in order to make them **more transparent, reproducible and better interpretable**. (13) The aim of the STRICTA working group was to **create a checklist for acupuncture studies**. This list has been developed from a variety of experts from 15 countries (41 academics, 31 acupuncturists, and 18 employees of journals, 15 physicians and 11 which were previously involved in the preparation of this guidelines). The following figure shows a short part of this checklist.

Item	Detail
1. Acupuncture rationale	1a) Style of acupuncture (e.g. Traditional Chinese Medicine, Japanese, Korean, Western medical, Five Element, ear acupuncture, etc)
	1b) Reasoning for treatment provided, based on historical context, literature sources, and/or consensus methods, with references where appropriate
	1c) Extent to which treatment was varied
2. Details of needling	2a) Number of needle insertions per subject per session (mean and range where relevant)
	2b) Names (or location if no standard name) of points used (uni/bilateral)
	2c) Depth of insertion, based on a specified unit of measurement, or on a particular tissue level
	2d) Response sought (e.g. <i>de qi</i> or muscle twitch response)
	2e) Needle stimulation (e.g. manual, electrical)
	2f) Needle retention time
	2g) Needle type (diameter, length, and manufacturer or material)
3. Treatment regimen	3a) Number of treatment sessions
	3b) Frequency and duration of treatment sessions
4. Other components of treatment	4a) Details of other interventions administered to the acupuncture group (e.g. moxibustion, cupping, herbs, exercises, lifestyle advice)
	4b) Setting and context of treatment, including instructions to practitioners, and information and explanations to patients
5. Practitioner background	5) Description of participating acupuncturists (qualification or professional affiliation, years in acupuncture practice, other relevant experience)
6. Control or comparator interventions	6a) Rationale for the control or comparator in the context of the research question, with sources that justify this choice
	6b) Precise description of the control or comparator. If sham acupuncture or any other type of acupuncture-like control is used, provide details as for Items 1 to 3 above.

2. Needling in Acupuncture Studies

One of the most important factors in acupuncture studies is the particular usage of needles. Therefore, a few of needling aspects will be discussed in the following.

2.1. Needle Design

Needles are available in different lengths and thicknesses.

2.2. Depth of Needling

According to the TCM, the appropriate depth of needling is dependent on many factors. For example if the patient is an “emptiness“ or a “fullness“ type, which layers (regarding the TCM) are affected etc. (compare chapter “Structure and diagnosis of acupuncture“). Ah SHI points (compare chapter: Myofascial Trigger Points...) should be needled sufficiently deep so that the affected muscles are reached. (1) It is important to **record the applied procedure for each patient in order to create justifiable studies**.

Comparing superficial and depth insertion needling, the study by Ceccherelli et al. showed a small but significant difference after three month follow-up but not immediately after treatment. (2)

2.3. Duration of Needling

There are only a few studies regarding the question whether acupuncture success is dependent on the duration of the treatment sessions. (1) However, it can be expected that there is an optimum length concerning to better placebo or verum effects. In most trials **30 min sessions are used**.

2.4. Number of Points and Point Selection

In general, the acupuncture points should be selected based on the particular scientific question. If studies should be carried out according to TCM criteria, **the practitioners must have the possibility for some variability**. For different diseases there are different recommendations in TCM, and **fixed treatment regimens (= predetermined fixed point combinations) are not within the meaning of TCM**. Here too, the record of proceedings is important in studies.

Suzanne et al. found a **moderate level of inter-rater reliability between practitioners** according to TCM diagnoses and treatment. Hogeboom et al. found that for patients with chronic low back pain there is a **wide variation in diagnoses and treatments across practitioners**. Hence, there is a **variation in diagnosis and treatment between practitioners** although in their opinion all practitioners act according to TCM criteria. It is logical that the TCM criteria allow some room for interpretation because they are constructed on relative subjective fundamentals. In scientific studies it should be ensured that this subjectivity is reduced as much as possible. However, the **holistic framework of TCM should not be lost**.

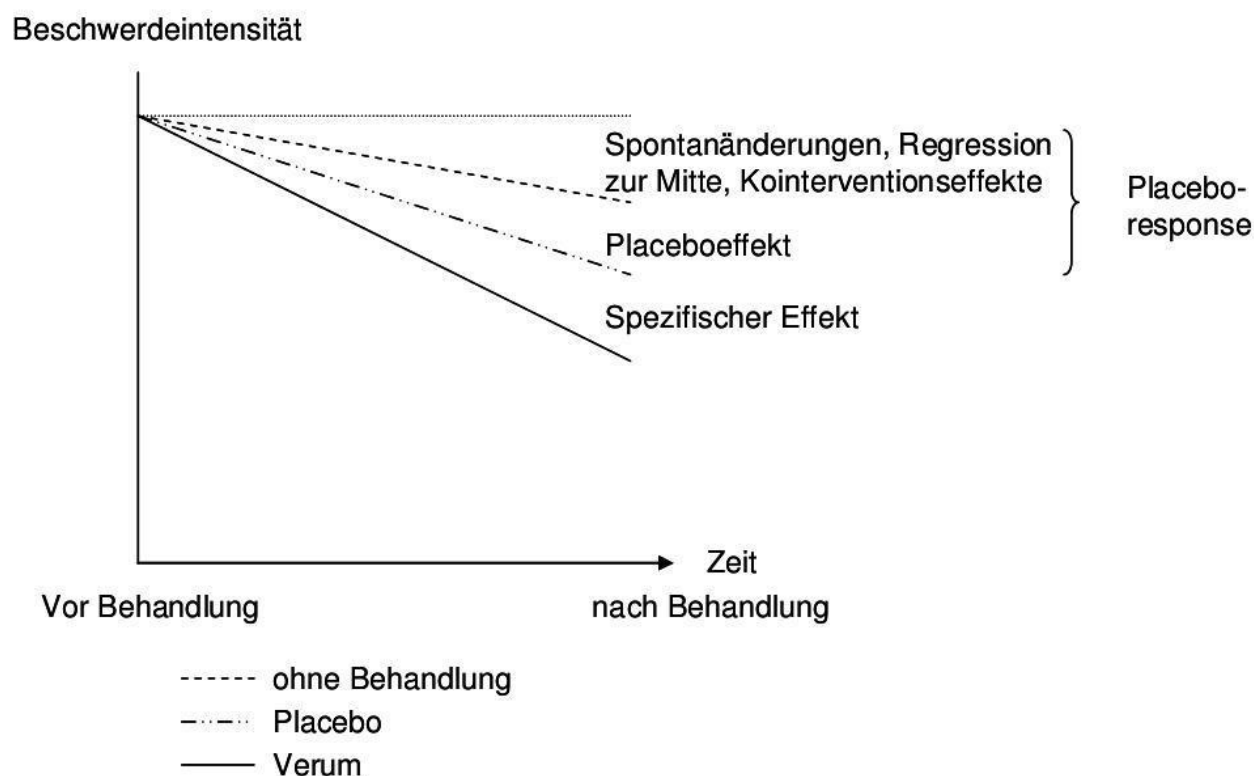
2.5. Stimulation

The needles can be stimulated by **hand, warmth** (moxibustion) or by **electric current** (1).

The importance of stimulation (De-Qi sensation) for various therapeutic effects is, yet, not entirely clear (compare chapter “De-Qi Sensation and Acupuncture”).

3. Control Groups in Studies

Treatment effects in studies can always be divided in **verum, placebo** and **other effects**. Other effects are for example **spontaneous improvement, statistical artefacts** (regression to the mean) and **co-interventions**. (7)



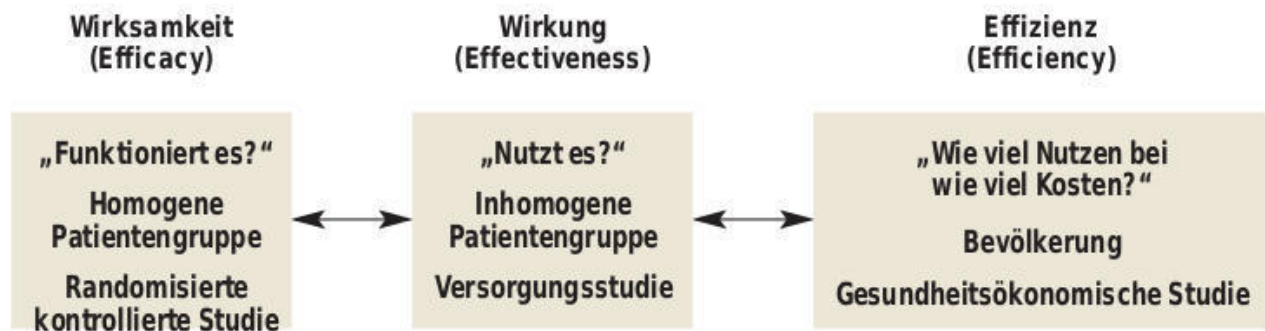
Three arm studies are necessary in order to assess these effects.

4. Three Arm Studies

This type of study design is essential in order to distinguish between placebo, verum and other effects. As the name suggests, these studies include three groups: **a verum, a placebo and a control group.**

5. Different Levels of Evidence in Studies – Supply and Economic Studies

It is important to understand that three arm studies are **only the first step in a medical science process.** Answering the question of effectiveness, **supply studies, health supply studies and economic studies** often provides great benefit and are **the next steps in the scientific process.** **Medical action should not be founded solely on the results of randomized controlled trials.** Supply studies and economic studies should improve the scientific basis and allow a relationship to practice. (6)



This figure shows the three pillars of medical scientific research. (6)

6. Including and Baseline Criteria

It should be ensured that **poorly chosen including criteria do not generate false statistical effects** (compare chapter “Psychological Factors and Acupuncture“). One way to solve this problem is the inclusion of a **control group**.

7. Social Desirability

One factor which should be eliminated in studies as much as possible is **social desirability** because it might produce incorrect results. **Personal patient surveys are naturally very susceptible to this influence**. For example the VAS pain score should be determined in the course of a study. This data can be collected in a personal interview, a telephone survey or an anonymous questionnaire. **Each of these three methods will provide different results**. In general, the more anonymously data is assessed from patients, the better it is for the reliability of the study (except if one wants to investigate distortion effects caused by different data collection methods).

8. Blinding of the Acupuncture Needle

In studies aiming to determine the verum and placebo effect, **a good blinding of patients and clinicians is a big challenge**. In the following, placebo needles are shown which should allow this blinding.

8.1. Placebo Needle Should Touch the Skin

Takakura et al. (11) showed that it is **important that the placebo needle touches the skin a little bit**. This is logical because without contact the patient has got no reason to believe that a verum needle was used. Anyone who has ever tested acupuncture might have noticed that the stitch into the skin creates only very slight “pain”. Only the rotation or touching a nerve with the needle causes an increase in De-Qi or pain feeling.

8.2. Placebo Needle by Streitberger and Kleinhenz (12)

The following pictures show the application of the Streitberger Placebo Needle. Placebo and verum needle have to be applied in the same manner.



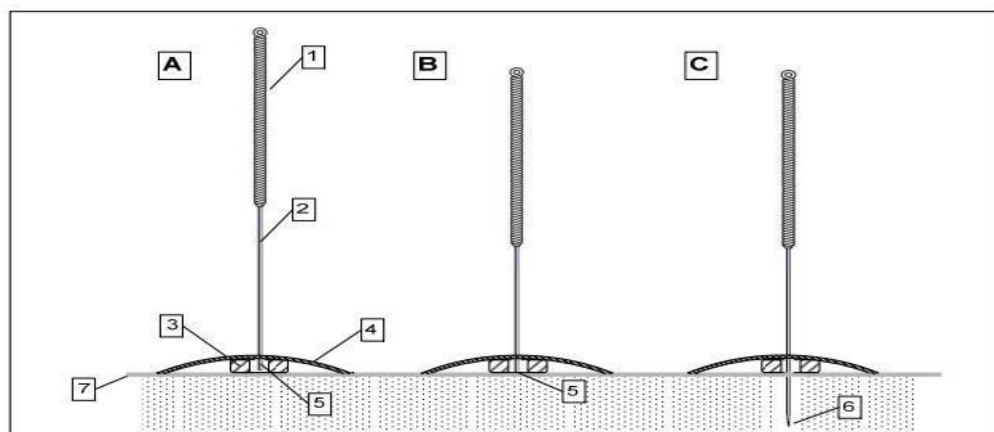
Fig 1



Fig 3



Fig 4



1 needle handle, 2 needle, 3 plastic ring, 4 plaster, 5 blunt tip of the needle, 6 sharp tip of the needle, 7 cutis

In the study by Streitberger and Kleinhenz 54 persons felt a penetration with acupuncture (mean visual analogue scale [VAS] 13.4; SD 10.58) and 47 felt it with the placebo needle (VAS 8.86; SD 10.55). In the **verum acupuncture group 34 persons** felt a **dull pain sensation (De-Qi)**, compared to **13 persons** in the **placebo group**. **All patients believed that the needle penetrated their skin.** Therefore, the authors concluded that these needles are **suitable for studying placebo acupuncture**.

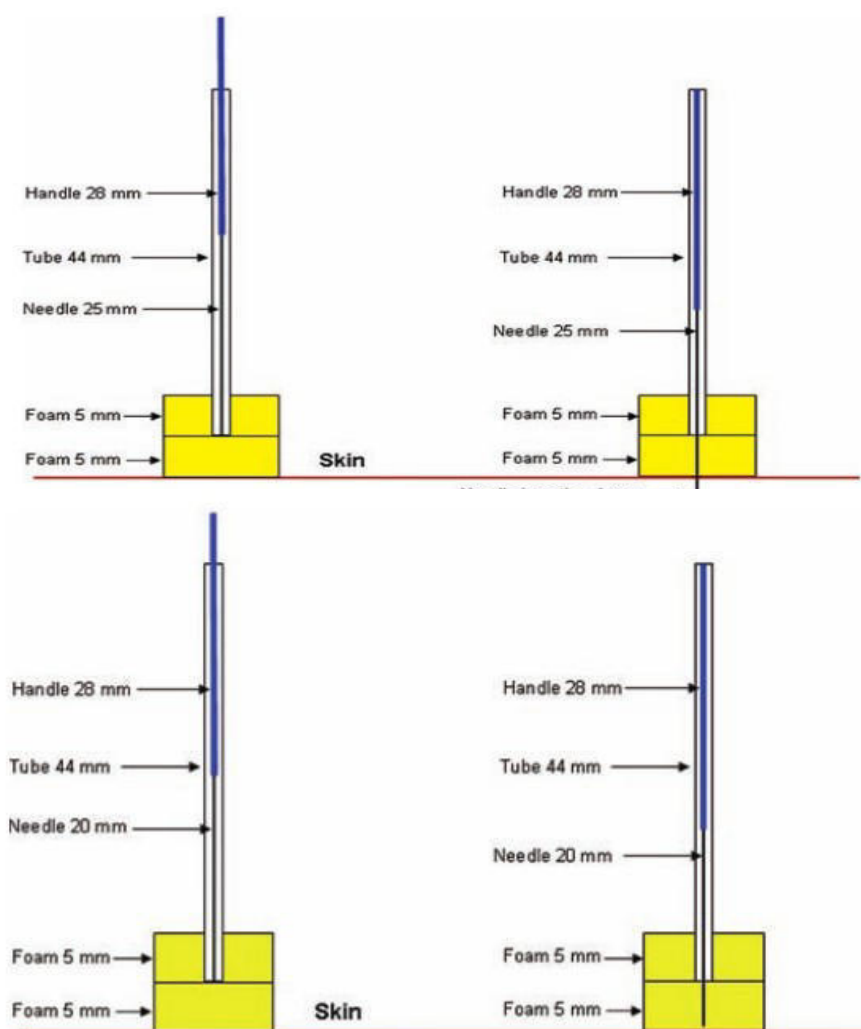
8.3. Placebo Needle by Kreiner et al. (9)

Kreiner et al. investigated the blinding success of a sham acupuncture technique on “acupuncture naïve subjects”. The subjects were answering yes or no questions according to their feelings during or after the acupuncture. The results of this survey can be found in the following table.

After treatment with the **placebo needle**, 14/16 (87.5%) persons believed that they had received **real acupuncture before crossover** and 10/16 (62.5%) **after crossover**. After usage of **real acupuncture needles**, 12/16 (75%) persons believed that they received real acupuncture **before crossover** and 15/16 (93.8%) **after crossover**.

This study brought two interesting results. Firstly, it showed that **in naïve patients blinding with the placebo needle works**. Secondly, that **blinding is at least partially cancelled by real acupuncture experience**.

The following figures show schemes of the needles used in the study by Kreiner et al.



Real acupuncture: This needle has a sharp end and a rigid handle. When it is applied with pressure, this needle penetrates the skin.

Sham acupuncture: When it is applied **with pressure**, **this needle glides into the handle**. Therefore, it does not penetrate the skin.

Five questions	Before crossover						After crossover					
	Real		Sham		p*		Real		Sham		p*	
	LI4†	ST6‡	LI4†	ST6‡	LI4	ST6	LI4†	ST6‡	LI4†	ST6‡	LI4	ST6
1. Did you feel the needle penetrate your skin?	9/16 56%	10/16 62%	7/16 44%	6/16 36%	0.72	0.28	12/16 75%	12/16 75%	2/16 12%	3/16 19%	<0.01	<0.01
2. Do you feel that you received real acupuncture?	12/16 75%	12/16 75%	14/16 87%	14/16 87%	0.65	0.65	15/16 94%	15/16 94%	10/16 62%	12/16 75%	0.08	0.33
3. Were there <i>de qi</i> sensations?	8/16 50%	7/16 44%	7/16 44%	6/16 37%	0.73	0.73	6/16 37%	8/16 50%	4/16 25%	5/16 31%	0.60	0.72
4. Was the procedure painful?	1/16 6%	2/16 12%	0 0%	0 0%	0.48	0.54	2/16 12%	0 0%	0 0%	2/16 12%	0.48	0.48
5. Do you consider this procedure comfortable?	15/16 94%	16/16 100%	16/16 100%	16/16 100%	1	1	15/16 94%	16/16 100%	16/16 100%	16/16 100%	1	1

*chi square, real vs sham for each point; †Hand acupuncture point (LI4); ‡Facial acupuncture point (ST6).

Following conclusions can be drawn from this study:

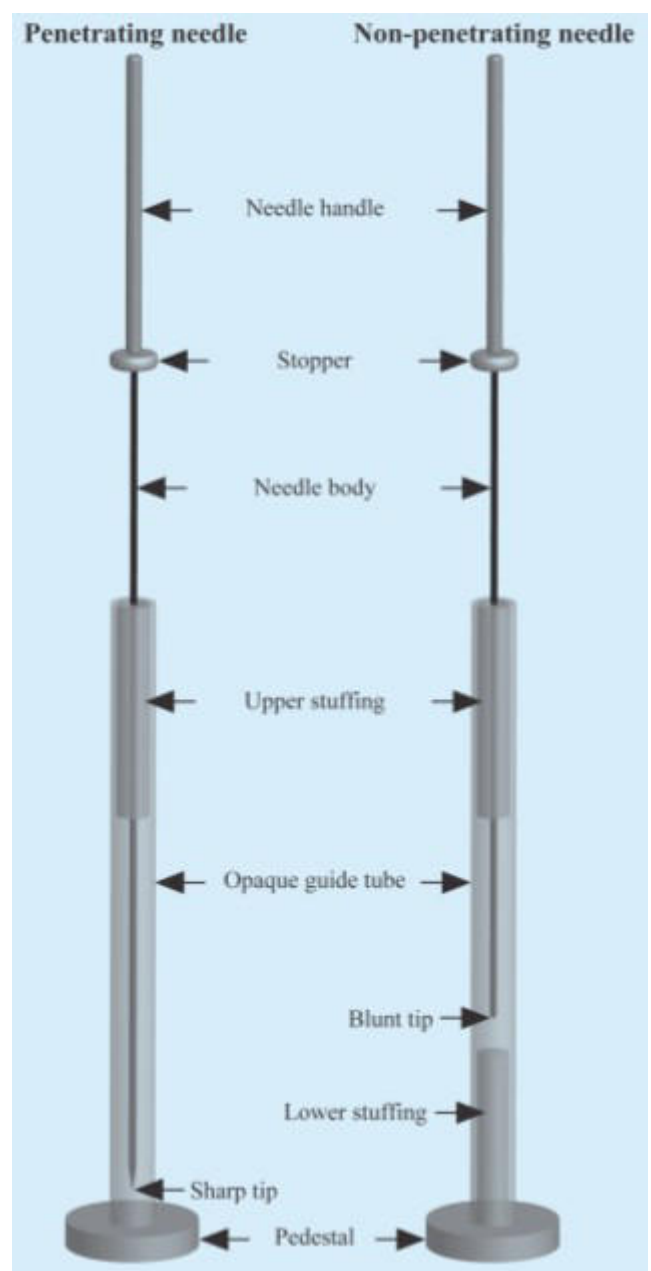
The **patients' knowledge and experience of acupuncture plays an important role in blinding. In general, the less experienced the patient the better the blinding.**

This factor could be evaluated by **using a questionnaire** and should be considered when designing a placebo acupuncture study.

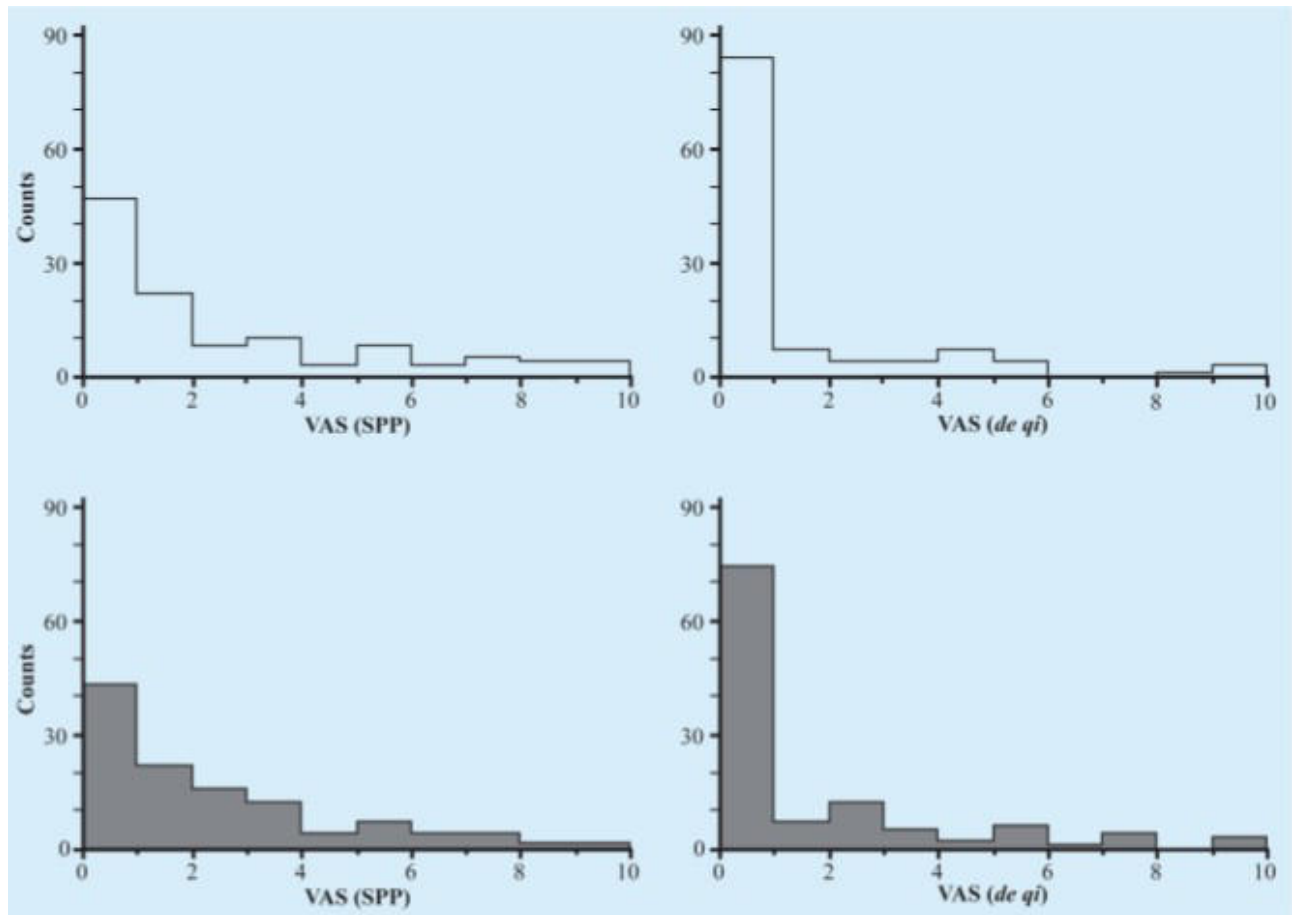
8.4. Placebo Needle by Takakura et al. (9)

Takakura et al, also developed a non-penetrating placebo needle for their study. This study showed as well that **non-penetrating placebo needles are effective for masking.**

The illustration on the right shows the structure of the needles developed by Takakura et al.



The following figure shows the intensity of skin penetration pain (SPP) or penetration-like pain, respectively, and dull pain sensation (De-Qi) of the subjects. The vertical axis indicates the number of non-penetrating or penetrating needles, respectively. The horizontal axis indicates the score of



SPP and De-Qi on the VAS (0 – 10).

The following figure shows the skin penetration pain or penetration-like pain, respectively, and elicited De-Qi sensation. This data was collected based on 114 non-penetrating and 114 penetrating needles.

		Number of needles (% of 114 needles)	Number (%) of correctly identified needles	Number (%) of incorrectly identified needles
114 non-penetrating needles	Neither SPP nor <i>de qi</i> felt	30 (26.3)	25 (83.3)	5 (16.7)
	Only SPP felt	54 (47.4)	16 (29.6)	38 (70.4)
	Only <i>de qi</i> felt	12 (10.5)	5 (41.7)	7 (58.3)
	Both SPP and <i>de qi</i> felt	18 (15.8)	4 (22.2)	14 (77.8)
114 penetrating needles	Neither SPP nor <i>de qi</i> felt	24 (21.1)	9 (37.5)	15 (62.5)
	Only SPP felt	50 (43.9)	36 (72.0)	14 (28.0)
	Only <i>de qi</i> felt	18 (15.8)	15 (83.3)	3 (16.7)
	Both SPP and <i>de qi</i> felt	22 (19.3)	18 (81.8)	4 (18.2)

8.5. Sham Acupuncture is Not a Placebo Treatment? (14)

Birch (14) believes that placebo **acupuncture with non-penetrating needles is not a placebo treatment**. He justified this statement by the fact that the **non-penetrating needle touches the skin and this leads to verum effects**.

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Table 1: STRICTA 2010 checklist of information to include when reporting interventions in a clinical trial of acupuncture (Expansion of Item 5 from CONSORT 2010 checklist)

Item	Detail
1. Acupuncture rationale	1a) Style of acupuncture (e.g. Traditional Chinese Medicine, Japanese, Korean, Western medical, Five Element, ear acupuncture, etc)
	1b) Reasoning for treatment provided, based on historical context, literature sources, and/or consensus methods, with references where appropriate
	1c) Extent to which treatment was varied
2. Details of needling	2a) Number of needle insertions per subject per session (mean and range where relevant)
	2b) Names (or location if no standard name) of points used (uni/bilateral)
	2c) Depth of insertion, based on a specified unit of measurement, or on a particular tissue level
	2d) Response sought (e.g. <i>de qi</i> or muscle twitch response)
	2e) Needle stimulation (e.g. manual, electrical)
	2f) Needle retention time
	2g) Needle type (diameter, length, and manufacturer or material)
3. Treatment regimen	3a) Number of treatment sessions
	3b) Frequency and duration of treatment sessions
4. Other components of treatment	4a) Details of other interventions administered to the acupuncture group (e.g. moxibustion, cupping, herbs, exercises, lifestyle advice)
	4b) Setting and context of treatment, including instructions to practitioners, and information and explanations to patients
5. Practitioner background	5) Description of participating acupuncturists (qualification or professional affiliation, years in acupuncture practice, other relevant experience)
6. Control or comparator interventions	6a) Rationale for the control or comparator in the context of the research question, with sources that justify this choice
	6b) Precise description of the control or comparator. If sham acupuncture or any other type of acupuncture-like control is used, provide details as for Items 1 to 3 above.

Note: This checklist, which should be read in conjunction with the explanations of the STRICTA items provided in the main text, is designed to replace CONSORT 2010's item 5 when reporting an acupuncture trial.

Table 2: CONSORT 2010 checklist with the Non-pharmacological Trials Extension to CONSORT (with STRICTA 2010 extending CONSORT Item 5 for acupuncture trials)

Section/Topic	Item #	CONSORT 2010 Statement*: Checklist item[10]. Describe:	Additional items from the Non-pharmacological Trials Extension to CONSORT[14]. Add:
<i>TITLE AND ABSTRACT</i>			
	1.a	Identification as a randomized trial in the title	In the abstract, description of the experimental treatment, comparator, care providers, centres and blinding status.
	1.b	Structured summary of trial design, methods, results, and conclusions; for specific guidance see CONSORT for Abstracts [58,59]	
<i>INTRODUCTION</i>			
Background and objectives	2.a	Scientific background and explanation of rationale	
	2.b	Specific objectives or hypotheses	
<i>METHODS</i>			
Trial design	3.a	Description of trial design (e.g., parallel, factorial) including allocation ratio	
	3.b	Important changes to methods after trial commencement (e.g. eligibility criteria), with reasons	
Participants	4.a	Eligibility criteria for participants	When applicable, eligibility criteria for centers and those performing the interventions.
	4.b	Settings and locations where the data were collected	
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	Precise details of both the experimental treatment and comparator - see Table 1 for details
Outcomes	6.a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	
	6.b	Any changes to trial outcomes after the trial commenced with reasons	
Sample size	7.a	How sample size was determined	When applicable, details of whether and how the clustering by care providers or centers was addressed.
	7.b	When applicable, explanation of any interim analyses and stopping guidelines	
Randomization			
<i>Sequence generation</i>	8.a	Method used to generate the random allocation sequence	When applicable, how care providers were allocated to each trial group.
	8.b	Type of randomization; details of any restriction (e.g., blocking and block size)	
<i>Allocation concealment</i>	9	Mechanism used to implement the random allocation sequence (e.g., sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	

Section/Topic	Item #	CONSORT 2010 Statement*: Checklist item[10]. Describe:	Additional items from the Non-pharmacological Trials Extension to CONSORT[14]. Add:
<i>Implementation</i>	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	
Blinding	11.a	If done, who was blinded after assignment to interventions (e.g. participants, care providers, those assessing outcomes) and how	Whether or not those administering co-interventions were blinded to group assignment. If blinded, method of blinding and description of the similarity of interventions.
	11.b	If relevant, description of the similarity of interventions	
Statistical methods	12.a	Statistical methods used to compare groups for primary and secondary outcomes	When applicable, details of whether and how the clustering by care providers or centers was addressed.
	12.b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	
RESULTS			
Participant flow (A diagram is strongly recommended)	13.a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analyzed for the primary outcome	The number of care providers or centers performing the intervention in each group and the number of patients treated by each care provider or in each center.
	13.b	For each group, losses and exclusions after randomization, together with reasons	
Implementation of intervention			Details of the experimental treatment and comparator as they were implemented.
Recruitment	14.a	Dates defining the periods of recruitment and follow-up	
	14.b	Why the trial ended or was stopped	
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	When applicable, a description of care providers (case volume, qualification, expertise, etc.) and centers (volume) in each group.
Numbers analyzed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	
Outcomes and estimation	17.a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (e.g., 95% confidence interval)	
	17.b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	

Section/Topic	Item #	CONSORT 2010 Statement*: Checklist item[10]. Describe:	Additional items from the Non-pharmacological Trials Extension to CONSORT[14]. Add:
Harms	19	All important harms or unintended effects in each group; for specific guidance see CONSORT for Harms [60]	
<i>DISCUSSION</i>			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	
Generalizability	21	Generalizability (external validity, applicability) of the trial findings	Generalizability (external validity) of the trial findings according to the intervention, comparators, patients and care providers and centers involved in the trial.
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	In addition, take into account the choice of the comparator, lack of or partial blinding, unequal expertise of care providers or centers in each group.
<i>OTHER INFORMATION</i>			
Registration	23	Registration number and name of trial registry	
Protocol	24	Where the full trial protocol can be accessed, if available	
Funding	25	Sources of funding and other support (e.g., supply of drugs); role of funders	

- We strongly recommend reading this Statement in conjunction with the CONSORT 2010 explanation and elaboration [11] for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomized trials [61], noninferiority and equivalence trials [62], herbal interventions [63], and pragmatic trials [16]. Moreover, additional extensions are forthcoming. For those and also for up-to-date references relevant to this checklist, see <http://www.consort-statement.org>.

XII.

EVIDENCE MAP OF ACUPUNCTURE According to the Department of Veterans Affairs (DVA)

Summary and Conclusion of this Chapter:

The guide for the following chapter according to acupuncture treatment effects in this diploma thesis is the review "Evidence Map of Acupuncture" published by the Department of Veterans Affairs (DVA). This „review on reviews „was published in 2014“(1). This work included 42 reviews that have been published since 2005. The data collection was ended in March 2013. Ultimately, 183 reviews met the inclusion criteria. According to the investigated syndromes the reviews were divided into four groups: pain, wellness, mental health and adverse events.

Because I cannot take a closer look to all of this 51 diseases from the review of the DVA, a good selection with the highest prospects for good results are necessary. In the category pain, headache has according to the DVA „an evidence of a positive effect „and additionally the largest "literature size".

Therefore, in the following chapters headache will be discussed from the perspective of TCM, western medicine and studies data. Compare chapters: “Diagnosis and Treatment of headache from the viewpoint of TCM”, “Tension-type-headache from the viewpoint of Western Medicine”, “Treatment of Tension type headache (TTH) with Acupuncture - an Overview of studies” and “Headache – treatment capabilities from the viewpoint of TCM apart from acupuncture”.

Reviews referring to the diseases dysmenorrhoea and osteoarthritis will be discussed in the chapter: “Studies in the field of Acupuncture for Pain”.

In the category wellness and mental health the results of studies referring to depression and schizophrenia will be discussed in the chapter: “Studies in the field of Acupuncture and Mental Health”.

In the category adverse events the results of studies referring to insomnia, smoking cessation, PONV and restless legs will be discussed in the chapter: “Studies in the field of Acupuncture and Adverse Events”.

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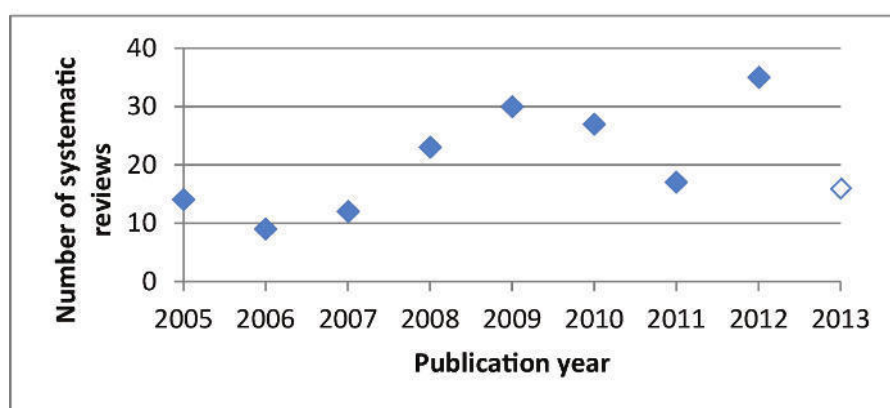
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1. „Review on Reviews“ by the Department of Veterans Affairs (DVA)

This review was published in 2014 by the **Department of Veterans Affairs (DVA)** (1). It represents a “**review on reviews**” and **includes 42 reviews** that have been **published since 2005**. The **data collection was ended in March 2013**.

The result provides an **overview of the evidence** for and a **visual illustration** of the studied data. The review includes 29 pages (excluding bibliography) and the aim of this chapter is to reflect the results in compressed form.

According to the Department of Veterans Affairs (DVA) **every year 9-35 reviews were published (during the period 2005 - 2012)**. Results for 2013 refer to the reviews published until March 2013. The following figure shows the number of published reviews in each year.



(Source: 1))

Inclusion criteria of this review were among others (incomplete summary): Only adults were included. Acupressure, laser acupuncture, nerve stimulation transcutaneous and dry needling were excluded. Only studies were included, which were published in 2005 and thereafter. Only in English published literature was considered. The focus was only on the patient outcome.

The following electronic databases were included in the literature search for this “review of reviews”: PubMed, Database of Abstracts of Reviews of Effects (DARE), the Cochrane Library of Systematic Reviews, AMED (Allied and Complementary Medicine Database) and the review registry PROSPERO (published reviews of reviews).

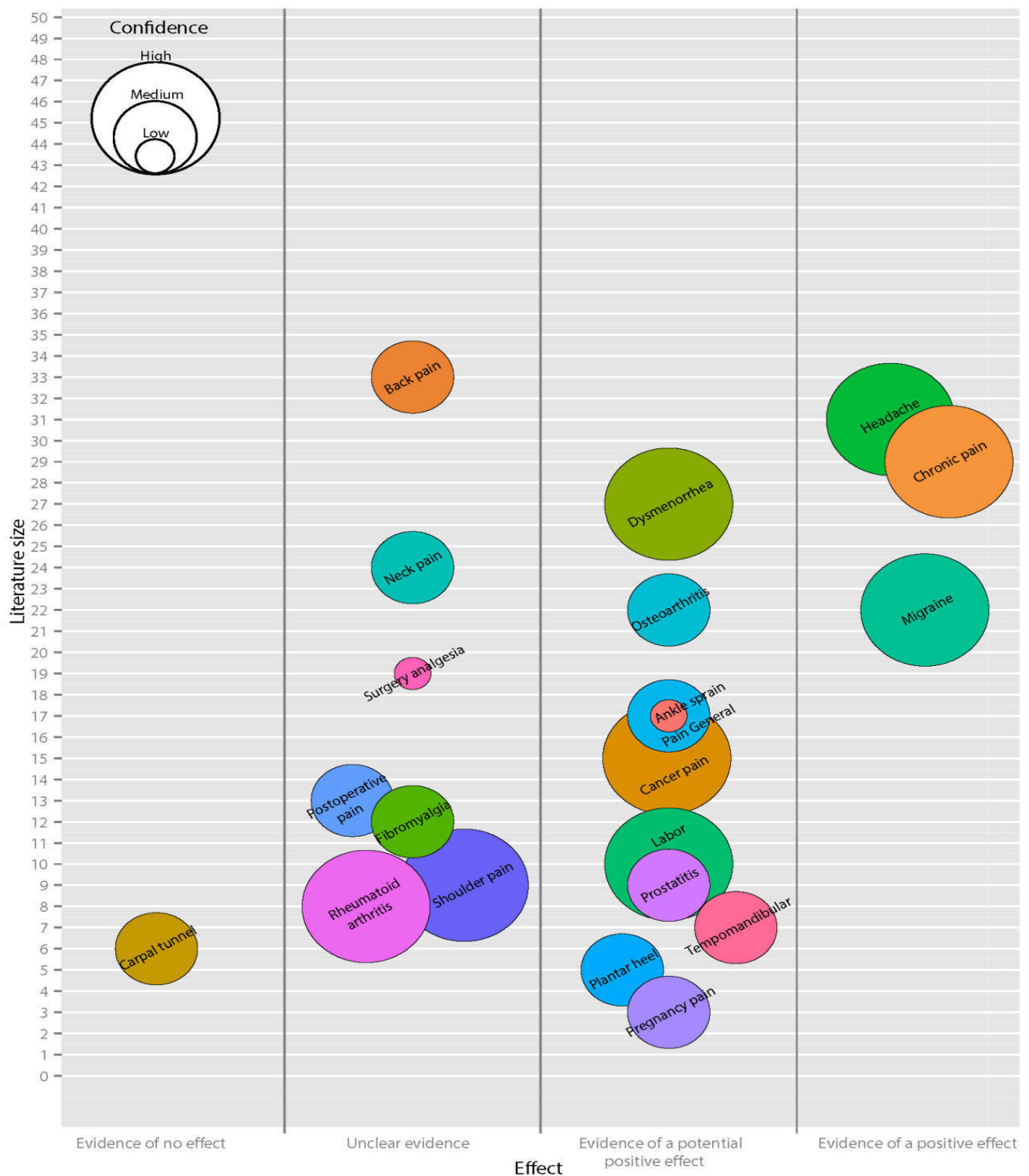
The visual presentation was made in the form of **bubble plots**. This bubble plots give information in three dimensions: The **y-axis represents the number of publications**. The **x-axis shows the clinical effectiveness**. The **size of the bubbles indicates the confidence**.

The **inclusion criteria were met by 183 reviews**. The reviews were **divided into 4 main categories**. These categories are **pain, wellness, mental health** and **adverse events**.

2. DVA - Evidence Map for Acupuncture and Pain

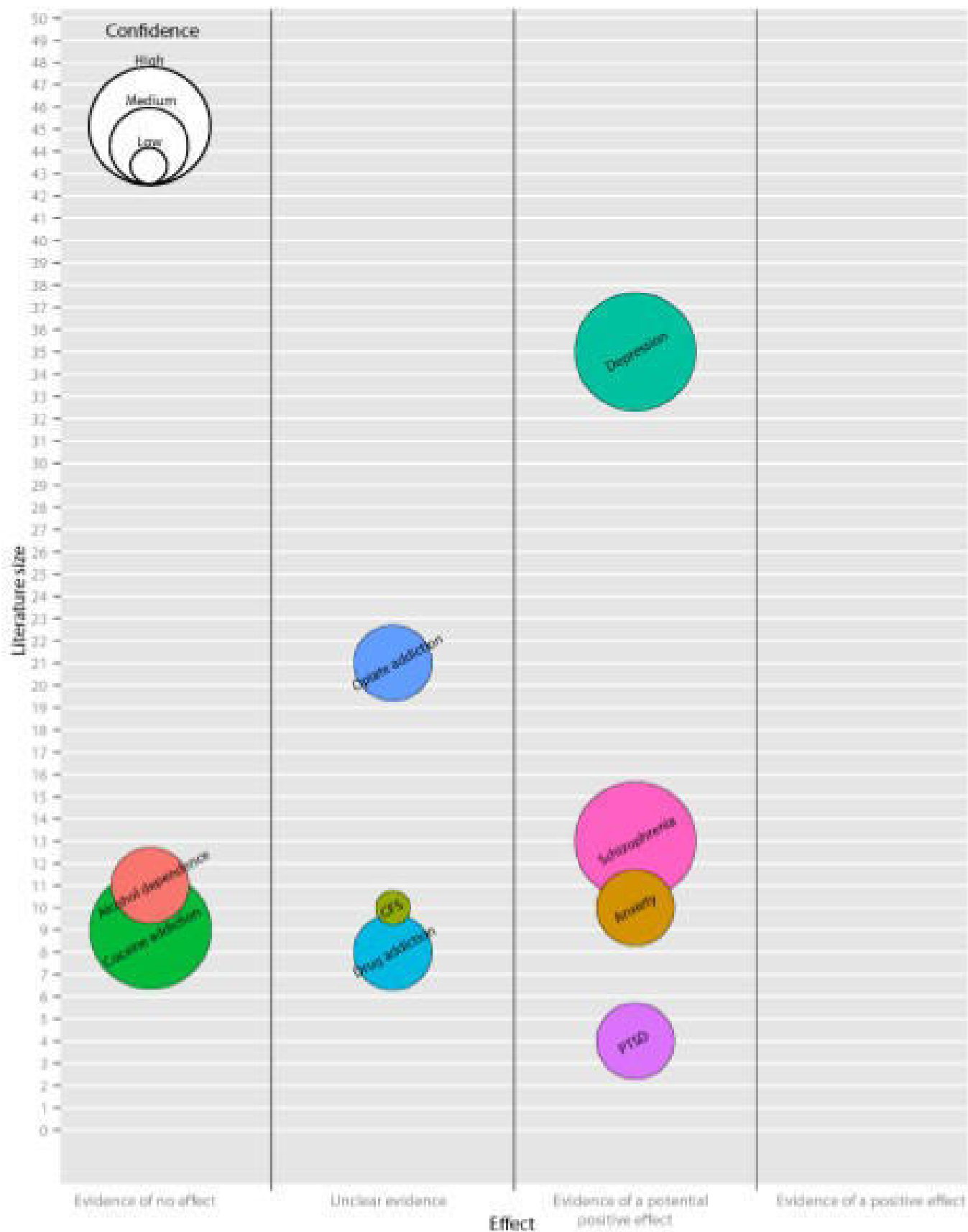
The following figure shows 21 different syndromes. 59 reviews were included. The common characteristic of these studies is, that the patient's pain was the measured variable.

According to the DVA, acupuncture causes no pain reduction compared to an untreated control group in the treatment of carpal tunnel syndrome. The reviews showed a positive effect of acupuncture on headache, chronic pain and migraine. According to the authors, the effect of acupuncture in the treatment of the 17 other included syndromes is unclear or potentially positive.



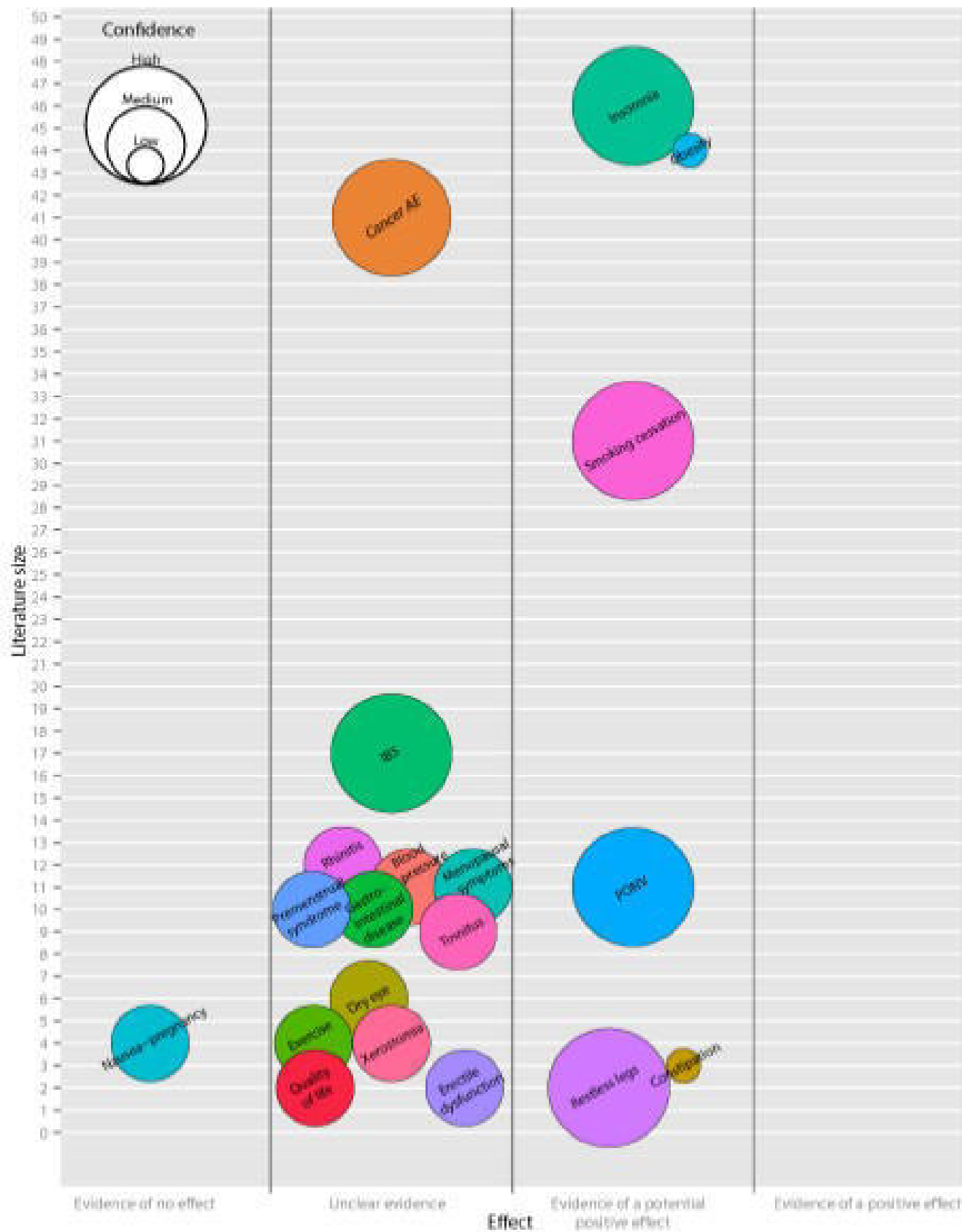
3. DVA - Evidence Map for Wellness and Mental Health

The following picture show the inferred effects of acupuncture on syndromes in the categories wellness and mental.



4. DVA - Evidence Map for Adverse Events

The following picture show the inferred effects of acupuncture on syndromes in the category adverse events.



5. Bibliography

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- 2) Linde K, Allais G, Brinkhaus B, Manheimer E, Vickers A, White AR. Acupuncture for tension-type headache. *Cochrane Database Syst Rev.* 2009(1):CD007587.
- 3) Vickers AJ, Cronin AM, Maschino AC, et al. Acupuncture for chronic pain: individual patient data meta-analysis. *Arch Intern Med.* Oct 22 2012;172(19):1444-1453.
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- 6) *Gesichts- und Kopfschmerzen aus interdisziplinärer Sicht Gebundene Ausgabe* – 11. Oktober 2005 von A. Hugger (Herausgeber), H. Göbel (Herausgeber), M. Schilgen (Herausgeber) Verlag: Springer; Auflage: 2006 (11. Oktober 2005) SBN-10: 354023052
- 7) Headache Classification Committee of the International Headache Society (IHS). The international classification of headache disorders, 3rd edition (beta version). *Cephalalgia* 2013;33:629–808.
- 8) R. Andrew Moore, Sheena Derry, Philip J. Wiffen, Sebastian Straube, Lars Bendtsen. Evidence for efficacy of acute treatment of episodic tension-type headache: Methodological critique of randomised trials for oral treatments, *PAIN* 155 (2014) 2220–2228
- 9) *Praxis und Theorie der Neuen Chinesischen Akupunktur, Bd.2, Anleitung zur Praxis, Interpretation der Theorie Gebundene Ausgabe* – 1. Dezember 1994 Georg König, Ingrid Wancura Verlag: Facultas / Maudrich; Auflage: 3., erg. Aufl. (1. Dezember 1994) Deutsch ISBN-10: 3851756347

XIII.

Studies in the Field of Acupuncture – Mental Health and Adverse Events

Summary and Conclusion of this Chapter:

In the field of depression no significant differences could be found between patients that were not subjected to any treatment (people on waiting list), patients treated by sham acupuncture and those treated by verum acupuncture (1.). Hence, in the treatment of depression there is no evidence for the usefulness of acupuncture (1.)

According to the Cochrane review by Cheuk et al. (2.) in the field of insomnia no studies about the treatment with acupuncture and only two studies about the treatment with acupressure were obtainable. In these two studies no placebo group was investigated. Both studies revealed a positive effect of acupressure in the treatment of insomnia (2.)

In the Cochrane review regarding smoking cessation (3.) no evidence was found that acupuncture treatment is better than no treatment (people on waiting list) or short- and long-term psychological interventions. No significant difference between the effects of verum versus sham acupuncture were found. The respective funnel plot includes 14 studies and shows no evidence for publication bias. Therefore, these data seem to be valid.

There are only few studies on restless leg syndrome (RLS) (only 170 included patients). In the Cochrane review by Cui et al. (4.) only two studies met the inclusion criteria for this meta-analysis. One study found no significant difference in treatment outcome between acupuncture and medications. One study examined the effects of three different treatments, one using a combination of medications and massage, another one only medications and a third one only massage. A reduction of unpleasant sensations in the legs and RLS frequency was found in this review. There was no difference according to the reduction of RSL.

In the meta-analysis by Lee et al. (5.) concerning the prevention of postoperative nausea and vomiting (PONV), 40 trials with a total of 4858 participants were included. The authors found a significant reduction of nausea (RR 0.71, 95% CI 0.61 – 0.83) and vomiting (RR 0.70, 95% CI 0.59 – 0.83) as a result of verum compared to sham acupuncture (5.).

In the study from Streitberger et al. (5.1.) with 220 included subject's postoperative nausea and vomiting (PONV) were investigated after gynecological and breast surgery. For the placebo group non-penetrating needles were used. Considering both, gynecological and breast surgery, there was no significant difference found between the effects of verum and sham acupuncture. However, by evaluating only the gynecological surgery group there was a statistical significant difference. The verum acupuncture group showed a reduction of about 20% related to PONV compared to the placebo group (5.1.).

Throughout the whole literature research for this thesis, the study by Streitberger et al. was the only “non-penetrating acupuncture study“, which showed significant verum effects for acupuncture treatment. Therefore, considering this study by Streitberger et al. and the meta-analysis by Lee et

al., a verum effect in the treatment of PONV, at least for some types of surgery (5.1.), can be suggested.

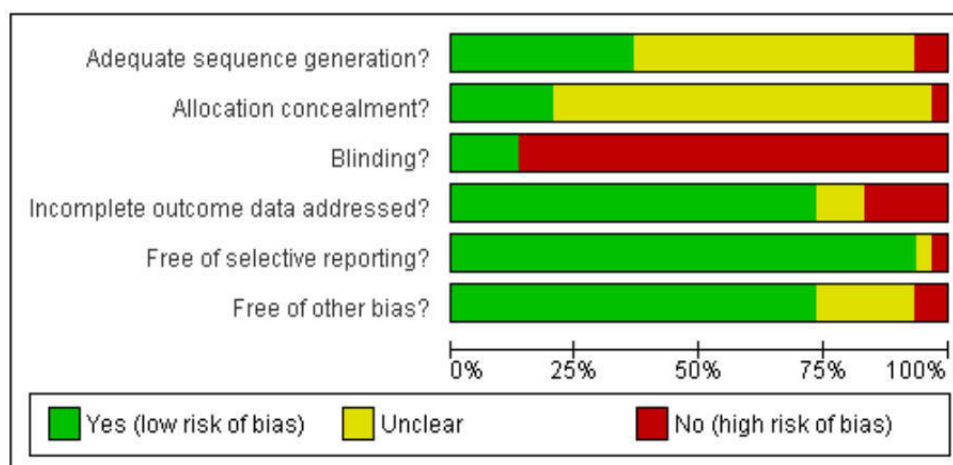
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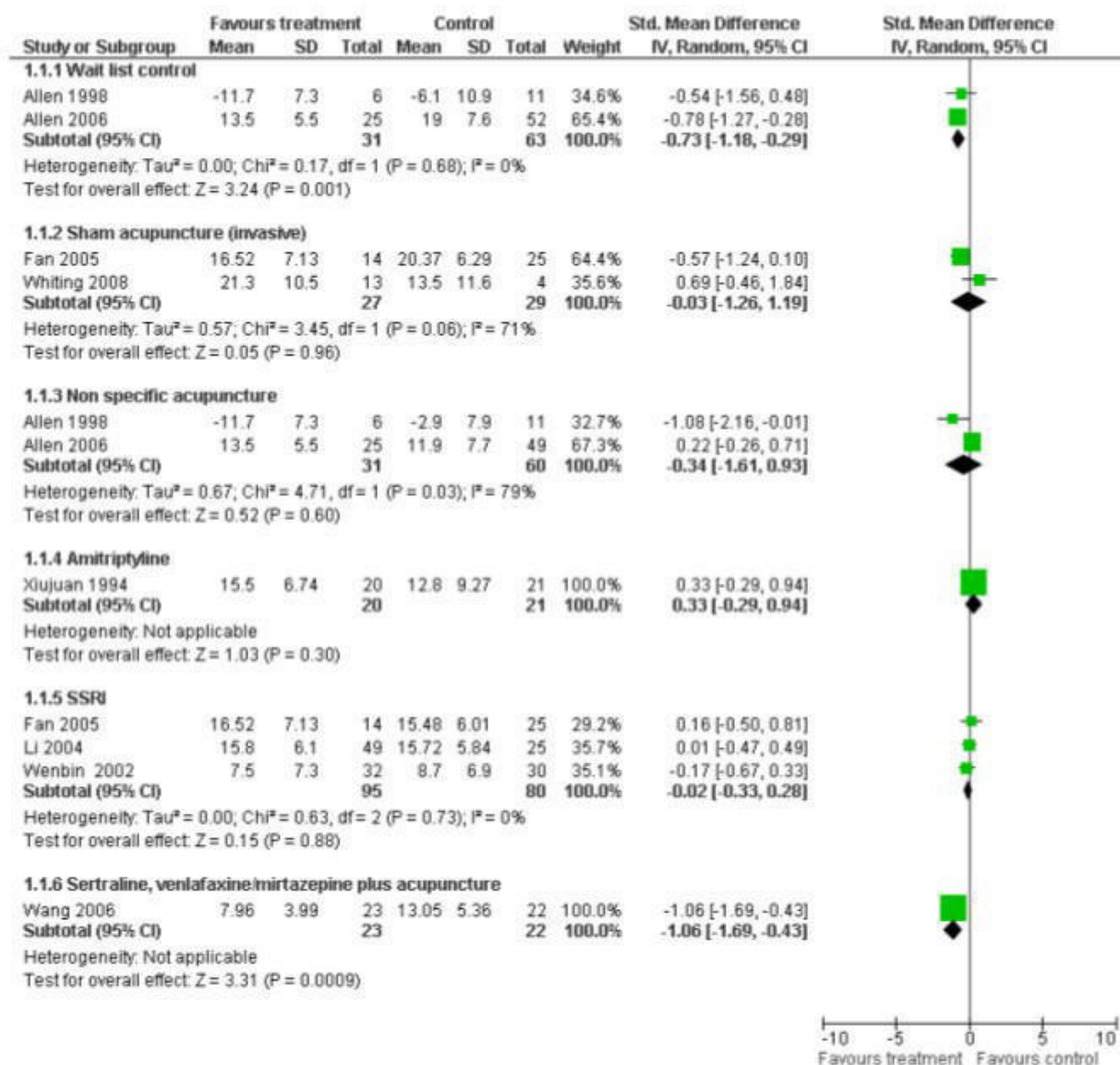
1. Smith et al. (3) – Acupuncture for Depression – A Cochrane Review

In this meta-analysis by Smith et al., 13 trials with 2812 patients were included.

The following diagram shows the overall methodological quality of these 13 studies. According to the authors, there was a **high risk of bias** in the majority of studies.



In the following forest plot, the results of this meta-analysis regarding the **reduction of the severity of depressions** can be seen. There was **no statistically significant** difference between the waiting list control group and sham acupuncture control group compared with the verum group. The authors concluded that there is **insufficient evidence for the usefulness of acupuncture in the treatment of depression**.



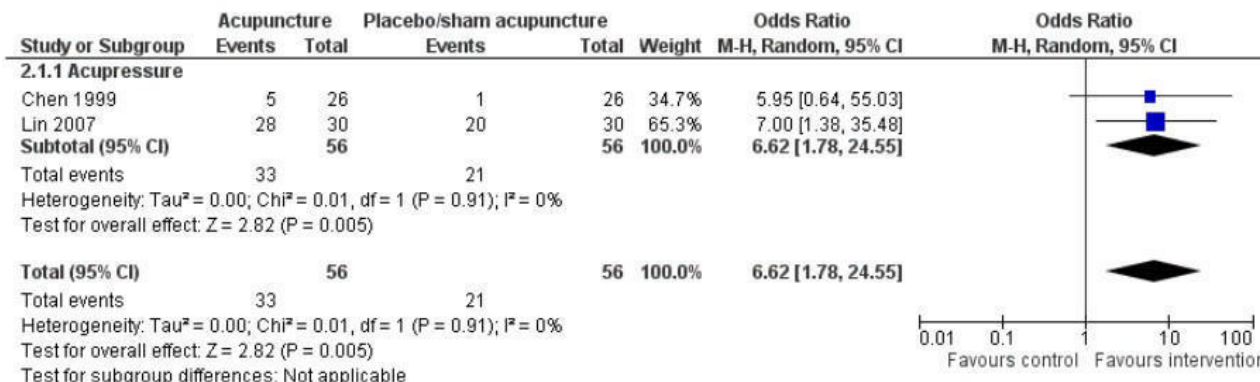
In the **two studies which included a placebo group** (sham acupuncture), **no statistically significant difference** was found between the placebo and the verum group (**Fan 2005, Whiting 2008**).

For the study of Fan et al. access could only be gained to the abstract. The study included three groups: (a) a verum acupuncture group ($n=28$), (b) a Prozac group (medication) ($n=24$) and (c) a non-acupuncture points group ($n=24$). The following results were obtained, the former values showing after and the latter values those before treatment (depression score values): (a) **26.01**+3.99, **16.52**+7.13; (b) **25.14**+5.78, **15.48**+6.01; (c) **25.65**+3.42, **20.37**+6.29. There are no significant differences in depression score between this three treatment groups.

For the study of Whiting et al. access could as well only be gained to the abstract. Unfortunately there was only little information about the results in the abstract. This study contained a very small number of subjects (nineteen participants). The **placebo group showed better effects** than the treatment group based on the Beck's Depression Inventory (BDI) and the RAND 36 Item Health Survey 1.0 (RAND), however, these **differences between the two groups were not significant**.

2. Cheuk et al. (6) – Acupuncture for Insomnia – A Cochrane Review

Cheuk et al. investigated the influence of acupressure on insomnia. The following Forest plot shows the results for acupressure and placebo. The observed variable was the improvement in sleep quality as a result of the treatments.

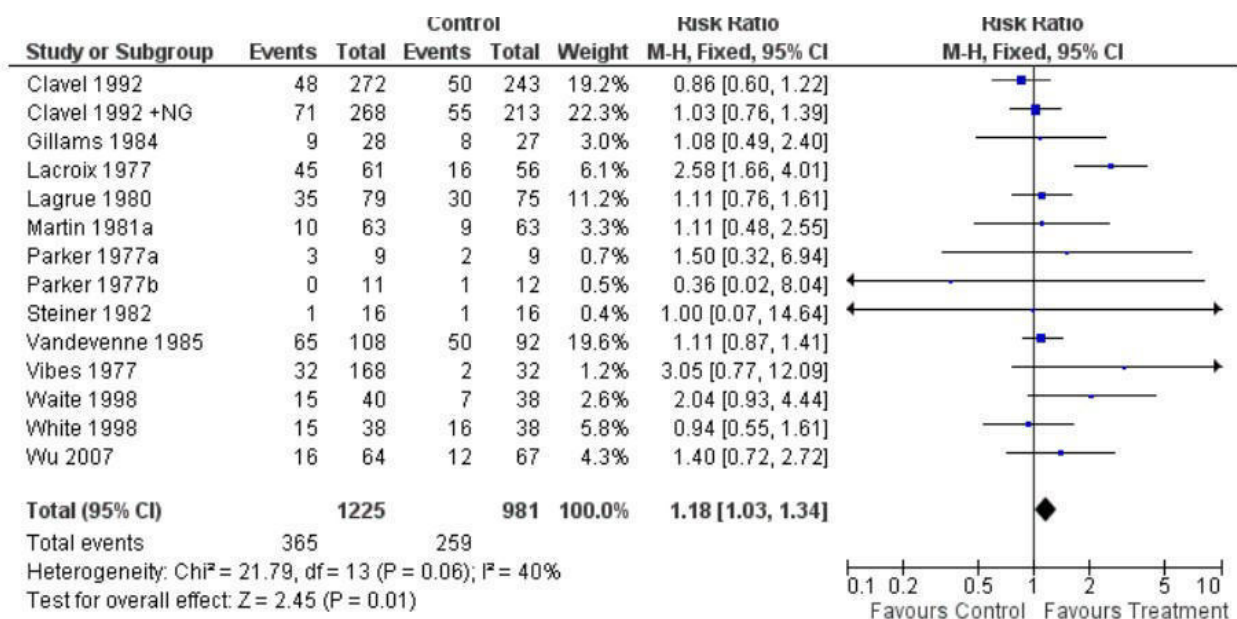


In two studies by Chen 1999 (7) and Lin 2007 (8) the effects of acupressure were investigated. Both studies showed positive treatment effects for insomnia but both studies did not include a placebo group. Therefore, these studies will not be further discussed in this chapter.

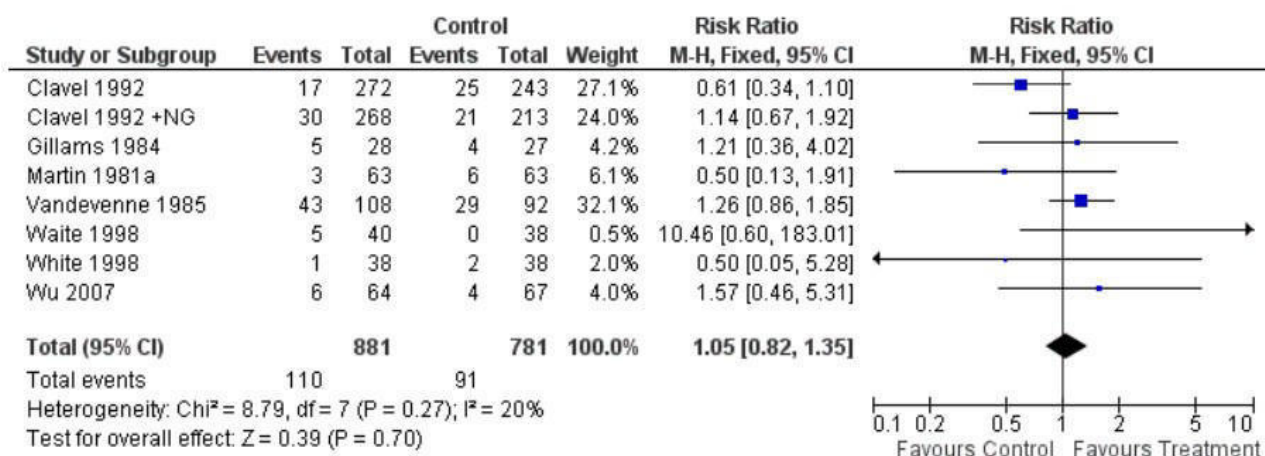
3. White et al. (9) – Acupuncture and Related Interventions for Smoking Cessation – A Cochrane Review

The Cochrane review by White et al. includes 33 studies. The authors concluded that **acupuncture was less effective than nicotine replacement therapy (NRT)**. In one of the following figures the comparison between acupuncture and NRT is shown. White et al. noted that these studies were not free from bias. There was also **no evidence that acupuncture treatment is better than no treatment** (waiting list) and short- or long-term psychological interventions. There was **no significant difference between the effects of acupuncture versus sham acupuncture** for the mainly considered variable, smoking cessation.

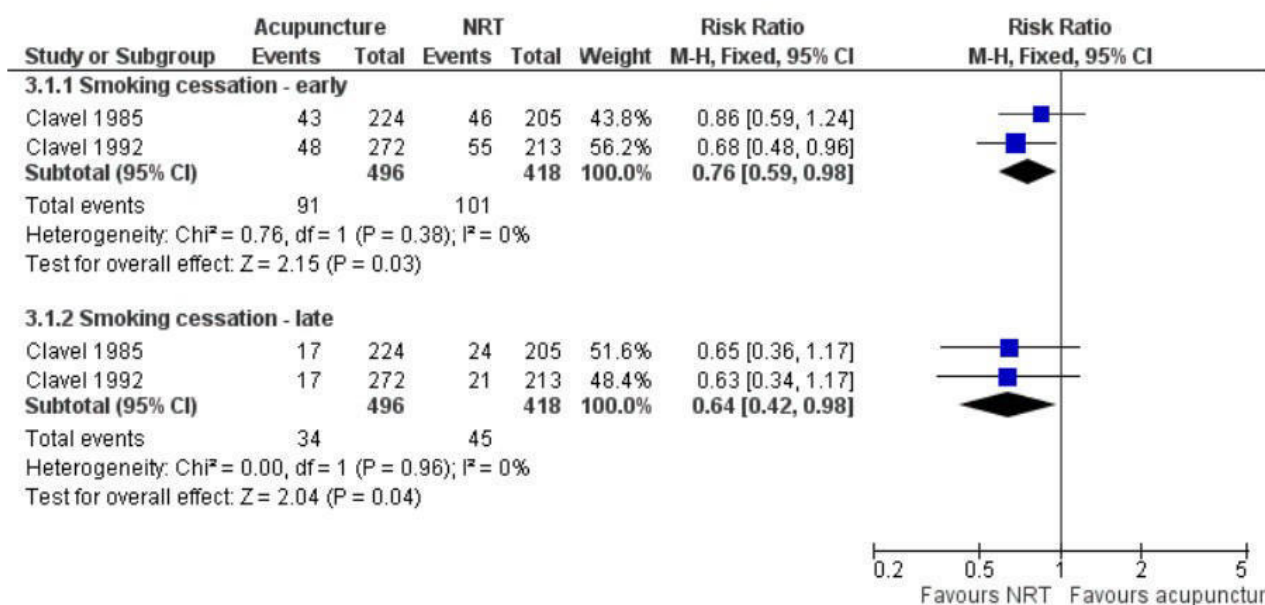
The following figure shows the results from various studies which compare the effects of acupuncture and sham acupuncture on early smoking cessation.



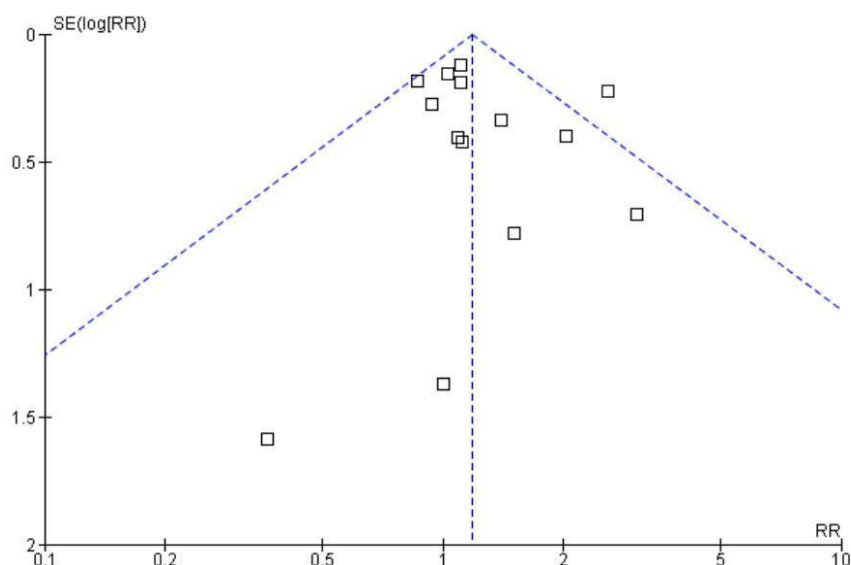
The following figure shows the results from several studies for acupuncture and sham acupuncture on smoking cessation after 6-12 months.



The following figure shows the comparison between acupuncture and nicotine replacement therapy (NRT).



The following figure shows the **Funnel plot** with the variables acupuncture and sham acupuncture (early measurement outcome).



The funnel plot includes **14 studies** and **shows no evidence of publication bias**. A strong bias would indicate the absence of studies (studies that are not published because they provided a negative result).

4. Cui et al. (10) – Acupuncture for Restless Legs Syndrome – A Cochrane Review and Lee et al. (11) – Acupuncture for Schizophrenia – Meta-analysis

Restless Leg Syndrome

In the review of Cui et al. only two studies (with 170 patients, Shi et al. 2003 and Zhou et al. 2002) met the inclusion criteria for this meta-analysis. Both of these studies did not include a placebo group. In the study by Shi et al. no significant difference between the acupuncture and medications trial was found (RR 0.97, 95% CI 0.76 to 1.24). The second study examined the differences in treatment outcome between a combination with medications and massage, medications alone and massage alone. Unpleasant sensations in the legs (RR 1.36, 95% CI 1.06 to 1.75; WMD -0.61, 95% CI -0.96 to -0.26) and RLS frequency (WMD -3.44, 95% CI -5.15 to -1.73) were reduced by treatments (medications and massage, medications alone and massage alone). There was no difference found regarding the reduction of RSL (WMD -2.58, 95% CI -5.92 to 0.76; WMD -0.38, 95% CI -1.08 to 0.32).

Schizophrenia

Lee et al. conducted a meta-analysis regarding the treatment of schizophrenia with acupuncture. Only one study including a placebo group was integrated, which unfortunately could not be accessed. All studies contained in this meta-analysis are originating from China. In order to allow for an objective analysis, studies from several countries should be included (compare chapter: „Trustworthiness of Studies“).

5. Lee et al. (1) – Stimulation of the Wrist Acupuncture Point P6 for Preventing Postoperative Nausea and Vomiting

The meta-analysis from Lee et al. includes **40 trials** with **4858 participants** in total. The effect of **P6 acupuncture point stimulation** on **preventing PONV** was investigated. The authors found a **significant reduction of nausea** (RR 0.71, 95% CI 0.61 to 0.83) **and vomiting**

(RR 0.70, 95% CI 0.59 to 0.83) **compared to sham treatment.**

The following figure shows the risk ratio for nausea. The forest plot indicates the comparison between acupuncture point P6 stimulation versus sham treatment.

The following figure shows the risk ratio for vomiting. The forest plot indicates the comparison between acupuncture point P6 stimulation versus sham treatment.

1.2.14 Invasive P6 stimulation

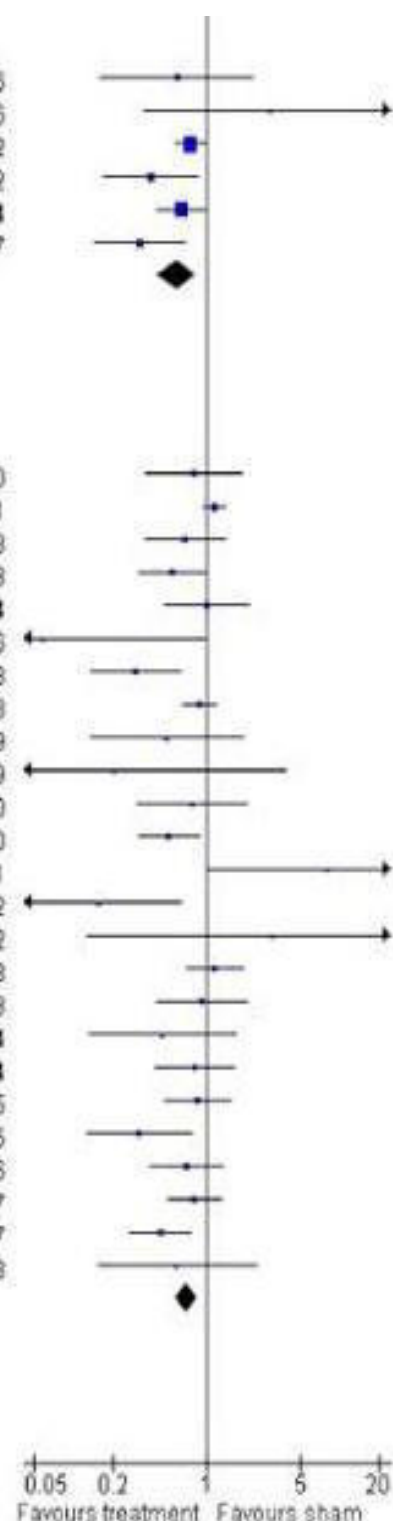
Dundee 1986	3	25	5	25	6.4%	0.60 [0.16, 2.25]	1986
Andzejowski 1996	3	18	1	18	2.6%	3.00 [0.34, 26.19]	1996
Rusy 2002	25	40	66	80	35.2%	0.76 [0.58, 0.98]	2002
Wang 2002	6	50	28	88	13.6%	0.38 [0.17, 0.85]	2002
Streitberger 2004	27	106	42	106	28.1%	0.64 [0.43, 0.96]	2004
Amir 2007	5	20	16	20	14.1%	0.31 [0.14, 0.69]	2007
Subtotal (95% CI)		259		337	100.0%	0.60 [0.43, 0.84]	

Total events 69 158
Heterogeneity: $\tau^2 = 0.06$; $\chi^2 = 8.26$, $df = 5$ ($P = 0.14$); $I^2 = 39\%$
Test for overall effect: $Z = 3.00$ ($P = 0.003$)

1.2.15 Noninvasive P6 stimulation

Barsoum 1990	8	49	11	54	3.6%	0.80 [0.35, 1.83]	1990
Lewis 1991	29	31	27	33	10.4%	1.14 [0.95, 1.38]	1991
Gleron 1993	9	30	13	30	4.6%	0.69 [0.35, 1.37]	1993
Fassoulaki 1993	12	51	22	52	5.4%	0.56 [0.31, 1.00]	1993
Allen 1994	9	23	8	23	4.3%	1.00 [0.49, 2.06]	1994
Ho 1996	0	30	8	30	0.4%	0.06 [0.00, 0.98]	1996
Schlager 1998	5	20	17	20	3.8%	0.29 [0.13, 0.64]	1998
Duggal 1998	50	122	56	122	9.1%	0.89 [0.67, 1.19]	1998
Harmon 1999	3	47	6	47	1.7%	0.50 [0.13, 1.88]	1999
Alkaissi 1999	0	20	2	20	0.4%	0.20 [0.01, 3.92]	1999
Agarwal 2000	7	100	9	100	2.9%	0.78 [0.30, 2.01]	2000
Harmon 2000	13	47	25	47	6.0%	0.52 [0.30, 0.89]	2000
Zarate 2001	8	110	1	111	0.8%	8.07 [1.03, 63.47]	2001
Agarwal 2002	2	50	13	50	1.5%	0.15 [0.04, 0.65]	2002
Alkaissi 2002	1	135	0	139	0.3%	3.09 [0.13, 75.15]	2002
Samad 2003	15	25	13	25	6.4%	1.15 [0.70, 1.89]	2003
Schultz 2003	6	13	8	16	3.9%	0.92 [0.43, 1.98]	2003
Gan 2004	3	26	6	24	1.8%	0.46 [0.13, 1.64]	2004
Klein 2004	12	75	15	77	4.5%	0.82 [0.41, 1.64]	2004
Misra 2005	13	38	16	40	5.5%	0.86 [0.48, 1.53]	2005
Butkovic 2005	5	40	16	40	3.1%	0.31 [0.13, 0.77]	2005
Habib 2006	12	47	16	44	5.1%	0.70 [0.38, 1.31]	2006
Arnberger 2007	25	110	31	110	6.9%	0.81 [0.51, 1.27]	2007
Turgut 2007	13	50	29	50	6.1%	0.45 [0.27, 0.76]	2007
Liu 2008	3	48	5	48	1.6%	0.60 [0.15, 2.37]	2008
Subtotal (95% CI)		1337		1352	100.0%	0.71 [0.58, 0.86]	

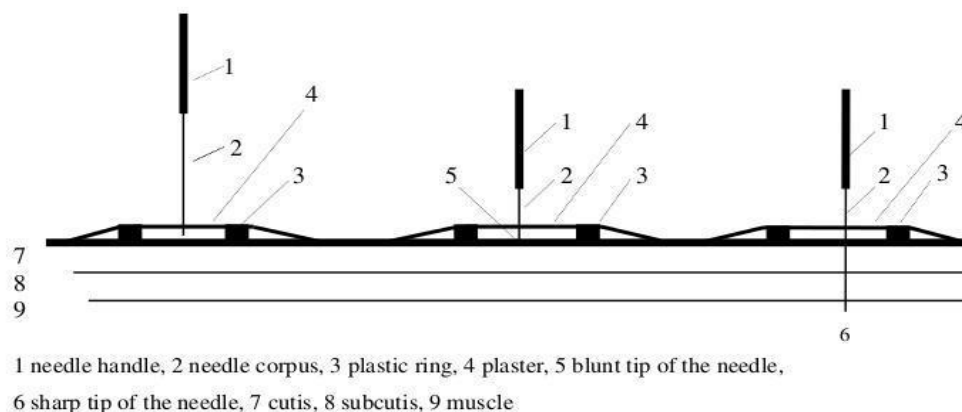
Total events 263 374
Heterogeneity: $\tau^2 = 0.11$; $\chi^2 = 52.01$, $df = 24$ ($P = 0.0008$); $I^2 = 54\%$
Test for overall effect: $Z = 3.37$ ($P = 0.0007$)



5.1. Streitberger et al. (2) – Acupuncture Compared to Placebo-acupuncture for Postoperative Nausea and Vomiting Prophylaxis: A Randomized Placebo-controlled Patient and Observer Blind Trial

In the study from Streitberger et al. the effect of stimulating the acupuncture point P6 on postoperative nausea and vomiting was investigated. The study includes **220 subjects**. Penetrating as well as non-penetrating needles were used.

The following figure shows the difference between the non-penetrating (placebo) and the penetrating needle (verum). The placebo-needle is only touching the skin and is disappearing into the handle when force is applied (middle). The real acupuncture needle is penetrating the skin (right).



The effects of needling the point P6 in the context of **gynaecological and breast surgery were investigated**. The patients were divided into **placebo and verum groups**, I.e. two groups for gynecological and two for breast surgery. The patients were receiving acupuncture either 20 min before or immediately after induction of anesthesia, in the verum as well as in the placebo group. The acupuncture needle was left in applied for 20 min. Only the acupuncturists knew the randomization results, I.e. which patients were receiving verum or sham treatment respectively. The primary results were drawn from the number of patients suffering from **PONV within 24 h after surgery**. PONV was defined as the occurrence of nausea or vomiting or the need for any antiemetic drugs. Earlier results (12 h after surgery) were conducted as well. The extent of PONV was evaluated by specifications from the patients on a four-point scale (none = 0, mild = 1, moderate = 2, severe = 3).

43,4% of patients in the verum acupuncture groups (gynecological and breast surgery) and **50,9%** in the placebo groups suffered from PONV within 24h. The difference between the verum and placebo group was **not statistically significant** ($p = 0.27$; Mantel-Haenszel test). When only the breast surgery group is evaluated, as well no significant difference is found in the occurrence of PONV between the verum (38.7%) and placebo (40.3%) group. However, when only the **gynecological surgery** group was evaluated, a **statistical significant difference** was found. The **verum acupuncture group** showed a reduction of PONV of about **18.5%** (from 67.4% to 48.9%) compared to the placebo group.

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XIV.

Diagnosis and Treatment of headache from the viewpoint of TCM

Summary and Conclusion of this Chapter:

The following chapter is necessary to judge scientific studies in the field of headache from the perspective of TCM. The following treatment recommendations are from the book "Practice and Theory of new Chinese Acupuncture - Volume 2" by König and Wancura (9). This is only a summary and should reflect as purely as possible the most important aspects according to the information of this book.

Climate factors play an important role in TCM (1.1.). In headache, wind is the central factor and can cause stiffness in the neck and the occipital region. In further consequence this can cause headache. This is evident. A person can be affected by a cold air conditioning system or during a drive with an open window. This leads to a stiff neck and subsequently may develop headaches. According to the chapter „Headache – treatment capabilities from the viewpoint of TCM apart from acupuncture“, this is plausible.

The differentiation according to the TCM between internal and external factors corresponds in principle in some aspects to the western separation between psychological and physiological factors.

The TCM diagnosis for headache is based on the one hand on affected meridians and on the other hand on classification of the ethology according to TCM (2.). The affected meridian respects the localization of the pain. According to the chapter “Myofascial Trigger Points / “Muskelverhärtung“/Myogelosis / AH-SHI-points and Tension Type Headache”, this is an important aspect in the diagnosis and treatment of headache. The detection of Ah-Shi-points could still improve this. According to a scientific view, this approach makes sense.

The classification of the ethology of TCM for factors that can cause headache are divided into three parts (3.)

- a) To external disease factors related headaches.
- b) Specifications subject to internal disease factors.
- c) Circulation disorders related pain (= posttraumatic headache).

Category a) contains accompanying headache in influenza infections, cold or other infectious diseases, electrolyte imbalances, headache caused by enteritis or headache that triggers by factors like draft-air, cold or excessive heat. According to the TCM this headache type starts strong and sudden (3.). From a modern scientific view this category includes logical relationships and is certainly not nonsense.

Category b) include headaches that occur on the basis of emotions and as a consequence of disturbances within the body. This category can be further divided into the headache types "Liver-YANG", "QI-weakness", "Blood-XUE weakness", "Kidney-deficiency" and "moisture-mucus".

“QI-weakness” describes headaches caused by iron deficiency and/or hypotension. “Blood-XUE weakness” categorizes headaches based on anaemia. “Kidney-SHEN weakness“ contains headaches connected to hypotension and neurasthenia. Finally, headache type “moisture-mucus” appears as a consequence of depressive disorders. These are all factors that are also important in western

medicine. For example, depression is frequently correlated with tension-type headache (see chapter: „Tension-type-headache from the Viewpoint of Western Medicine“). To that end, this TCM classification makes sense from a scientific point of view.

The diagnosis „Liver-YANG" corresponds to the western diagnosis "tension-type-headache" (3. 2b 1a). For this diploma thesis, this is the most important category. In TCM the liver corresponds to the emotion of anger. Also a lack of inner peace and stability can cause „Liver-YANG" (3. 2b 1b). The lack of inner peace leads in a further consequence to anger. Also the personality structure „liver“(impulsively, "with his head through the wall") and „heart“(“fiery enthusiasm") can cause „Liver-YANG" (3. 2b 1c).

In summary, the diagnosis „Liver-YANG" is connected to an unbalanced, impulsive, enthusiastic personality which causes anger. So according to TCM, tension-type-headache (TTH) is a result of anger. The TCM diagnosis is based on root causes. As described in the chapter „Tension-type-headache from the Viewpoint of Western Medicine“ factors like stress, psychiatric conditions, anxiety and coping deficits play an important role in the development of TTH.

During my education in medicine I have never seen that TTH was treated other than with drugs, regardless of underlying causes. In my opinion, this treatment is not based on scientific evidence and hence, is frustrating. In principle, the diagnosis „Liver-YANG" has a lot of overlap with the western model for tension type headache by Bischof (3, compare chapter „Tension-type-headache from the viewpoint of Western Medicine“) and is certainly not nonsense. A valid conclusion on such a complex topic, which is based on correct assumptions in various aspects, is certainly based on good perception of causes and effects by ancient TCM doctors. On the other hand, the question arises, how much of the diagnostic criteria according to the “new acupuncture” by König and Wancura are really based on ancient knowledge? Because in the time of Mao Zedong, acupuncture was remodelled to this “new acupuncture”. According to Lehmann (4), a lot of diagnostic and treatment procedures were changed in that time, only the framework is based on ancient TCM. And this TCM criteria by König and Wancura seems as if someone had mixed Western diagnostic criteria with “ancient TCM acupuncture”. But this is not the aim of this work. However, whether old or mixed old and new, this system is limited in a different area. It is not based on scientific studies according to western standards and much remained therefore in secret. Finally, science can reveal a lot of additional factors. A good doctor should not disregard this information.

In conclusion, headache diagnosis based on TCM is much differentiated and rests on logical considerations. However, the focus in this thesis is on acupuncture and therefore the important question is: Can acupuncture influence headache?

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1. Factors that causes headaches

From the viewpoint of TCM, headache can be divided in external and internal factors.

1.1. External factors

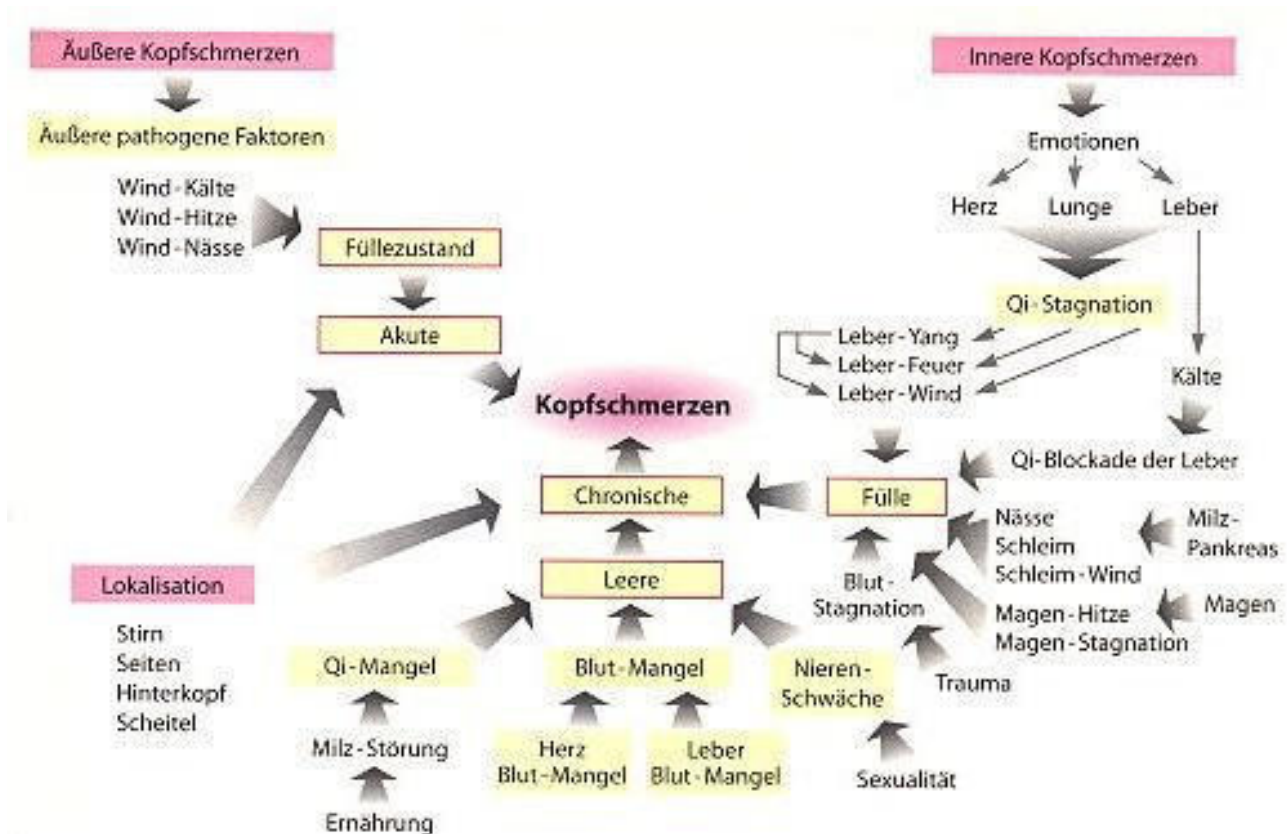
For headaches, the external factors wind, cold, heat or moisture, or combinations of these, plays an important role. Possible combinations of the external factors are wind-cold, wind-moisture or wind-heat. The climate factor wind plays a central role. The outer wind affects the upper body, acute headache is one of its main symptoms. Symptoms affected by wind can cause stiffness in the neck and in the occipital region. Subjectively, the patient has an aversion to cold. External factors can generate acute headache.

1.2. Internal factors

„Inside headache“ is caused by malfunction of organs (organs by definition of TCM) and dysregulation of the energy and blood (from a TCM perspective). It is important to distinguish between emptiness and fullness types.

Inner fullness type headaches are characterized by the presence of fullness in the head. This leads to a stagnation of qi and blood, which causes the symptom headache. This fullness state can have many causes, and is correlated to the fullness type which is always "very strong".

The following figure shows the factors that can cause headache. The most important relationships are explained in the following pages.



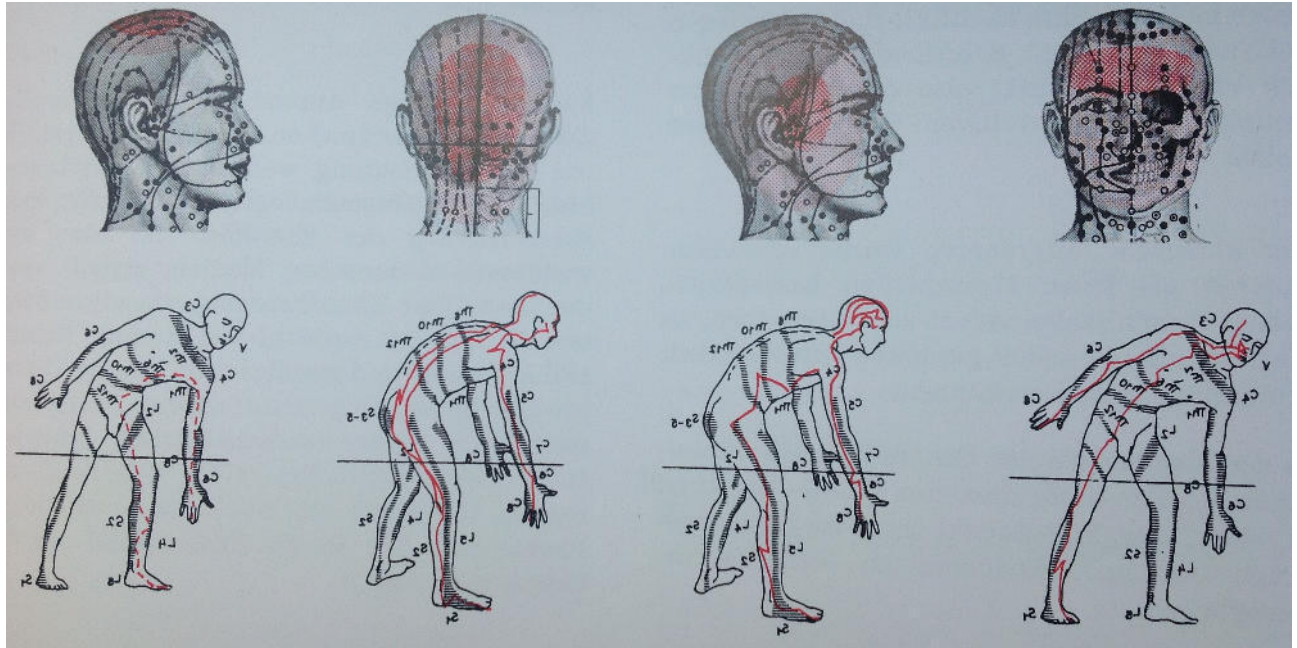
(Source: www.paracelsus-magazin.de)

2. Diagnosis – headache

In order to determine the correct location of acupuncture stimulation, the type of stimulus and the doses of stimulation two questions need to be clarified (9, King and Wancura, page 56).

1. The affected meridian pairs need to be determined. These are defined according the location of pain.
2. The classification of the ethology according to TCM.

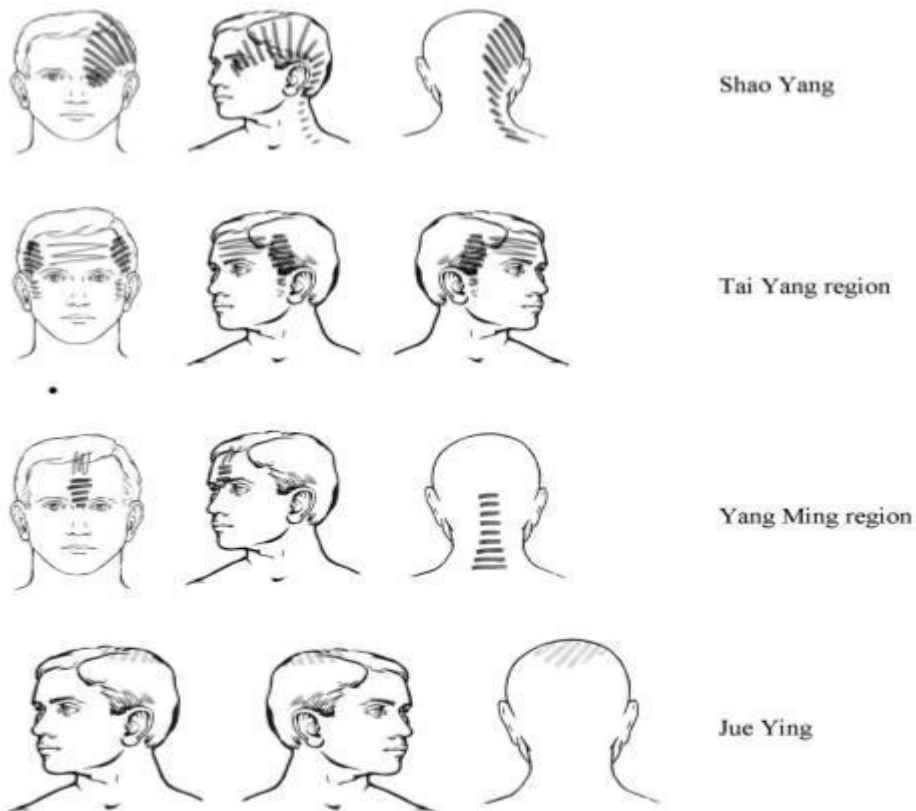
2.1. The classification according to the location of pain



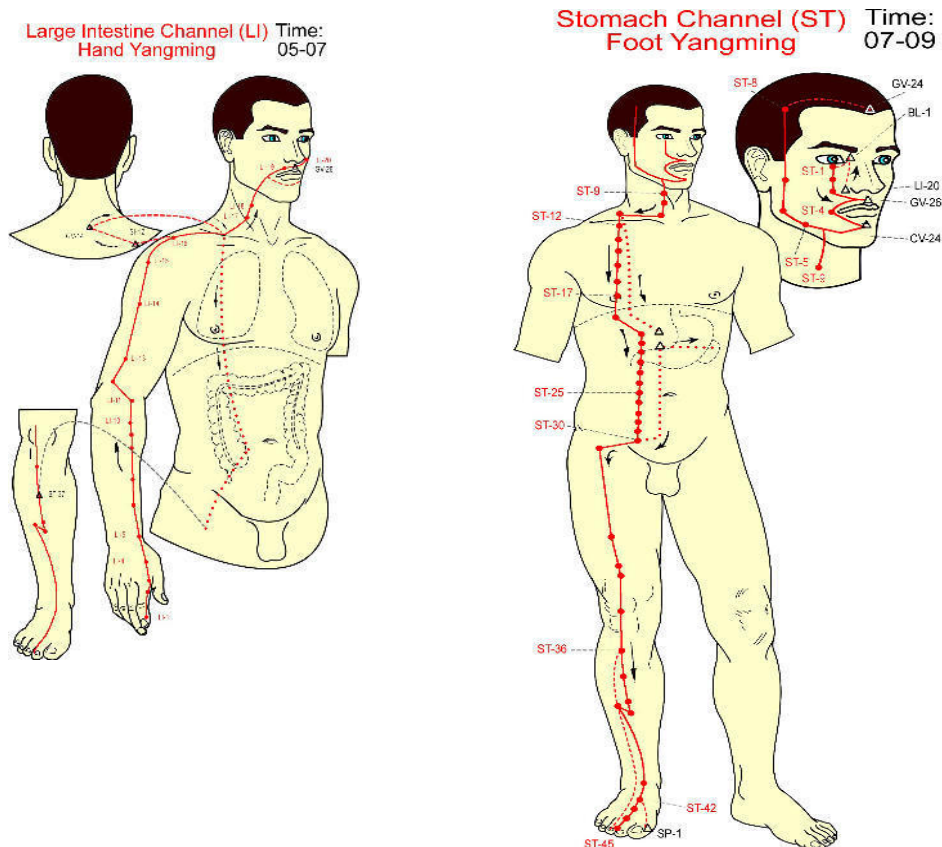
(Source: König, Wancura)

a) Front headaches (YANG MING headaches)

The affected meridian pair which passes through this pain area is the large intestine- and the stomach-meridian.



(Source: Moslsberger et al.)



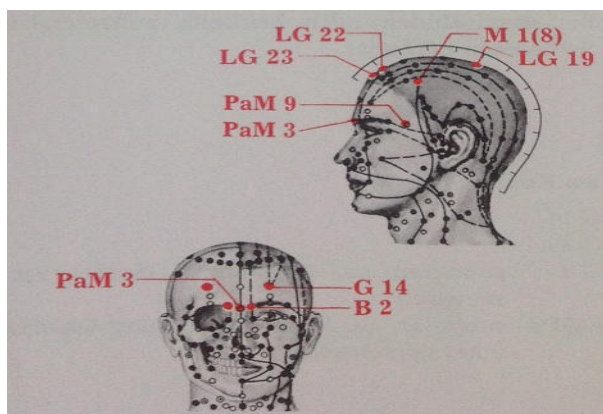
(Source: geneticacupuncture.com)

On the arms LI 4 and Lu 7 (Yin-Yang-rule), on the legs St 36 and eventually Liver 3 are possible acupuncture points for front headache.

(Source: König, Wancura)

On the head St 1 and new point 9 can be used. Furthermore, also the Du Mai-meridian in the centre of the forehead pass, the bladder meridian pass the medial eyebrow and the triple burner and the gall bladder meridian pass on the lateral part of the eye area. Therefore, the following points on the head are useful for acupuncture in this context: Du Mai 22 and 19, Gb 14 at pain of the eyebrows.

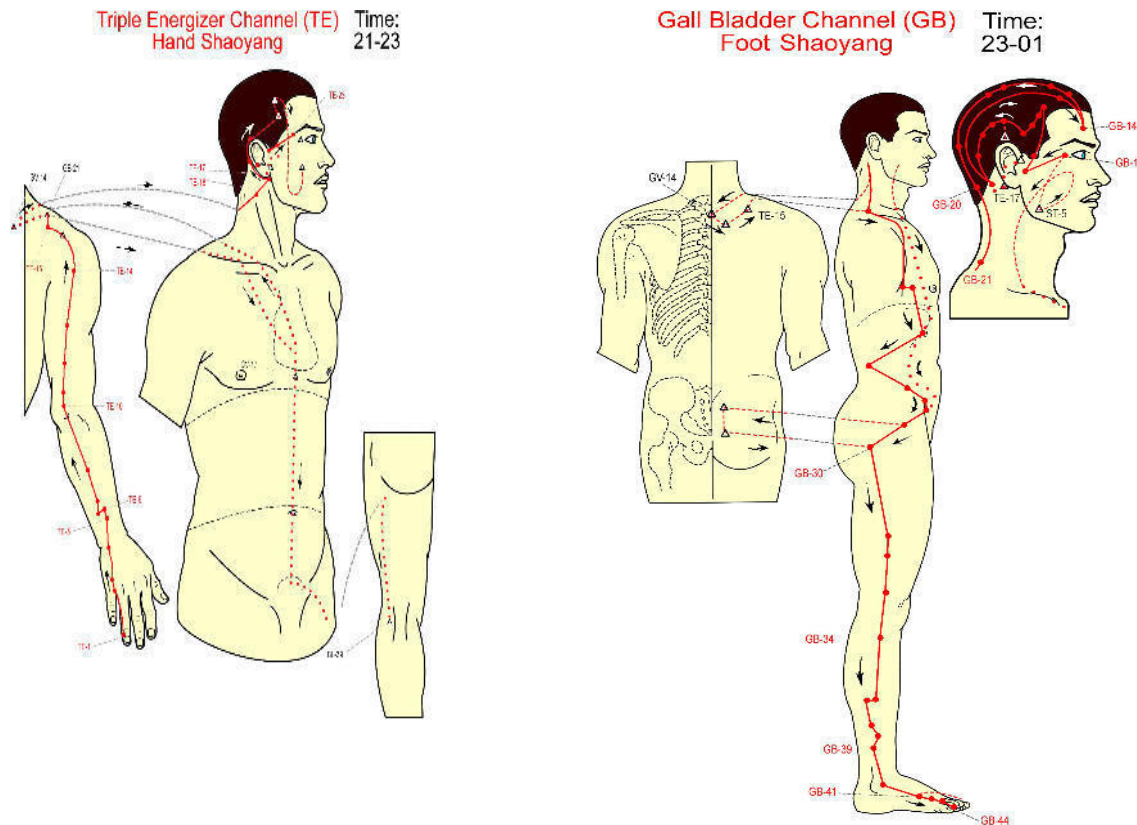
Furthermore, additional points can be chosen for specific problems: Bladder 2 can be selected in case of pain at the medial edge of the eye. New point 9 and new point 3 are suggested in case of diseases of the nose and sinuses.



(Source: König, Wancura)

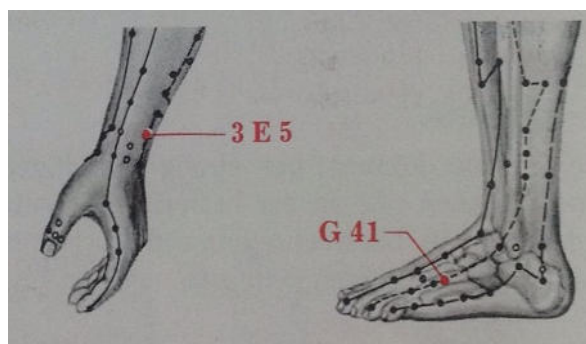
b) Side headaches (SHAO YANG headaches)

The affected meridian pair is the triple burner and the gallbladder meridian.



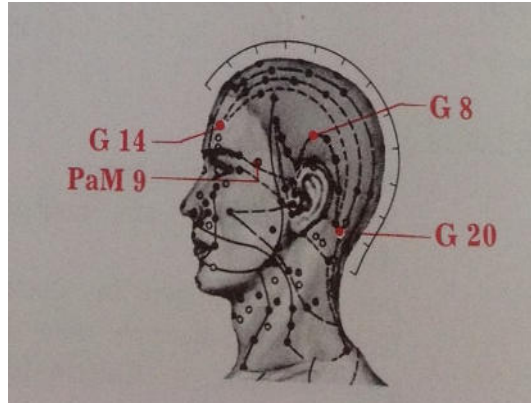
(Source: geneticacupuncture.com)

On the arm the acupuncture points triple heater 5 and on the food Gb 41 might be selected for treatment of side headaches. One-sided pain should be needled only unilaterally.



(Source: König, Wancura)

On the head G 14, 20, 8 and new point 9 are recommended.

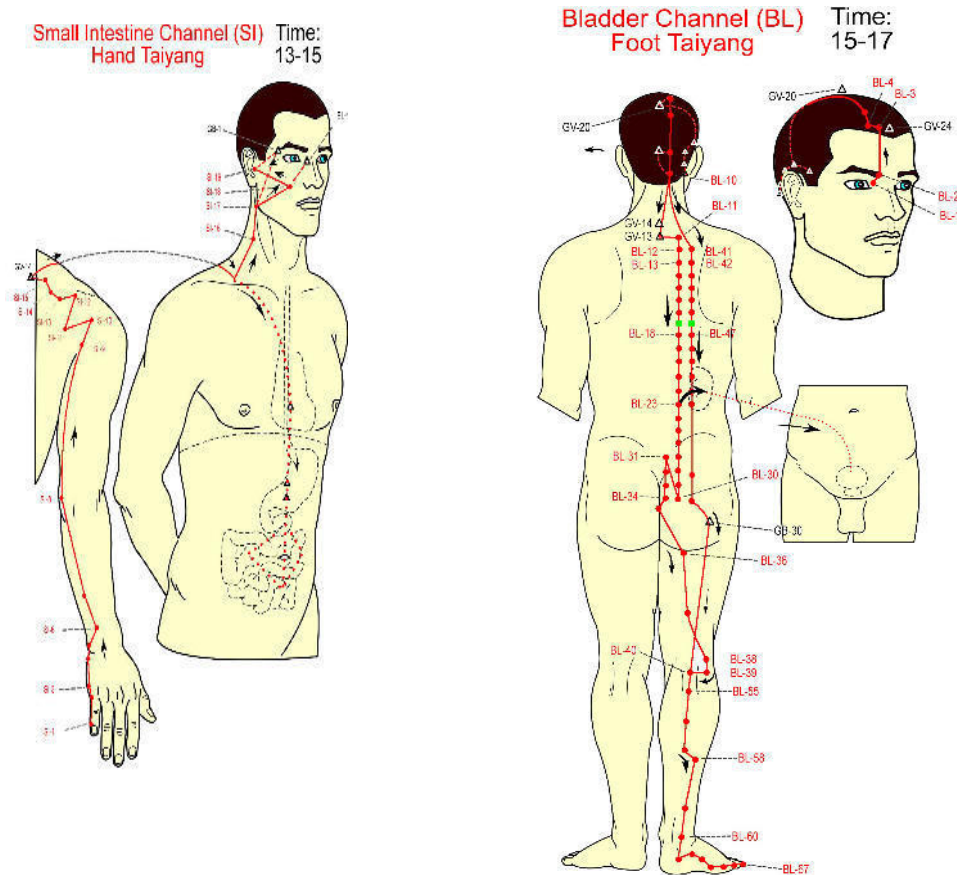


(Source: König, Wancura)

St 1 can be used when pain is radiating to the front and DU MAY when pain is radiating to the crown of the head. B 60 is recommended for the treatment of pain spreading to the occiput. St 36 and Spleen 6 can be used for patients with hypotension and general weakness.

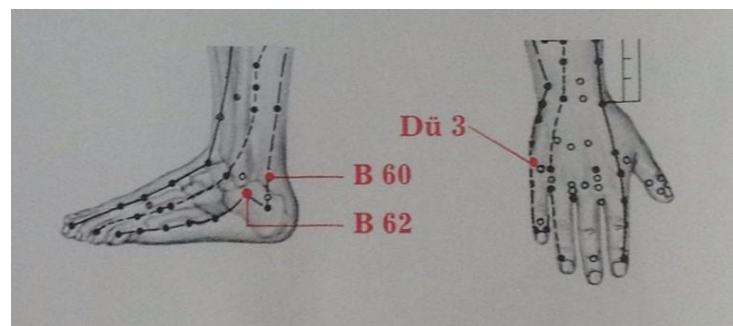
c) Occipital pain (TAI YANG headaches)

The small intestine- and bladder meridian are affected.



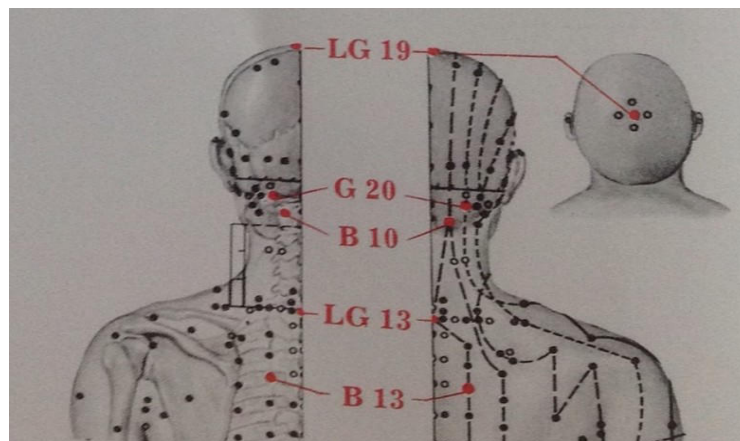
(Source: geneticacupuncture.com)

On the arm SI 3 and possible 5 3B (according to the inside-outside rule), on the leg B 60, B 62 or G 41 can be used.



(Source: König, Wancura)

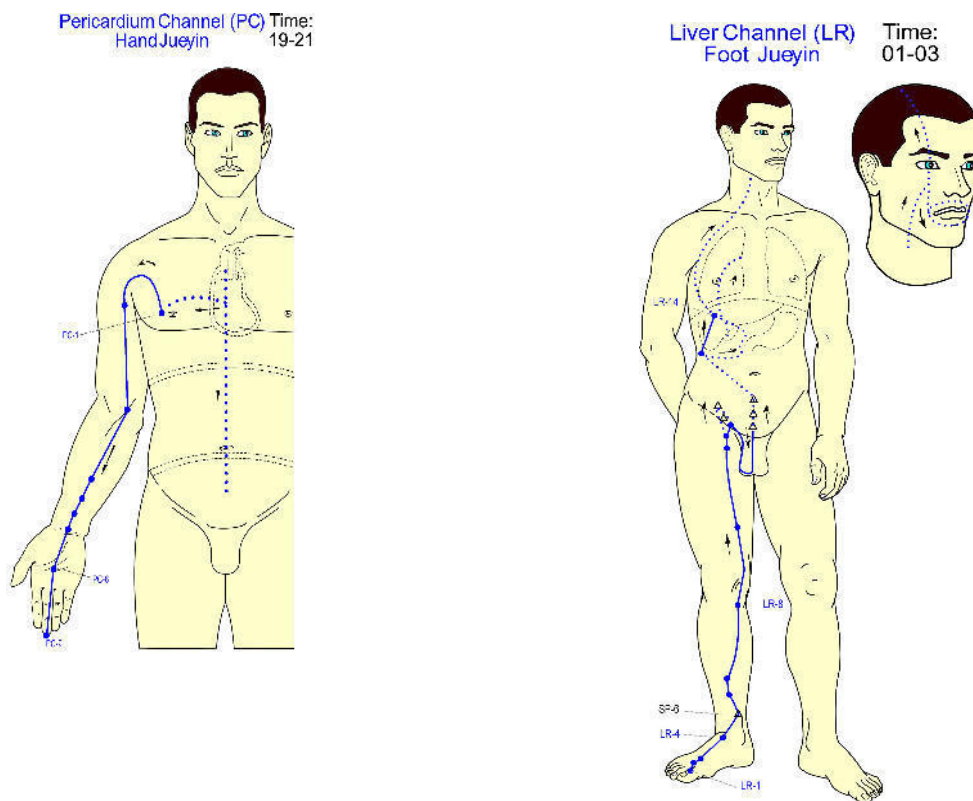
On the head B 10 or DU MAY 19 can be selected.



(Source: König, Wancura)

d) Vertex headache (YUE YIN headache)

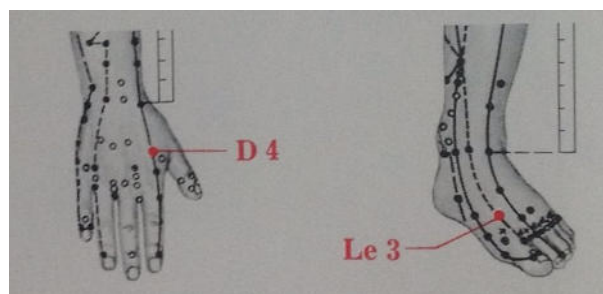
The KS- and liver meridian are affected.



(Source: geneticacupuncture.com)

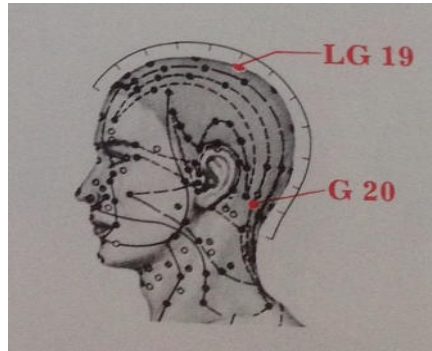
According to the ancient Chinese view an inner branch of the liver meridian goes to the vertex of the head. Therefore, this area corresponds to the liver circle.

On the arm LI 4 and on the leg L 3 can be used.



(Source: König, Wancura)

On the head LG 19 is suggested.



(Source: König, Wancura)

In case the pain radiating to the temple, DU MAY 9 can be needled.

Conclusion:

The localization and the affected meridian pair can be defined very easily. So it is all about where the patient is feeling the pain. (9, page 56)

3. The classification of the ethology of TCM perspective

According to König and Wancura the ethology of the headache can be divided into three distinct areas.

- a) Headaches related to external disease factors
- b) Specifications subject to internal disease factors
- c) Pain related to circulation disorders

3. a) Headaches related to external disease factors

These headaches occur as an accompanying pain in influenza infections, cold or infectious diseases. Other important triggers are draft-air, cold or excessive heat. They are usually connected with fullness Shi symptoms. That means that they start strong and sudden and the pain persists continuously.

Three main types of external factors can be distinguished:

3. a1) Headache type „draft-air – cold“

This type corresponds to the western diagnosis "accompanying headaches for trivial infections". So this type of headache is typical for chill and flu.

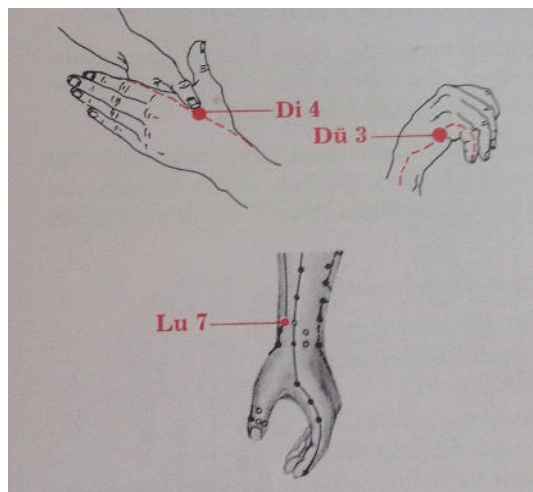
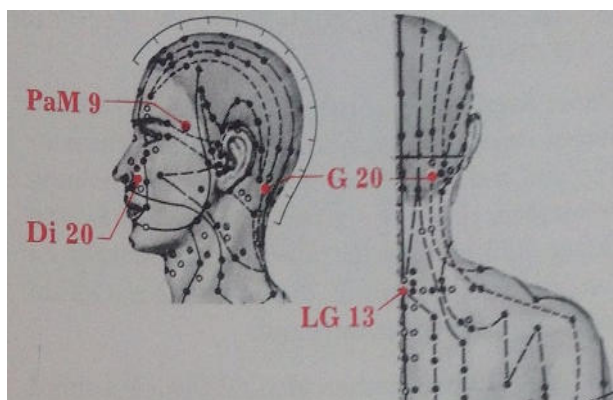
Symptoms: Painful tension in the neck and back, pale facial colour, secreting nose, general fatigue and heaviness, lack of sensation of thirst, endeavour cold and wind effects, necessity for warm drinks, warm environment and general application of heat.

Tongue coating: white and thin

Pulse: superficial and tense.

Treatment: "scatter wind-FENG and cold-HAN"

Suggested acupuncture points: Lu 7, LI 4, LI 20 (with simultaneous rhinitis), G 20, New Point 9, LG 13 and Dū with simultaneous neck- and back pain.



(Source: König, Wancura)

3. a2) Headache type „draft-air – heat“

According to the ancient Chinese theory chill-HAN convert to heat-RE. In the first phase of a chill the patient has a cold feeling, which can subsequently convert to a feeling of heat-RE. The symptoms of Heat-RE therefore are equivalent to that of a feverish patient. An a1) „draft-air - cold“ converts in a a2) „draft-air - heat“. The patient then has a necessity for cool drinks and a cool environment.

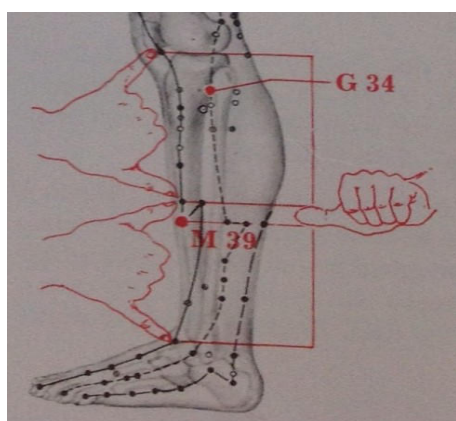
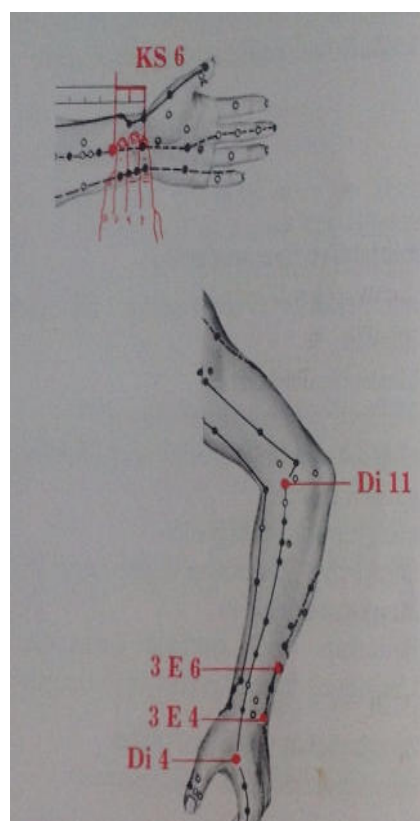
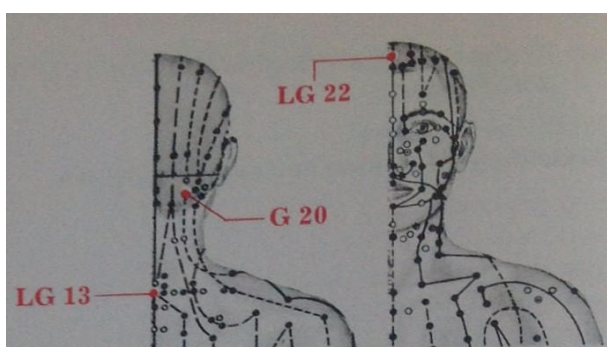
Symptoms: aching hot head, flushed face, heat throughout the body, strong thirst, and patient avoids external heat and drafts

Tongue coating: yellowish and thin

Pulse: superficial and quickly

Treatment: "disperse Wind-FENG and heat-RE"

Suggested acupuncture points: LI 4, LI 11 (against heat symptoms), and G 20 (effect on drafts-FENG, LG 13 (strengthening the defence) ...



(Source: König, Wancura)

3. a3) Headache type „draft-air – moisture“

This headache type frequently occurs as a **secondary symptom of a dysfunction in the digestive tract**. Chronic indigestion such as enteritis lead to **electrolyte imbalances**, which can **cause headaches**.

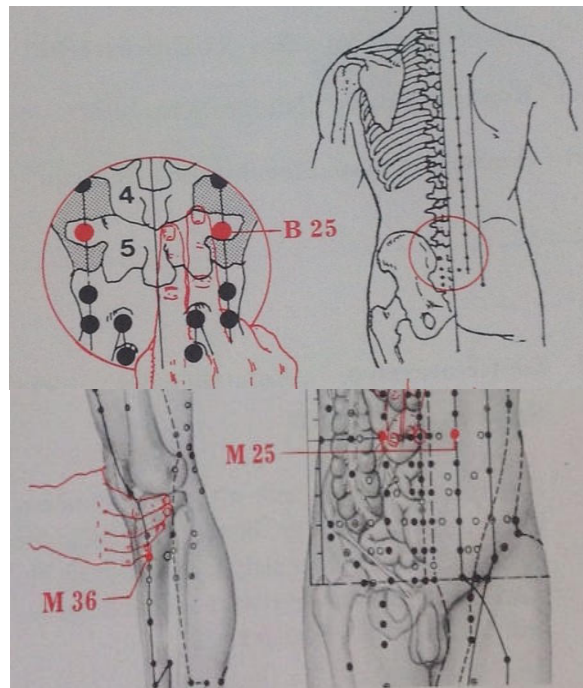
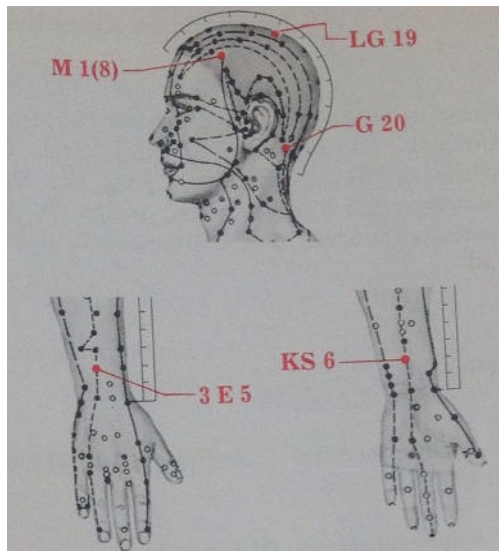
Symptoms: headache, which are perceived as a solid and aching band around the head, tightness in the chest, loss of appetite, easy fatigue, heaviness throughout the body, weakness in the limbs, watery stool, decreased urine output.

Tongue coating: thick, grainy, white

Pulse: slow

Treatment: "Scatter wind-FENG and moisture-SHI"

Suggested acupuncture points: GB 20, GV 19, St 1, 3 H 5 ...



(Source: König, Wancura)

3. 2 b) Specifications subject to internal disease factors

This type includes headaches that occur **on the basis of emotions** as a consequence of disturbances **within the body** (e.g., **digestive disorders and anaemia**)

These headaches are further divided into five types:

3. b 1) "upward Liver-YANG"

3. b 2) "QI-weakness"

3. b 3) "Blood-XUE weakness"

3. b 4) "Kidney-deficiency"

3. b 5) "moisture-mucus"

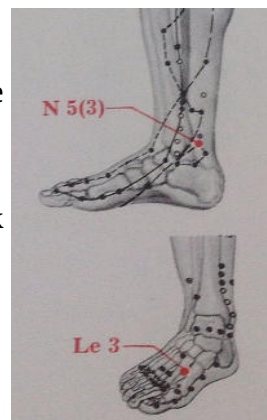
3. b 1) headache type "upward Liver-YANG"

This type corresponds according to König and Wancura to the western diagnosis "**tension-type-headache**".

3. b 1a)

People develop these headaches as a consequence of a **lack of inner peace and stability** (= YIN deficiency, especially kidney YIN deficiency). **Kidney YIN deficiency produces a liver Yin weakness, which leads to a rise of the liver-YANG** (mother-son-rule). This liver is connected to the emotion **anger**. **The lack of inner peace therefore leads to anger.**

Treatment: Li 3, Ki 5, (YUAN-points). The stimulus intensity should be weak (BU FA) because it is a YIN-disorder.

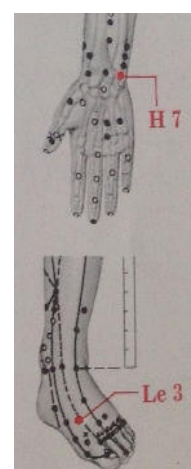


(Source: König, Wancura)

3. b 1b)

This type is a combination of the personality structure **liver-GAN** (impulsively, "with his head through the wall") and **heart-XIN** ("fiery enthusiasm"). According to the 5-element-teaching, liver GAN and heart-XIN are affected.

Treatment: Li 3, H 7 (YUAN-points)



According to the authors, headaches that occur subsequent to **anger and aggression** often result in headaches at the temple and the crown.

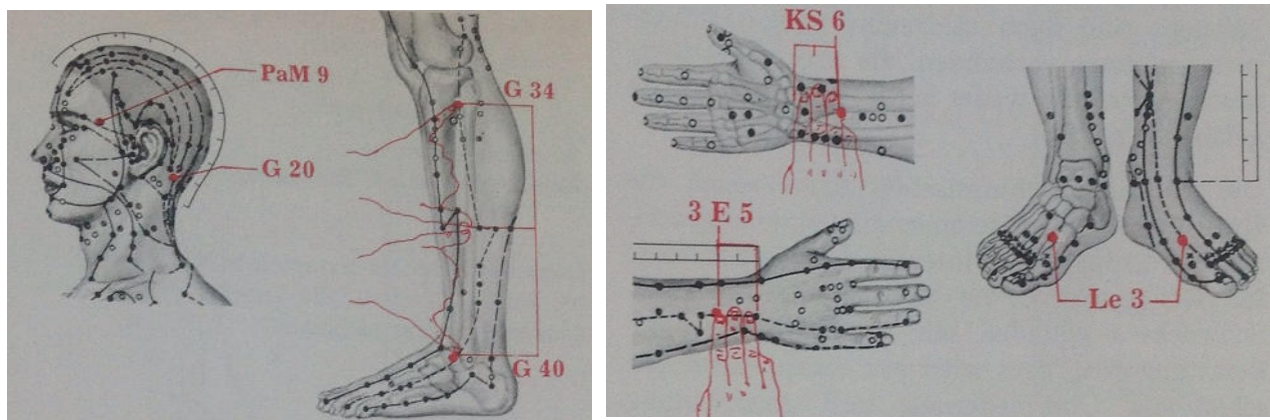
Symptoms 3. b 1a/b: Lateral and temporal headache, feeling of pressure in the chest, headache according to occurrence of anger and aggression, insomnia, bitter taste in mouth (5-element: bitter = liver), uncertainty in the legs, feeling of heaviness in the head.

Tongue: yellow

Pulse: rapid and tense, like the string of a musical instrument.

Treatment of 3. b 1a / b: "Lowering the ascending YANG liver")

Gb 20, 34, 40, PaM 9, GV 6, 3 H 5, KS 7 and / or H 7 b for insomnia and irritable weakness



(Source: König, Wancura)

3. b 2) Headache type "QI-weakness"

This form is similar to the Western diagnosis "**headache caused by iron deficiency and / or hypotension**".

It occurs either in isolation or in combination with blood-XUE-weakness.

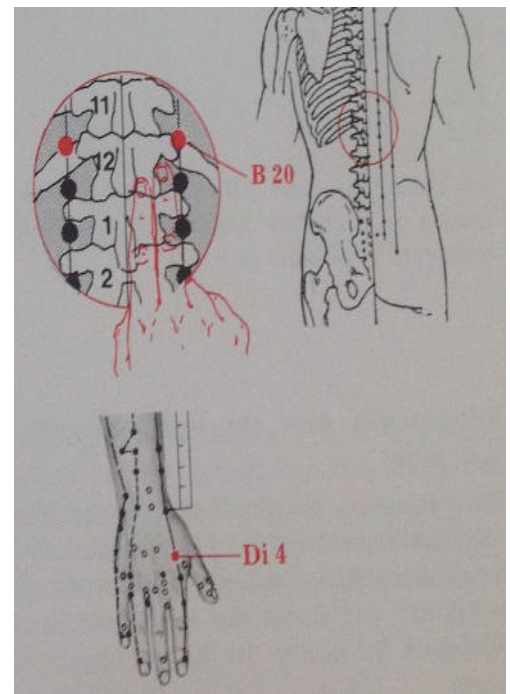
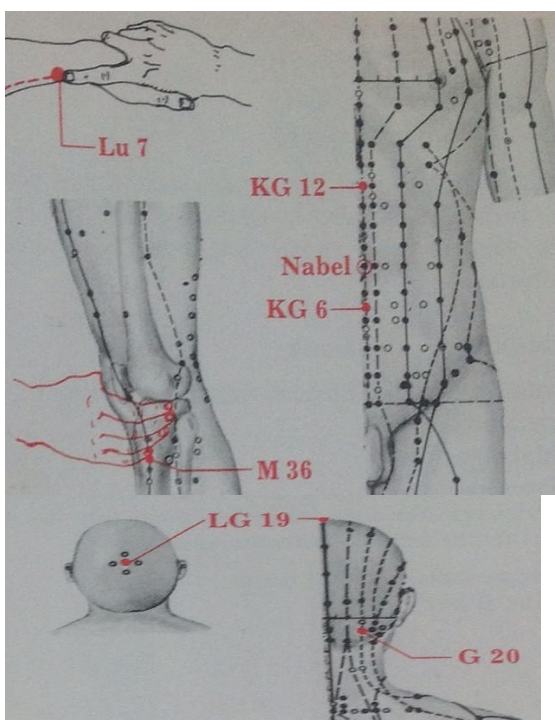
Symptoms: moderately strong but constant pain, pain diffusely felt at the head, concentration and memory weakness, low physical resilience, sense of weakness and tiredness in the limbs, fear of exposure to cold in the extremities (fear of exposure to cold is a typical symptom of QI-weakness)

Tongue coating: white

Pulse: Weak and fine

Treatment: "strengths of Qi"

CV 12, 6 - moxibustion, GV 19, M 36, Lu 7, LI 4, UB 20 - moxibustion, G 20



(Source: König, Wancura)

3. b 3) headache type "Blood-XUE weakness"

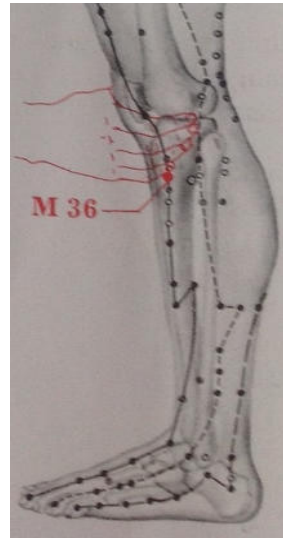
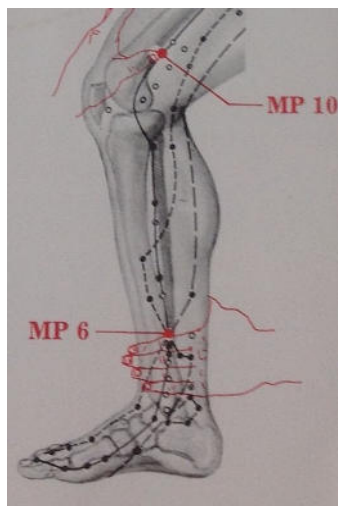
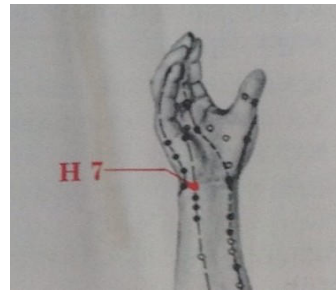
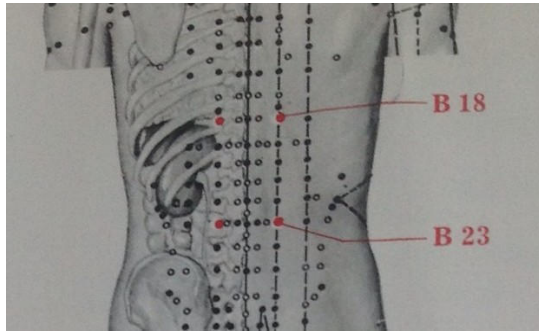
This form is similar to the Western diagnosis "**anaemia headache**" and is very similar to the previously described form (3. b 2).

Symptoms: headache associated with eye flicker, insomnia, palpitations, nervousness, decreased vision (according to TCM, this indicates a bad liver function), paraesthesia of the hands and feet

Tongue coating: white, thin

Pulse: fine

Treatment: Sp 6, 10, 7 H, M 36, B 23, 18



(Source: König, Wancura)

3. b 4) Headache type "Kidney-SHEN weakness"

This headache type corresponds to the Western diagnosis: "**Headaches with hypotension and neurasthenia**".

Patients suffering from this headache type often have a general feeling of weakness, reduction of vitality and a sensation of emptiness in the head. According to the TCM, the vital energy is attributed to the kidney function circuit.

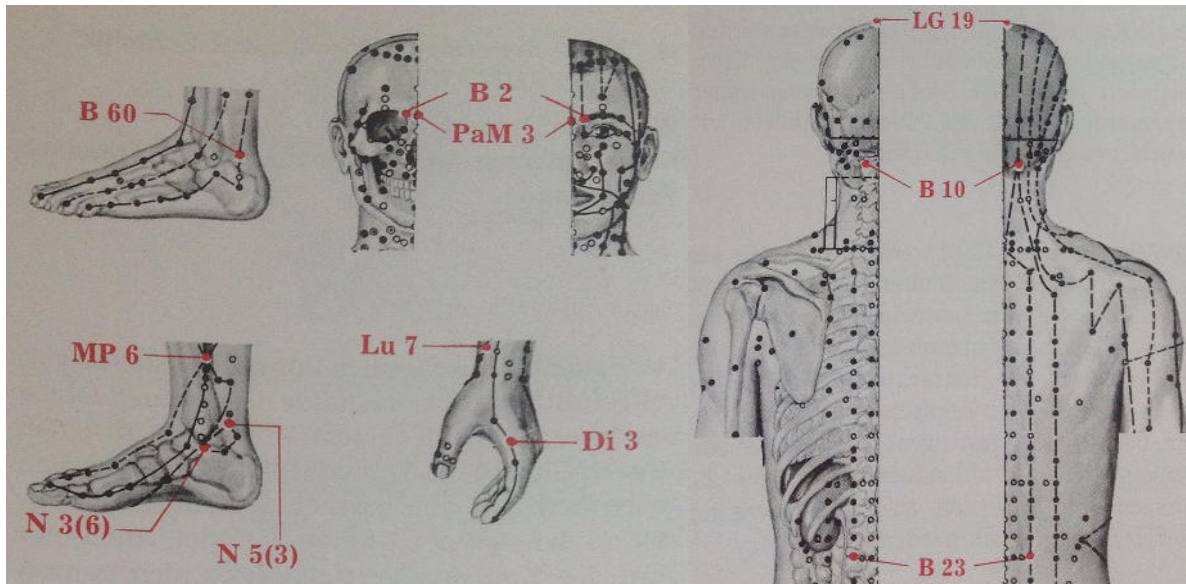
Symptoms: pain (especially in the neck and back of the head), vertigo and tinnitus, pain and feeling of fatigue in the lumbar region, sexual disorders.

Tongue coating: white, thin

Tongue corpus: reddened

Pulse: powerless, fine, deep

Treatment (to strengthen the YIN and kidney): B 60, B 23, B 10, N 5, N 3, Lu 7, MP 6, LG 19



(Source: König, Wancura)

3. b 5) Headache type "moisture-mucus"

Western diagnosis: **headaches in neurasthenic-depressive disorders.**

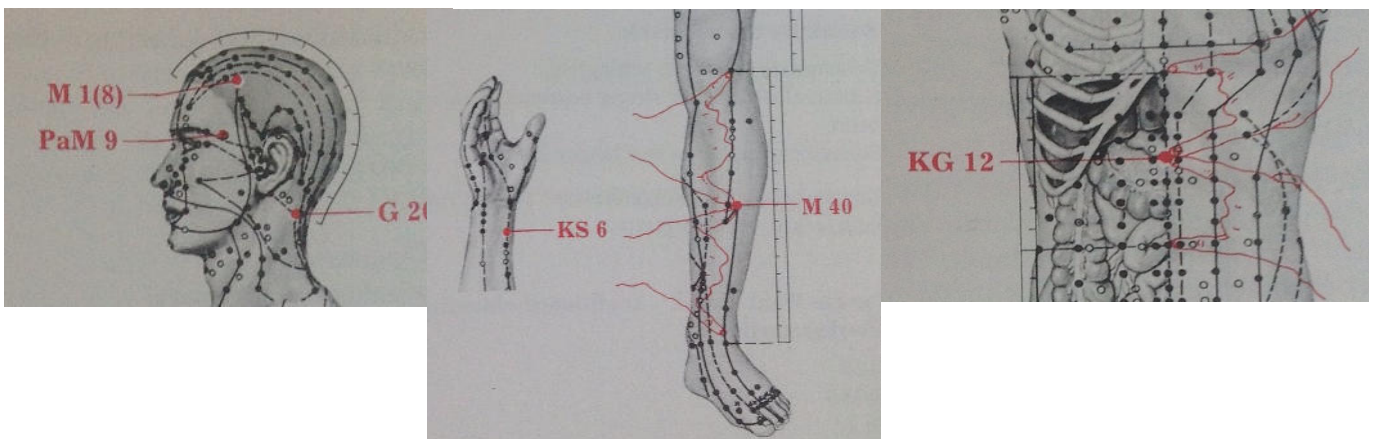
The patient suffering from this headache type describes his head as heavy and filled and is feeling **powerless and tired**. Pain is located mainly at the front of the head and forehead.

Symptoms: feeling of heaviness in the head, feeling of constriction in the chest, nausea, mucoid vomiting.

Tongue coating: white, grainy

Pulse: slippery

Acupuncture points for treatment: M 1, M 40 (based on to the symptoms mucus), KS 6 (based on the symptoms nausea), KG 12, G 20 PaM 9



(Source: König, Wancura)

3. c) Headache type "blood-stop"

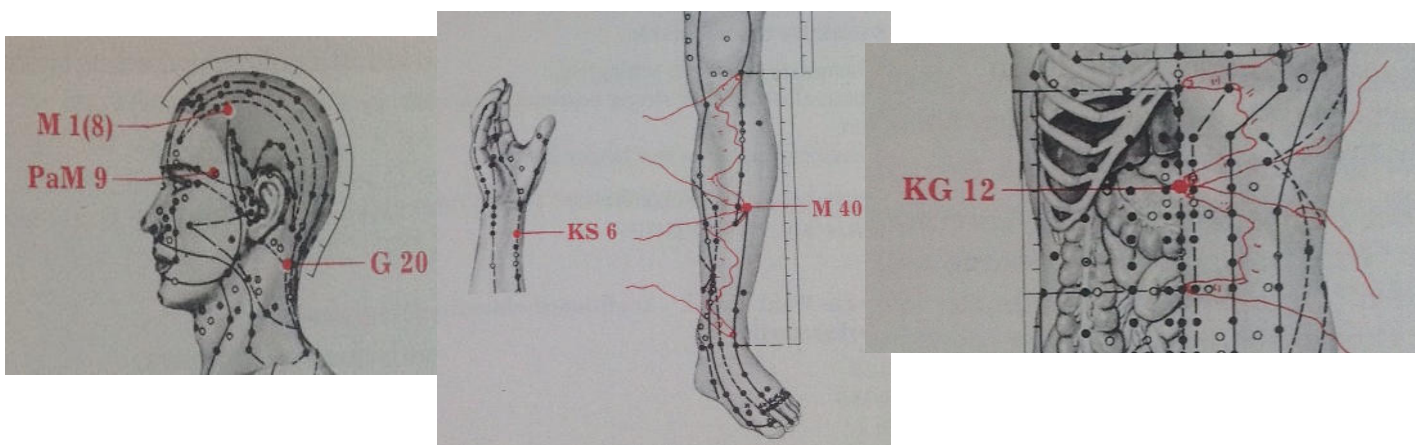
Western diagnosis: **posttraumatic headache.**

An important feature in this type of headache is the **consistent pain character** and the **consistent pain localisation.**

Tongue coating and tongue: spotted red

Pulse: angular, hard, and slow

Acupuncture points for treatment: G 20, PaM 9, Di 4, Le 3, B 17, Lu 5, B 54



(Source: König, Wancura)

4. Localization of the headache depending on the triggering emotions

With regard to the localization, emotions and affects that cause headache the following relationship can be established:

- **Wrath and anger triggered headaches often occur on the temple, on the vertex and in the area of the eyebrows.**
- **Fear and anxiety triggered headaches often occur in the neck and occiput.**
- **Mistrust triggered headaches often occur on the forehead and in the jaw area.**

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XV.

Tension-type Headache from the Viewpoint of Western Medicine

Summary and Conclusion of this Chapter:

Headaches usually have a multifactorial genesis, therefore, the bio-psycho-social model is necessary for a holistic viewpoint (1.). Tension-type headache (TTH) is the most common type of primary headache, accounting for more than 50% of all headaches (2.). TTH has a pushing/pulling headache pain character. In TTH the pain sensitivity of the pericranial muscles should be tested (3.). A lot of different factors can cause TTH. For example: sleep apnea and other sleep-related breathing disorders (4.2.), sustained contraction of muscles (4.1.), bruxism (4.3.), stress (4.4.), psychiatric conditions (4.5.), fibromyalgia (4.6.), anxiety (4.7.), scoliosis (4.7.), coping deficits (5.), proprioceptive deficits (5.), psychogenic factors (4.8.) etc.

According to Bischoff, all of this mentioned factors can cause increased muscle tension (5.). In further consequence this tension can induce local ischemia and cause tension-type headache (5.). This explanation is similar to the “trigger points pathogenesis” suggested by Simons and Travell (15). In summary, this increased muscle tension is caused by primary factors such as stress.

It is important to understand that this increased tension is always present, even at rest. Maybe, there are also forms of TTH without increased muscle tension, but on the whole this pathogenesis certainly plays an important role.

Assuming this model is right, some conclusions for the treatment of TTH can be drawn, according to the specific circumstances.

- 1) A primary factor has caused „trigger points“ (for the term “trigger points” compare chapter: XIX. Myofascial Trigger Points/...) but disappeared. For example, a person was exposed to extreme stress at work, but only for a short time period. In this case, the primary factor is no longer present and the "trigger points" as secondary factors should be treated.
- 2) A primary factor caused „trigger points“ and is still present. For example, a person suffers from apnea and this causes the „trigger points“. The primary factor must be treated as well, otherwise headaches would reoccur after a treatment of only the “trigger points”.

These examples should illustrate that different treatment methods are necessary to treat TTH, depending on the particular situation.

Antibiotics and vaccines were certainly one of the greatest achievements of medicine. Virus or bacteria can be treated with a specific antibiotic or vaccine. But many illnesses cannot be treated in such a straightforward manner because their causes are multi factorial. In my opinion, weaknesses in medicine are particularly appearing in the treatment of diseases with multi factorial genesis and TTH is an example for that.

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1. Bio-psycho-social Model in Western Medicine

In order to get a comprehensive overview of headache from a Western viewpoint, a psychosomatic approach is necessary. The **bio-psycho-social model** provides this integrated approach. It considers biomechanical, psychological and social components. Probably the most well-known standard work in German-speaking countries is the book "Psychosomatic medicine" from Adler et al. The following chapter will give a brief overview of tension-type headache with respect to bio-psycho-social perspectives.

2. Primary and Secondary Headaches

Headaches can be divided into **primary and secondary**. Primary headache means that other underlying diseases such as eye diseases, metabolic diseases or cervical syndrome can be excluded as possible causes. The **most common type, accounting for more than 50% of incidents**, is the **tension-type headache**, closely followed by migraine (11). Other forms only account for a few percent. The following classification is in accordance with the **International Headache Society (IHS)** 2013 (11):

Primary headache disorders

- A1. Migraine
- A2. Tension-type headache
- A3. Cluster headache and other trigeminal autonomic headache disorders

Secondary headache disorders

- A6. Headache attributed to vascular disorders in the head or neck
- A7. Headache attributed to non-vascular intracranial disorders
- A8. Headache attributed to a substance or its withdrawal
- A9. Headache attributed to an infection
- A10. Headache attributed to a disruption of homeostasis
- A11. Headache or facial pain attributed to disorder of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cranial structures

Cranial neuralgias, facial pain and other headaches

- A12. Headache attributed to psychiatric disorder
- A13. Cranial neuralgias and central causes of facial pain

(Reference: http://ihs-classification.org/de/02_klassifikation/05_anhang/)

3. TTH - Subdivision and Definition

The following classification and definition is adopted from the IHS (International Headache Society, 2013), but only an overview should be given. In the original work (11), an even more differentiated subdivision of TTH types and their definitions are available.

According to the information provided by the IHS (2013), TTH should be divided into the following categories (11):

- 1) **Infrequent episodic tension-type headache**
- 2) **Frequent episodic tension-type headache (fTTH)**
- 3) **Chronic tension-type headache (cTTH)**
- 4) **Probable tension-type headache**

A **distinction** should be made between headache **with and without increased pain sensitivity of pericranial muscles**. The pain sensitivity should be evaluated with **manual palpation**. (11)

According to the IHS, **TTH is defined as headache pain in the area around the entire head (bilateral/holicephal)**. TTH has a **pushing-pulling character**, but **not pulsating one**. The **intensity is mild to moderate** and **does not increase during physical activity**. Vegetative **accompanying symptoms** such as photophobia and excessive noise sensitivity, nausea, vomiting and loss of appetite **do usually not occur** and, if so, only very rarely.

The term infrequent episodic tension-type headache is used when at least ten episodes of headache are occurring on less than one day per month (**< 12 days per year**).

The distinction between fTTH and cTTH is based on the frequency of occurrence: **fTTH** refers to headaches that have occurred **at least ten times**, but there are **less than 180 headache days per year**; **cTTH** refers to headaches that occur **at least on 15 days a month for more than three consecutive months or on more than 180 days a year**. (11)

4. Causes/Factors of TTH

4.1. Borgeat et al. (9) - Muscle Contraction and Headache

Based on 20 subjects, Borgeat et al. showed that arbitrary **tensing/bracing of the frontal muscles** can **trigger headaches**. The authors used for this study, a group with a headache (headache group) and one with no headache (control group). The subjects stressed the frontal muscles for **two or five minutes** by tensing these muscles. Biofeedback was used for this purpose. The **headache group showed a stronger increase in pain** than the control group. (9)

4.2. Rains et al. (3) - Sleep Disorders

According to Rains et al., sleep disorders can worsen or even trigger TTH. According to these authors, wrong **sleeping patterns** are also a **risk factor** for episodic TTH or cTTH. In many cases cTTH occurs as a consequence of **sleep apnea** and **other sleep-related breathing disorders**. (3)

4.3. Jensen and Olesen (10) - Bruxism and TTH

According to the review of De Luca Canto et al., research regarding the correlation of bruxism and TTH or migraine is very rare (only two meaningful studies). However, at least in adults a **correlation is likely**. (4)

Jensen and Olesen found in 58 patients that a **30 min clenching at 10% of the maximum EMG signal lead to tension-type headache**. After this intervention, **within 24 h, 69% of headache patients** and 17% of the control group **developed headache**. (10)

4.4. Schramm et al. (5) - Stress and Headache

A study by Schramm et al., based on the investigation of more than 5000 patients, showed a statistically significant **correlation between stress intensity and frequency of headaches**. This study showed an **increase in the occurrence of headache of 6%** with a stress increase of **10 points** on the **VAS** (visual analogue scale, ranging from 0-100). (5)

4.5. Bera et al. (6) - Psychiatric Conditions and Headache

In **psychiatric disorders**, the **co-morbidity of migraine** and tension-type headache is about **50%** (6).

Bera et al. investigated the co-morbidity of TTH and migraine in 40 patients which suffering from different psychiatric disorders. He evaluated an average of about **60%** on all psychiatric disorders.

Psychiatric disorder	Group A N (%)	Group B N (%)	Group C N (%)	P value of pearson Chi-square test
Any psychiatric disorder	25 (62.5)	24 (60)	9 (22.5)	0.001
Major depressive disorder	15 (37.5)	12 (30)	4 (10)	0.015
Social phobia	7 (17.5)	5 (12.5)	0 (0)	0.018
Suicidality	2 (5)	3 (7.5)	0 (0)	0.23
Panic disorder	6 (15)	5 (12.5)	1 (2.5)	0.14
Agoraphobia	3 (7.5)	2 (5)	0 (0)	0.23
Obsessive compulsive disorder	2 (5)	3 (7.5)	2 (5)	0.85
Generalized anxiety disorder	5 (12.5)	3 (7.5)	2 (5)	0.46

*N is more than 40 due to multiple comorbidities in some patients

This table shows a comparison of psychiatric disorders in connection with the occurrence of migraine (Group A), tension-type headache (Group B) and the control group (Group C)* (Source: Bera et al. 2014) (6)

4.6. Bera et al. (6) - Fibromyalgia

The following figure shows the **coincidence of TTH or migraine and fibromyalgia**. TTH shows values between 35-60%. (7) Fibromyalgia also reveals a high association with mood disturbances and depression. (2)

Study (year)	Type of study	Population	Type of headache	Prevalence of fibromyalgia (%)	Ref.
Peres <i>et al.</i> (2001)	Observational	101 outpatients	Transformed migraine	35.6	[17]
Ifergane <i>et al.</i> (2006)	Observational	94 outpatients	Migraine	22.2	[23]
Schur <i>et al.</i> (2007)	Large-scale population	3982 twin individuals	Tension-type headache	Odds ratio: 5	[31]
Tietjen <i>et al.</i> (2007)	Retrospective	223 outpatients	Migraine	37.21	[24]
de Tommaso <i>et al.</i> (2009)	Observational	217 outpatients	Primary headaches	Migraine (including chronic migraine); 28.47; tension-type headache: 59	[18]
Tietjen <i>et al.</i> (2009)	Observational	1413 outpatients	Migraine	10	[25]
de Tommaso <i>et al.</i> (2011)	Observational	849 outpatients	Primary headaches	Migraine: 17.8; tension-type headache: 35.06	[26]
Le H <i>et al.</i> (2011)	Large-scale population	31,865 twin individuals	Migraine	20	[27]

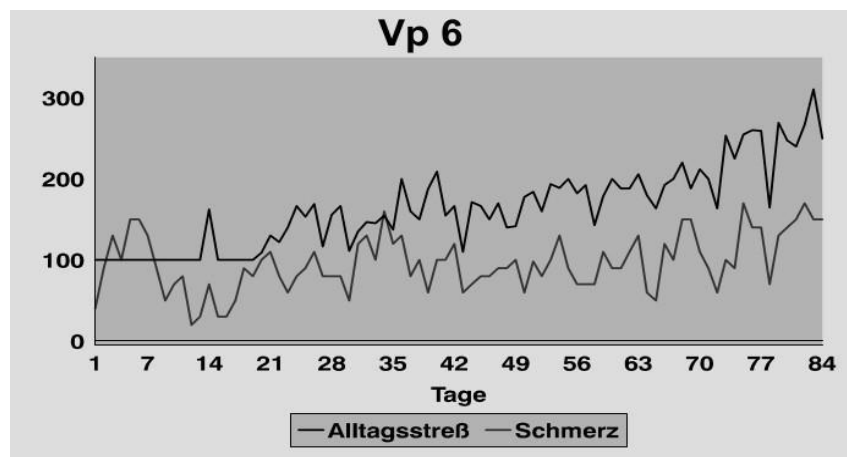
4.7. Psychosocial Factors and TTH

Olsen and Bonica (1990) suggest that psychosocial factors such as **anxiety, depression, stress, sleep, interpersonal relationships, sexual problems, scoliosis** etc. are **associated with TTH or can even cause it**. However, **empirical data** in this area is still very **rare**. (1)

In a three-month diary study (the patients kept a diary), De Benedetti *et al.* (1990) showed that **critical life events** play a certain role in the **onset of chronic headaches**, while **everyday burdens** are primarily involved in the **maintenance of symptoms** (see also: De Benedetti & Lorenzetti, 1992, Fernandez & Sheffield 1996). (13, 14)

In a longitudinal study, Harald *et al.* investigated the relationship between headache symptoms, subjective well-being, everyday stress, mood and emotional inhibition in 31 patients suffering from migraine and chronic tension-type headache. This study was conducted for a period of 84 days. They found **relationships between the variables stress and headache**. Whenever stress occurred, the headaches increase.

The following figure shows this relationship for one patient. The extent of everyday stress (Alltagsstress) and pain (Schmerzen) are shown in chronological order.



This figure shows the course of the time series for daily stress and headache pain in a subject

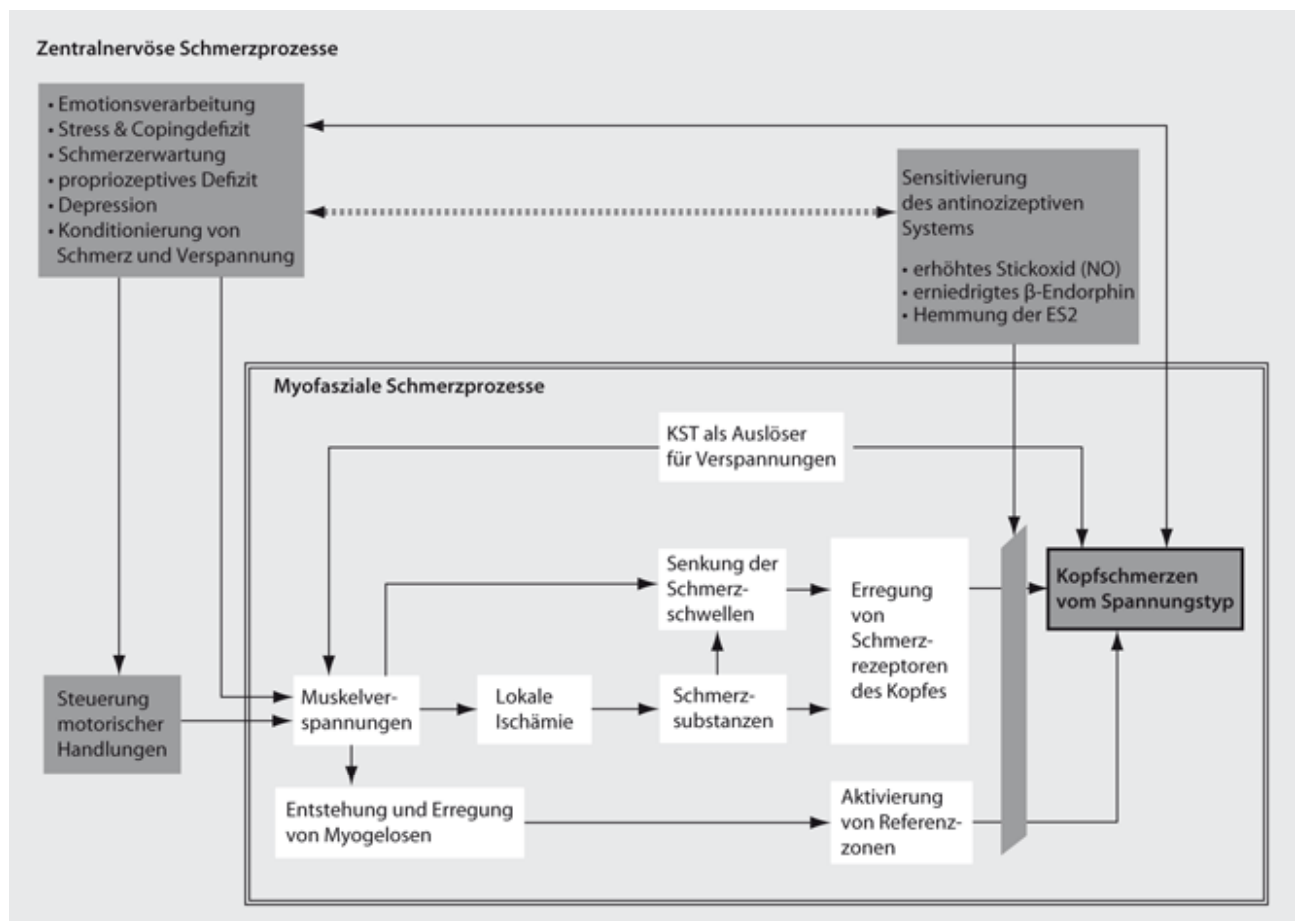
In patient interviews, **60-70% are naming stress as a trigger factor** for their headache (Scharff et al., 1995; Fernandez & Sheffield, 1996). (15)

4.8. Psychogenic Models and TTH

Psychogenic models attempt to integrate factors like **classical conditioning**, **operant reinforcement** of pain behaviors etc. into the pathogenesis of headache. These factors lead to an **increased usage of head muscles**. (8) However, these models are very complex and are therefore not covered in this chapter.

5. Model for TTH

The following figure shows a diagram from Bischoff (7) for tension-type headache. **Emotion processing, stress, coping deficits, pain expectation, proprioceptive deficit, depression or a conditioning of pain and tension is leading to muscle tension.** This **elevation of tension** in the affected muscles results in **local ischemia**. Ischemia in turn is leading to **insufficient supply of oxygen**. Due to this **lack of oxygen, pain receptors are activated**, which is **perceived as tension-type headache**. Headache or pain in turn are influencing the triggering factors. (7)



(Source: Bischoff 2011) (7)

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XVI.

Treatment of tension-type headache (TTH) with acupuncture – an overview of studies

Conclusion and summary of this chapter:

The „Evidence Map of Acupuncture“ published by the DVA (2014) forms the basis for this chapter (1.). According to this review, migraine, tension-type headache (TTH) and chronic pain are the three indicators for which a certain positive effect was detected (1.). In this chapter the focus is on tension-type headaches.

Acupuncture compared to routine care treatment (about 670 probands included):

Acupuncture showed better results (by about 40%) compared to routine care treatment (3.). Based on this data, two facts can be concluded. Acupuncture has a high efficacy. The reduction of headache days in the two studies (Melchart et al. and Jena et al.; 3.) was very similar, somewhere around 40%. "Routine care treatments" showed nearly no effect at all.

In studies, which compare acupuncture to sham treatment, two different methods are used. On the one hand, there are non-invasive methods (for example with Streitberger and Kleinhenz placebo needles" (4.1.1.), on the other, there are skin penetrating methods at „non acupuncture points“.

Non penetrating placebo studies (about 110 probands included) (4.1.)

In those studies the skin was not penetrated in the placebo groups. In my opinion, the „Streitberger and Kleinhenz placebo needles“ is a good method for patient blinding (4.1.1). Both „non penetrating placebo studies“ showed no significant difference between the verum and the placebo group (4.1.), which indicates that the blinding is working. Those studies, however, included only 110 patients. A larger number of cases would increase the validity of „non penetrating placebo studies“.

The study by Karst et al. showed lower treatment success than the other studies mentioned in this chapter. I could not find any explanation for this. In this study, a correlation between the severity of depression and the response to acupuncture was found. The more severe the depression of a patient was, the lower was the response to acupuncture. (4.1.1.) According to the chapter „Psychological Factors and Acupuncture“ this make sense. Depressed patients are not particularly susceptible to placebo effects.

„Non penetrating placebo studies“ are the best method to assess verum and placebo effects, but three-armed studies would have even better expressiveness (compare chapter: „Psychological Factors and Acupuncture“). Collectively, in those „non penetrating placebo studies“ all effects are placebo effects. No verum effect was found. But the observed effects are not marginal, they are in the vicinity of 40%.

"Non-acupuncture points" studies (about 710 subjects included)

The study designs from Endres et al. and Melchart et al allowed variable points selection, based on TCM diagnosis, at least within certain limits. The placebo group was treated at non-acupuncture areas with max. 3-mm depth.

In the study by Melchart et al. a waiting list was included as well. In this study, after a three month period, the verum group showed a 43%, the placebo group a 39%, and the waiting list a 6% reduction in headache days. Therefore, 6% of the reduction is based on spontaneous changes, etc. About 10% of the effect stems from verum-effects, while about 90% of the effect is coming from placebo-effects.

The study of Endres et al. showed similar results. In this study, no control group was integrated. Therefore, spontaneous changes etc. could not be evaluated. The verum group showed a 56%, the placebo group a 45%, reduction.

To sum it up, treatment with needle acupuncture can cause a reduction of headache days of 50%, or even more. Those are strong effects. Compared to routine care (analgesic,..) acupuncture is far superior. The logical conclusion is that medicine should be concerned about the effectiveness of „routine care treatments". Their low effectiveness is definitely not acceptable.

In all groups there are still too few studies to obtain a funnel plot (compared to routine care, „non-penetration-“and „penetrating-placebo acupuncture“). Particularly, in the „non-penetrating-placebo-acupuncture“there are still not enough patients included.

But overall, the data shows a very consistent image. The effect of verum acupuncture treatment is in the range of 0-10%. 0% verum effect, if the 10% verum effect in „penetrating placebo studies“ is caused by inadequate blinding of patients, meaning that those are not verum effects after all. 10% verum effect could be attributed to the treatment. The truth probably lies somewhere in between. Nevertheless, the verum effect is definitely minimal.

In PubMed 2 studies are available, where headache was treated with laser acupuncture. 72 patients were included (5.), 22 of them children (5.2.). One study (50 adult patients (5.1.)) showed a 75% reduction in headache days after one months. The placebo group only showed a 10% reduction. On days, suffering from headaches, the patients had 50% less pain.

In the study with the children, the headache attacks declined until the 5th week by more than 70% (placebo group about 20%). The pain intensity was reduced by about 30-40%.

Both studies showed huge reductions of about the same magnitude. The placebo response in both studies was very low, in the range of 10-20%. In my opinion, there are two possible explanations: laser acupuncture does not show high placebo efficacy due to its non-invasiveness, or, patients recognize the blinding (the chapter „De-Qi Sensation and Acupuncture“ shows that this is unlikely).

Why does laser acupuncture produce such enormous effects? There are two logical possibilities: Either those two studies are not representative, or, laser acupuncture is more effective. If the second assumption is true, one explanation (for me the most plausible) could be the higher effectiveness of laser acupuncture for solving “trigger points”.

In the future, more studies should be conducted with a verum-, a placebo- and a control group. A good blinding method for patients and the therapist is also necessary.

In my opinion, there is huge improvement potential for headache therapies. Science should not rigidly be based on currently used acupuncture needle procedures. According to these studies, different TCM acupuncture treatment schemes don't improve treatment effects. Rather, the known physiological bases should be factored in, and new treatments should be developed.

Questions for studies to answer could be: Is it enough to treat Ah-Shi points (trigger points) only? Does laser acupuncture actually have such strong verum effects? What are good coping strategies for patients? Et cetera.

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1. Meta-analyses of acupuncture and tension-type-headache

According to the "**Evidence Map of Acupuncture**" of the **Department of Veterans Affairs (DVA) in 2014**, headache is one of the **only three indications**, for which a **certain positive effect** of acupuncture is **proven by meta-analyses**. The other two are **migraine and chronic pain**. (1)

One of the main reviews that influenced the "evidence map of acupuncture, is the Cochrane review of Linde et al. (2009). (6) This work will be presented briefly in the following lines and a closer look will be taken on studies, involved in this work.

2. Cochrane review of Linde 2009

Investigations by Linde et al. include publications in PubMed up to April 2008. **Ultimately 11 studies** met the inclusion criteria: Ahonen 1984; Carlsson 1990; Tavola 1992; White 1996; Wylie 1997; Endres 2007; Jena 2008; Karst 2001; Melchart 2005; Söderberg 2006; White 2000.

Altogether **2317 people** (median 62, range 10 to 1265) were included in those studies (11 publications).

In one of those studies, acupuncture was compared to normal routine care treatments (Jena 2008). One study compared acupuncture with conventional acute headache treatment (Melchart 2005). **Six studies compared verum acupuncture to a sham-acupuncture group. Three** of these six studies used "**non-acupuncture points**" for sham acupuncture (Endres 2007; Melchart 2005; Tavola 1992). **Three studies** used "**non-skin-penetrating techniques**" (Karst 2001; White, 1996; White 2000). Six studies compared acupuncture to physiotherapy, relaxation techniques and a combination of massage and relaxation (Endres 2007; Melchart 2005; Tavola 1992; Karst 2001; White 1996; White 2000).

3. Melchart et al. (3), Jena et al. (6) - Comparisons between acupuncture and routine care treatment of acute headaches

The study by Melchart et al. included **118**, those of Jena et al. **553, people**. In the study from Melchart the mean frequency of headaches was **17.6 days at baseline**. In the one from Jena it was **7.0 days**.

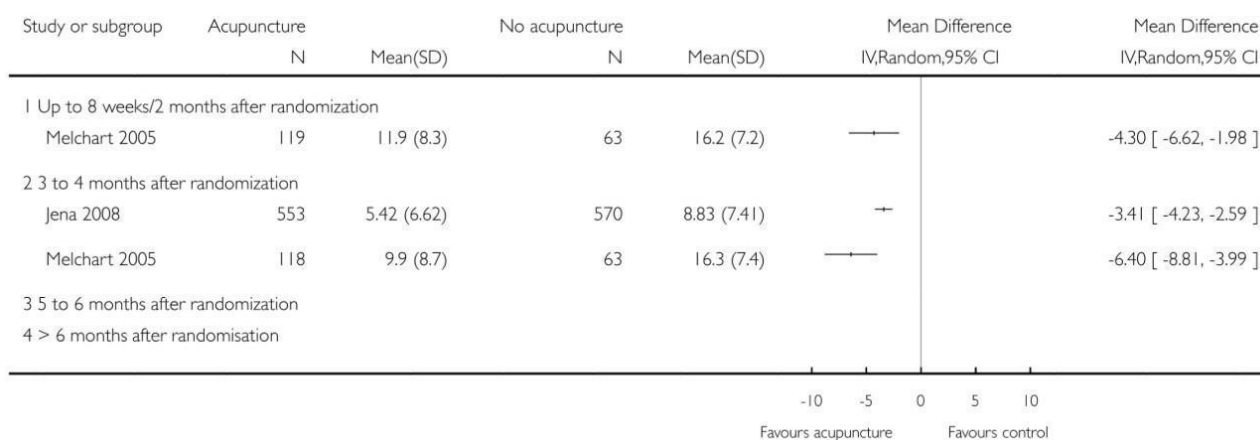
After 2-4 months: In the study of Jena the subjects in the acupuncture group had, on average, **5.42** headache days per month, the control group had **8.83**. The difference is **3.41 days (baseline 7 days)**. In the study of Melchart, the subjects in the acupuncture group had, on average, **9.9** headache days per month, in the control group **16.3**. The difference is **6.4 days (baseline 17.6 days)**. The intensity of headaches also decreased a little. In Jena **0.63** and Melchart **1.08**, measured on the VAS (visual analogue scale).

The following two figures show the outcome (number of headache days and headache intensity) of the studies from Melchart and Jena.

Review: Acupuncture for tension-type headache

Comparison: 1 Acupuncture vs. no acupuncture

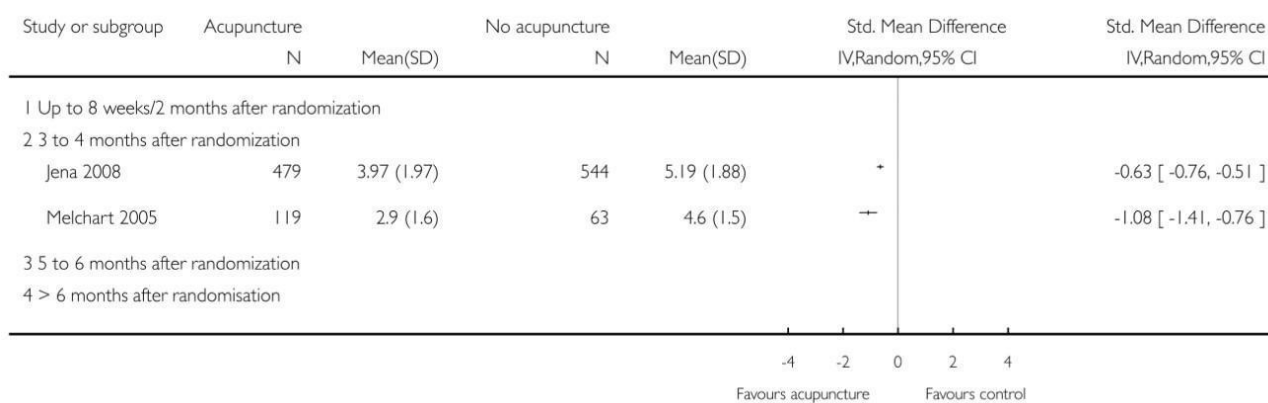
Outcome: 2 Number of headache days



Review: Acupuncture for tension-type headache

Comparison: 1 Acupuncture vs. no acupuncture

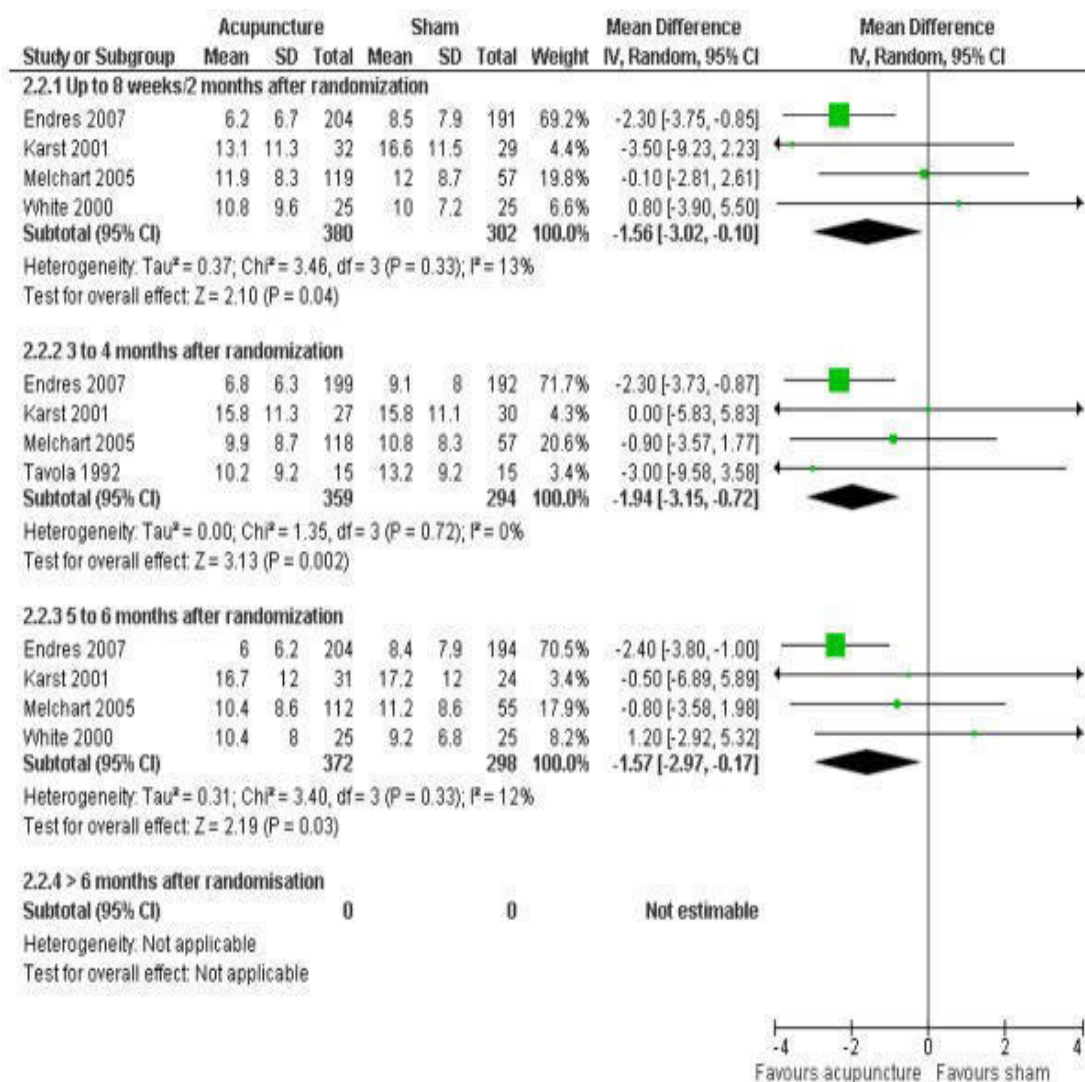
Outcome: 3 Headache intensity



4. Comparisons between acupuncture and sham treatment

Linde et al. included 6 studies for the comparison between acupuncture and sham treatment. Out of these six, three studies used "**non-acupuncture points**" for sham acupuncture (Endres 2007; Melchart 2005; Tavola 1992). Also, three studies used "**non-skin-penetrating techniques**" (Karst 2001; White 1996; White 2000).

The following figure shows the effect of the different studies after two, four, and six months. Positive effects are shown on the left of the zero line, negative effects on the right. The size of the mark indicates the study size.



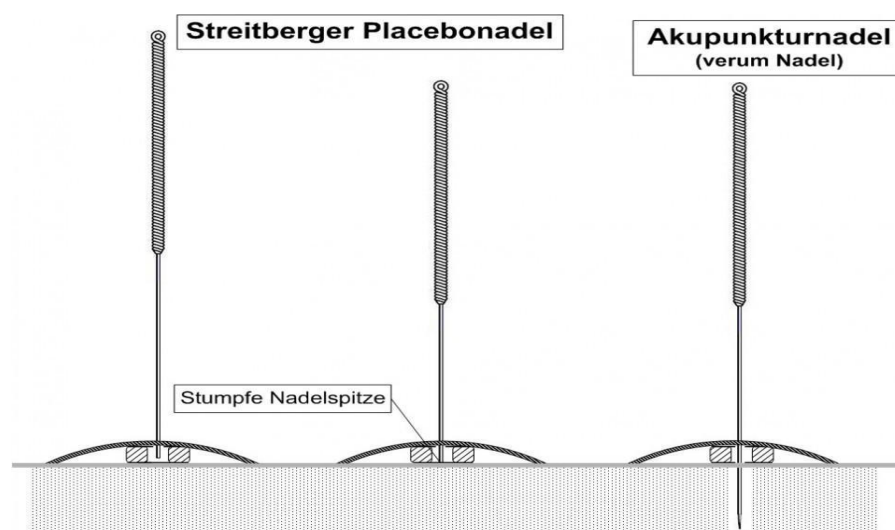
4.1. "Non-skin-penetrating technique" studies

4.1.1. Study from Karst et al. (12) – Streitberger and Kleinhenz placebo needle

In the study by Karst et al. **69 subjects** with episodic or chronic TTH were included. As usual in such studies, the **pain intensity** was based on the **VAS**. Also the **duration of headache attacks** and the daily consumption of analgesics was measured.

In the placebo group they used a "**Streitberger and Kleinhenz placebo needle**". To the patient it looks like the needle is piercing his skin when using this type of needle, but the **needle actually retracts into the handle holder**. So the **needle does not penetrate the skin**, it only touches the skin. Of course, only a blinding of the patients, and not the therapist, is possible with this method.

The following figure shows the principle of the Streitberger needle.



(Source: www.acupunctureworld.de)

Patients received a total of 10 treatments, 2 per week. As **fixed points** GB20, LI4 and LR3 were selected. **Depending on the symptoms**, the acupuncturists would choose one of the following points: GB8, GB14, GB21, GB41, UB2, UB10, UB60, LU7, TW5, ST8, ST36, ST44, DU20. A maximum of 15 needles were inserted. The needles were left for 30 minutes.

The **pain reduction measured on the VAS scale was relatively low, in contrast to the other studies presented** in this chapter. In the beginning of the study the patients had, **in the verum as well as in the placebo group, an average of 6.4 VAS**. This value was **reduced** in the following measurements by an average of about 2 VAS. There was **no significant difference between the placebo and the verum group**. The authors also measured the **Zerssen Depression Score (DS)**, which measures the degree of depression. According to the authors, there is a **correlation between the severity of depression and the response to acupuncture**. **More depressed patients showed less response to acupuncture**.

The following figure shows the results of this study. Follow-up 1, last day of treatment; follow-up 2, 6 weeks after treatment; follow-up 3, 5 months after treatment.

Follow-up	Placebo				Verum			
	Baseline	1	2	3	Baseline	1	2	3
Frequency per month (days)	20.5 (10.3)	16.6 (11.5)	15.8 (11.1)	17.2 (12.0)	21.1 (10.2)	13.1 (11.3)	15.8 (11.3)	16.7 (12.0)
VAS	6.4 (1.9)	4.4 (2.5)	4.1 (2.7)	4.8 (3.1)	6.4 (2.0)	4.4 (2.4)	4.3 (2.4)	4.4 (2.2)
Mean VAS	4.4 (1.3)	3.9 (1.7)	4.6 (1.7)	–	4.6 (1.8)	4.3 (2.0)	4.0 (1.9)	–
Analgesics per month	15.6 (32.4)	13.9 (41.4)	26.0 (74.0)	–	9.0 (11.1)	6.4 (9.9)	5.3 (9.0)	–
D-S	9.0 (5.7)	6.6 (5.0)	6.9 (5.6)	–	9.0 (8.3)	6.4 (5.0)	5.3 (4.6)	–
FQCI 1	2.4 (0.7)	2.0 (0.7)	2.0 (0.8)	–	2.1 (0.7)	2.1 (0.7)	1.9 (0.7)	–
FQCI 5	2.5 (0.8)	2.1 (0.7)	2.2 (0.8)	–	2.1 (0.9)	2.0 (0.8)	2.1 (0.8)	–
					Z = -2.125 P = 0.034			
CGI	–	1.1 (1.5)	1.3 (1.6)	0.7 (0.9)	–	1.7 (1.3)	1.4 (1.4)	0.9 (1.5)
						Z = -2.086 P = 0.037		
NHP	28.6 (5.7)	31.4 (6.4)	31.4 (5.4)	–	29.9 (7.2)	33.1 (4.9)	34.1 (4.5)	–
							Z = -2.174 P = 0.030	
ELQ	116.1 (23.8)	128.3 (21.7)	127.8 (23.7)	–	114.7 (25.0)	132.1 (18.7)	132.1 (20.6)	–
LS	5.2 (2.6)	6.4 (2.2)	6.5 (2.2)	–	5.6 (2.2)	6.5 (1.8)	6.6 (2.0)	–

D-S, von Zerssen Depression Scale, range 0–48; FQCI 1, Freiburg Questionnaire of Coping with Illness, subscale depression, range 1–5; FQCI 5, Freiburg Questionnaire of Coping with Illness, subscale wishful thinking, range 1–5; CGI, Clinical Global Impressions, range -4 to +4; NHP, Nottingham Health Profile, range 0–38; ELQ, Everyday-Life-Questionnaire, range 0–168; LS, Life Quality Scale, range 0–10.

4.1.2. White et al. (2000) - Acupuncture for episodic tension-type headache: a randomized controlled trial

No full article was available from this study (2000). Even the abstract contained **very little information**. For the study from White et al. 1996 not even an abstract was available.

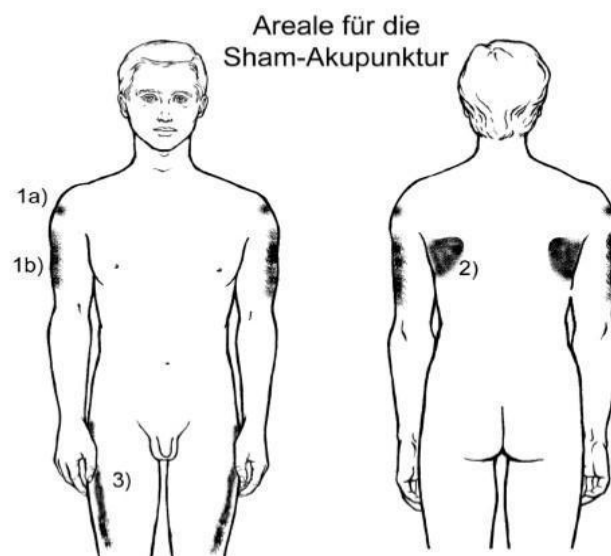
Fifty subjects were allocated to, either acupuncture, or, sham acupuncture (non-penetrating). The follow up period was 3 months. There was **no significant difference between those two groups for any of the measurements at any point in time**. The authors concluded that the patient blinding was successful.

4.2. "Non-acupuncture point" studies

4.2.1. Endres et al. 2007 (4, 5) - the nationwide, randomized, controlled German acupuncture trials on migraine and tension-type headache

The study of Endres et al. included 209 subjects in the treatment group, and 200 in the placebo group. With a total of 409 subjects, that is the largest study in this field.

The placebo needles were applied superficially (maximum 3-mm depth) at „non acupuncture points“. The „placebo areas“ can be seen in the following figure. According to the authors, this placebo treatment should better be defined as "minimal acupuncture" or "invasive sham acupuncture".



The acupuncture was carried out according to the following diagnosis (this is identical to that of Wancure and König): Shao Yang, Tai Yang, Yang Ming, Jue Yin (see Figure 2) and 10 important TCM syndrome patterns: Liver Qi Stagnation, Liver Blood Stagnation, Liver Yang Rising, Liver Fire Rising, Liver Wind Rising, Phlegm Retention, Spleen Qi Deficiency, Liver Blood Deficiency, Kidney Yin Deficiency, and Kidney Yang Deficiency.

Even a prick of AH-Shi points was possible.

Acupuncture category

Obligatory points

Selection according to the painful area

Ah-Shi

Regions of the head according to channels

1. Shao Yang (TW–GB)
2. Yang Ming (LI–ST)
3. Tai Yang (SI–BL)
4. Jue Yin (PC–LR)

Internal level Chinese syndrome

5. Liver Qi Stagnation
6. Liver Yang Rising
7. Liver Fire Rising
8. Phlegm Retention
9. Spleen Qi Deficiency
10. Liver Blood Deficiency
11. Kidney Yin Deficiency
12. Kidney Yang Deficiency

Symptomatic points

13. Neck and cervical spine
14. Nausea
15. Muscular tension

GV 20, LI 4, LR 3 (or LR 2), GB 20 (or BL 10)

0–4 Ah-Shi points

GB 14, GB 8, GB 20, Taiyang, TW 5, GB 41
ST 8, Yintang, GV 23, LI 4, ST 44
BL 2, BL 10, GV 16, GV 14, SI 3, BL 60, LU 7
GV 20, Sishencong, LR 3, PC 6

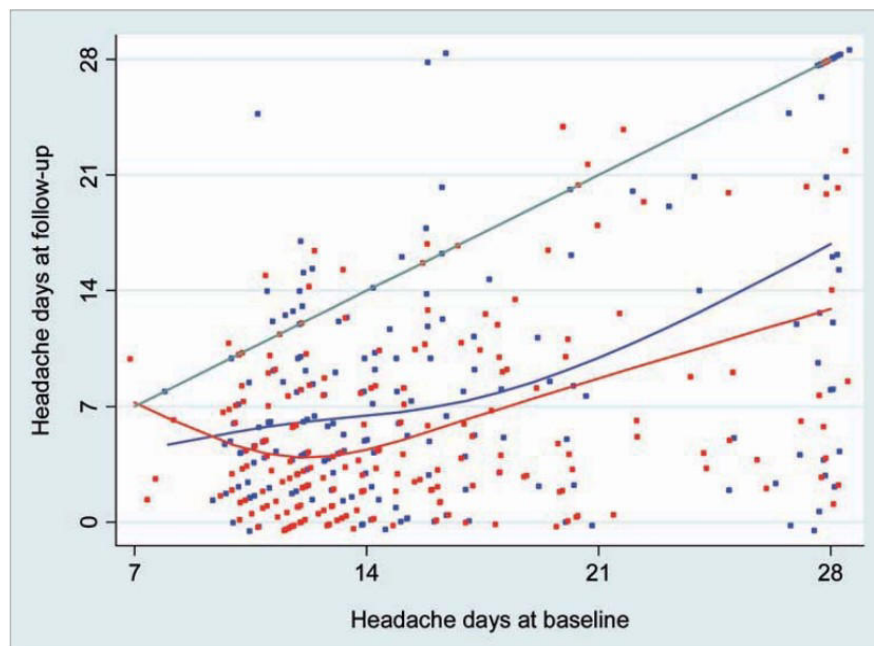
LR 3, BL 18, GB 34, CV 17
LR 3, GB 41, GB 34
LR 2, GB 38, ST 44, GB 41
ST 40, CV 12, BL 20, SP 3, SP 9
ST 36, SP 6, CV 6
SP 10, LR 8, CV 14
CV 4, KI 7, SP 6
KI 3, BL 23

GB 21
PC 6
GB 34

Although patients were **suffering from headache for 11.5 years on average**, **50-65% of patients experienced a reduction in headache days by more than 50%**.

Acupuncture was slightly better than sham treatment. The treatment groups had at baseline **15.6** headache days on average and **after three months treatment 6.8 (8.8 difference, 56% reduction)**. The sham group had at baseline, **16.4**, and after 3 months of treatment **9.1 (7.3 difference, 45% reduction)**. The **intensity of headaches changed only slightly in both groups**.

The authors are giving the following interpretation of the data. The **response** of both groups to the treatment is **very strong**. Acupuncture and sham acupuncture are **invasive methods**, therefore they have big psychological effects. Therefore acupuncture has an even stronger effect than, for example, a tablet. This interpretation is supported by a study from Kaptchuk et al. (13).



The following figure shows the frequency of headaches at baseline and after six months. The two bent lines are curved regression lines. The red line represents the verum, the blue one represents the sham group.

	Baseline		6 weeks		Difference between groups (95% CI; p value)	3 months		Difference between groups (95% CI; p value)	6 months		Difference between groups (95% CI; p value)
	Verum	Sham	Verum	Sham		Verum	Sham		Verum	Sham	
Number of patients	209	200	209	200		209	200		209	200	
>50% reduction of headache days/4 weeks ^a			138/204 (68%)	106/191 (55%)	12% [3%; 22%] p=0.013	119/199 (60%)	91/192 (47%)	12% [3%; 22%] p=0.014	135/204 (66%)	106/194 (55%)	12% [2%; 21%] p=0.024
Headache days/4 weeks ^a	15.6 (5.3)	16.4 (6.1)	n=204, 6.2 (6.7)	n=191, 8.5 (7.9)	1.86 [0.59; 3.14] p=0.004	n=199, 6.8 (6.3)	n=192, 9.1 (8.0)	1.80 [0.58; 3.02] p=0.004	n=204, 6.0 (6.2)	n=194, 8.4 (7.9)	1.94 [0.69; 3.18] p=0.002
Pain intensity ^c	68.3 (12.1)	67.5 (12.5)				n=198, 57.6 (17.2)	n=191, 60.0 (16.3)	2.58 [-0.75; 5.91] p=0.13	n=204, 53.5 (18.4)	n=194, 56.7 (19.6)	3.24 [-0.51; 6.99] p=0.09

4.2.2. Melchart et al. (3) - Acupuncture in patients with tension-type headache - randomised controlled trial.

In the study of Melchart et al. **270 subjects** with eTTH or cTTH participated. A verum group was formed, as well as a **minimal acupuncture group** (superficial needling at non-acupuncture points), and a control group. Patients received 12 treatments, 30 minutes each.

The following figure shows the pattern of the acupuncture treatments. In the verum group **three basis points** were applied by every therapist. Depending on the symptoms they could also select "optional points".

Box 1: Acupuncture points used in the trial

All physicians used sterile, disposable, single use needles but were free in their choice of length and diameter of needle

Basic points

- Gall bladder (GB) 20
- GB 21
- Liver (LIV) 3

Optional points

- Mainly frontal headache: large intestine (LI) 4, Du Mai (DU) 23, extra points Yintang and Taiyang, stomach (ST) 44, GB 2
- Headache mainly in the vertex: DU 20 or 23, extra point Si Shen Cong
- Mainly neck pain: bladder (BL) 10, 60, or 62; DU 14 or 19; small intestine (SI) 3 or 6
- Holocephalic pain with fatigue: extra point Taiyang, spleen (SP) 6 or 9, ST 36 or 40, Ren Mai (REN) 12
- Worse with wet or cold weather: LI 4, DU 14, GB 3, Sanjiao (SJ) 6, GB 39
- Modalities wind, dampness, cold: LI 4, DU 14, SJ 6, GB 34
- Modalities cold, wind: LI 4, lung (LU) 7, SJ 5, DU 14

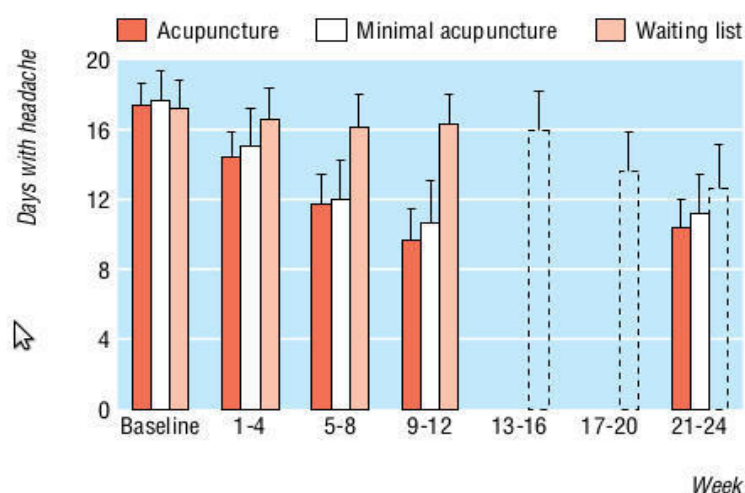
The following figure shows the location of the Sham acupuncture points.

Box 2: Minimal acupuncture points used in the trial

- "Deltoideus"—in the middle of the line insertion of M deltoideus (LI 14) and acromion
- "Upper arm"—2 cun laterally of LU 3
- "Forearm"—1 cun ulnar of the proximal third of the line between heart (HE) 3 and HE 7
- "Scapula"—1 cun laterally of the lower scapular edge
- "Spina iliaca"—2 cun above spina iliaca anterior superior in vertical line to the arch of left ribs
- "Back I"—5 cun laterally of the spine of lumbar vertebra IV
- "Back II"—5 cun laterally of the spine of lumbar vertebra V
- "Upper leg I"—6 cun above the upper edge of the patella (between the spleen and stomach meridians)
- "Upper leg II"—4 cun above the upper edge of the patella
- "Upper leg III"—2 cun dorsally of GB 31 (avoiding bladder meridian)

A cun is defined according to the rules of traditional acupuncture as the width of the interphalangeal joint of the patient's thumb

The following figure shows the effect of acupuncture compared to waiting list. The **initial values were just over 17**. Over a three-month period a reduction to **9.9 was measured** in the verum (**baseline 17.5, 43% reduction**) and **10.8** (**baseline 17.7, 39% reduction**) in the minimal acupuncture group (**waiting list: 16.3, baseline 17.3, 6% reduction**).



The following table shows the days with headache, hours with headache, headache score, days with more than mild headache, and days with analgesic drugs.

Outcome	Acupuncture		Minimal acupuncture		Waiting list		Acupuncture v minimal acupuncture		Acupuncture v waiting list	
	No	Mean (SD)	No	Mean (SD)	No	Mean (SD)	Difference* (95% CI)	P value†	Difference* (95% CI)	P value†
Headache diary weeks 9-12										
Days with headache	118	9.9 (8.7)	57	10.8 (8.3)	63	16.3 (7.4)	-0.6 (-2.4 to 1.2)	0.51	-5.8 (-7.6 to -4.0)	<0.001
Hours with headache	118	88 (128)	57	111 (162)	63	164 (145)	-8 (-33 to 17)	0.51	-48 (-72 to -23)	<0.001
Headache score‡	118	15.8 (15.3)	57	17.2 (14.4)	63	26.4 (14.3)	-0.8 (-4.4 to 2.7)	0.64	-10.9 (-14.3 to -7.4)	<0.001
Days with more than mild headache	118	4.8 (6.2)	57	4.6 (5.3)	63	8.4 (6.8)	0.3 (-1.2 to 1.8)	0.68	-4.0 (-5.4 to -2.6)	<0.001
Days with analgesic drugs	117	1.9 (2.9)	57	2.6 (2.6)	63	4.4 (4.1)	-0.6 (-1.4 to 0.2)	0.12	-2.3 (-3.1 to -1.6)	<0.001

4.2.3. Tavolta et al. (2) – Traditional Chinese acupuncture in tension-type headache: a controlled study

The study of Tavolta et al. involved thirty patients. A verum acupuncture group was compared to a sham acupuncture group. Intensity, duration and frequency of headache pain episodes, headache index, and analgesic intake were measured. The sham group was treated on non-acupuncture points. This study too found a significant reduction on headache days, especially in the frequency of headaches. However, **there was no significant difference between the verum and the sham groups**.

5. Laser acupuncture for TTH

In the following lines two studies will be presented owing to their good results. When you type the term “laser acupuncture tension-type headache” into PubMed, these two studies will show up.

5.1. Ebneshahidi et al. 2005 (10) – The effects of laser acupuncture on chronic tension headache

Ebneshahidi et al. investigated the effect of **laser acupuncture on TTH**. They used a laser with a wavelength of 830nm and a power output of 39mW / cm². **50 patients** participated in this study, 25 in the verum, and 25 in the placebo group. In the **placebo group** the laser was not switched on (see chapter „laser needle acupuncture“). Four points were irradiated bilaterally for 43 sec (8 points in total): LU7, LI4, GB14, GB20 (intensity 1.3J (~ 13J / cm²)). In total **10 therapy sessions** were applied, 3 per week.

The following figure shows the results of the treatment in relation to the median pain intensity of VAS. In the first month **the treatment group achieved a 50% reduction in headache days, in contrast to 10% for the placebo group**. In the following two months, the pain scores increased by 1-2 VAS.

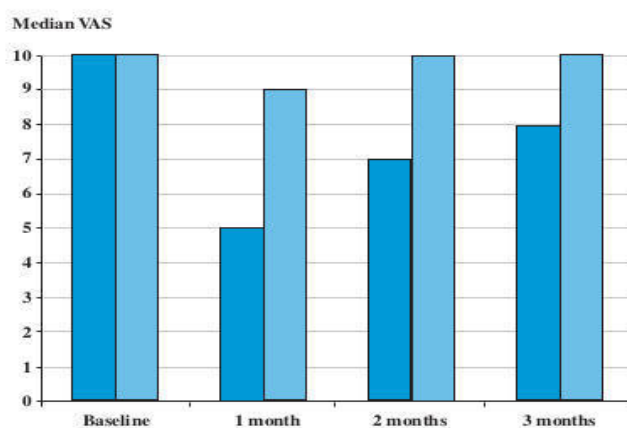
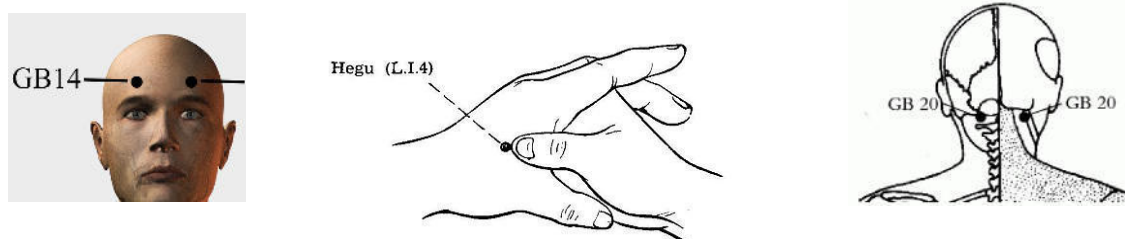


Figure 1 Median headache scores (VAS) reported at different time points by laser and sham laser groups.

The following figure shows that the number of headache days was reduced by 15 days in the treatment group (baseline was 20 days). The **patients had to suffer four times less headache days**, when compared with the baseline. The placebo group showed a slight reduction during the first month (two days). The **duration of headaches decreased significantly in the treatment group**. (10)

Table 2 Median (interquartile range) values for three headache measures at baseline, changes from baseline and comparison between groups

	Group A Active (n=25)	Group B Placebo (n=25)	Difference A-B	P†
VAS				
Baseline	10 (3.0)	10 (1.0)	0	0.1
Changes at 1 month	-5 (3.8)	-1 (2.0)	4	<0.001
Changes at 2 months	-3 (4.0)	0 (1.5)	3	<0.001
Changes at 3 months	-2 (6.3)	0 (0.0)	2	<0.001
Number of days				
Baseline	20 (15.0)	18 (15.0)	2	0.5
Changes at 1 month	-15 (16.5)	-2 (5.0)	13	<0.001
Changes at 2 months	-10 (20.0)	0 (5.0)	10	<0.001
Changes at 3 months	-8 (21.5)	0 (0.0)	8	<0.001
Duration (hours)				
Baseline	10 (4.0)	8 (4.5)	2	0.02
Changes at 1 month	-6 (4.5)	-1 (2.0)	5	<0.001
Changes at 2 months	-4 (6.0)	0 (0.5)	4	<0.001
Changes at 3 months	-4 (7.5)	0 (0.0)	4	<0.001

† Wilcoxon's test

5.2. Gottschling et al. (11) – Laser acupuncture in children with headache

Gottschling et al. investigated the effect of **laser acupuncture** on **migraine or TTH** by treating **22 children**. The patients suffer on headache on average for more than 12 months. They treated the subjects **4 times a week over a one month period**. The placebo group was treated using the same principle, however, **the laser acupuncture needles were not turned on**.

The laser used was a schwa-medico Modulas phone 2/99, 30 mW, 830 nm, continuous wave, power density 3.8 W / cm².

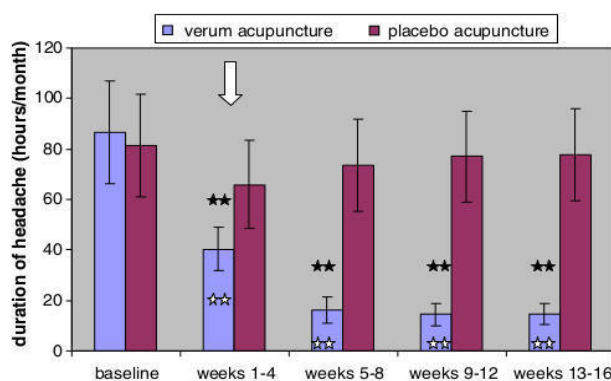
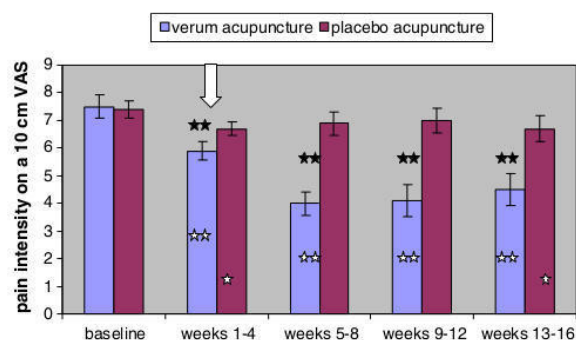
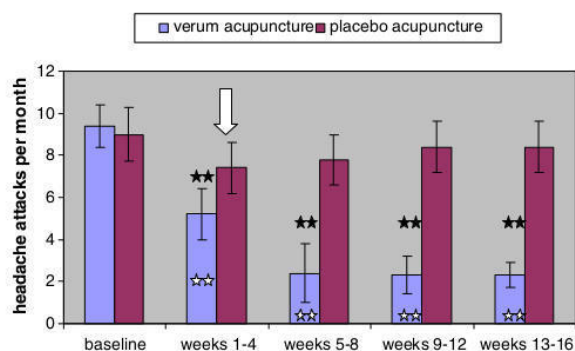
The patients were treated by 3 experienced acupuncturists.

As basis points they used LI 4, St 36, 3H 5 Gb and 34 at.

For patients with occipital headaches: SI 3 and B 60 **For patients with holo-cephalic pain:** Du Mai 20.

Additionally the acupuncturists could **also use Ah-Shi points**. The laser was applied for **30 seconds** (this corresponds to a total energy of 0.9 J / point).

The following two figures show the number of headache attacks and the pain intensity over a period of 4 months. **The number of headache attacks declined to more than 70% after the 5th week**. In the same period **pain intensity was reduced** by about **30-40%**. In the third figure the duration of headache attacks is shown. The decrease was comparable in proportion to the number of headache attacks. On average this means that the number of headache attacks went down to **less than one third from** what it was initially, and they are **40% less painful** during the treatment period.



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XVII.

Headache – treatment capabilities from the viewpoint of TCM apart from acupuncture

Summary and Conclusion of this Chapter:

The following chapter does not meet scientific criteria but should only provide an overview for the sake of completeness. In this area a scientific overview based on the available data from studies is not possible. For example a search in PubMed for the two terms "herbs and acupuncture" only find two studies that more or less meet scientific criteria. Most images and the main content in this chapter are taken from the website: <http://shen-nong.com/>. Images that are not from this website are cited.

For the treatment of headaches a variety of different approaches are available from the viewpoint of TCM. The most important methods are probably the herbal therapy, acupuncture, and Chinese dietetics, movement patterns such as Qi Gong, Chinese massage and recommendations for lifestyle. According to the TCM, acupuncture is only used for short-term pain relief in the treatment of headaches. The herbal therapy on the other hand should solve the problem on the long-term. A good TCM practitioner would certainly focus on lifestyle, emotional and dietary changes as well. Therefore the treatment of headache exclusively with acupuncture does not make sense according to the TCM.

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1. Herbal Therapies for Headaches

Like all forms of Chinese therapies the herbal therapy is based on the criteria of TCM. In TCM herbal therapies are the basis in the treatment of headaches. However, a close look at the herbal therapy would go beyond the scope of this chapter.

In the following some examples are listed for which herbs could be used depending on the localization of the headache and the respective meridian:

- Back of the head and upper neck (TAY-YANG headache) → Bladder meridian

Herbs: Rhizoma seu Radix Notopterygii Radix Ledebouriellae, Fructus Vitis, Herba Ephedrae

- Front head (YANG-MING headache) → Stomach meridian

Herbs: Radix Puerariae, Radix Angelicae Dahuricae

- Side of the head (SHAO-YANG headache) → Gallbladder meridian

Herbs: Radix Bupleuri, Rhizoma Ligustici Sinensis, Radix Scutellariae

- Crown of the head (JUE-YIN headache) → Liver meridian

Herbs: Fructus Evodiae, Rhizoma Ligustici

- All over the head → Herbs: Rhizoma seu Radix Notopterygii, Radix Ledebouriellae

2. Acupuncture Therapies for Headaches

According to TCM, acupuncture has rapid effects during acute attacks of headaches but should work alongside herbal remedies for more sustainable results.

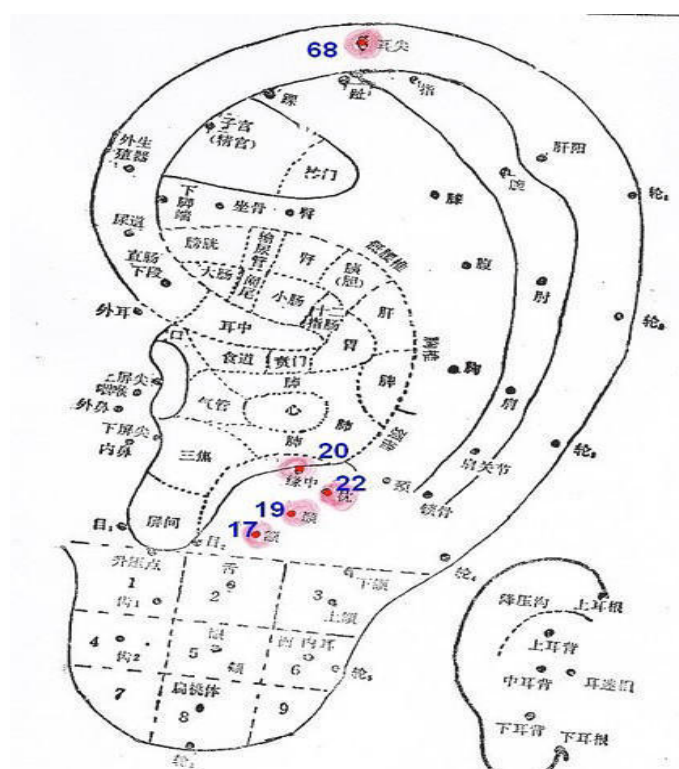
3. Non-medicinal Approaches to Headaches

3.1. Acupressure for Headaches

Acupressure is a non-invasive method for headache therapy in which patients use their fingers in order to influence acupuncture points.

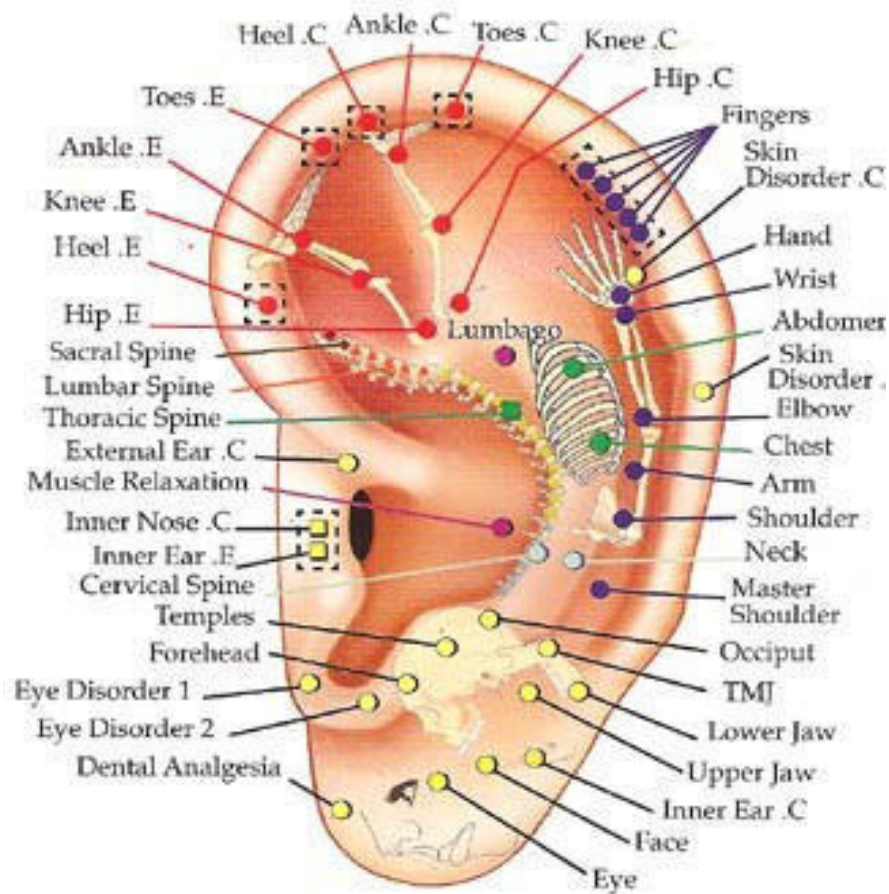
3.2. Auricular Therapy for Headaches

According to the TCM, all areas of the body can be influenced via the ear. This may be used both diagnostically and therapeutically.



(Source: www.shen-nong.com)

Auricular points, which (according to the TCM) relieve headaches in the front (17), occipital (22), on the temple (19), sub cortex (other side of brain point), brain point (20) and ear apex (68).



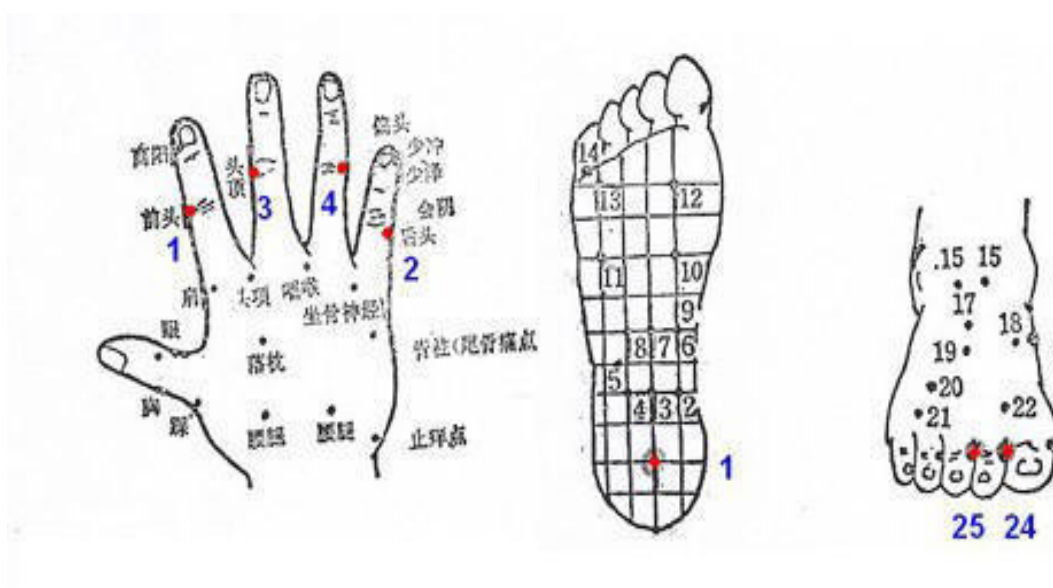
(Source: www.softtouchacu.com)

3.3. Hand and Foot Reflexology for Headaches

Similar to the auricle therapy the entire body can be influenced even at the hands and feet. In order to achieve a good effect they must be strongly stimulated. This can be used for example by acupuncture, massage or moxibustion.

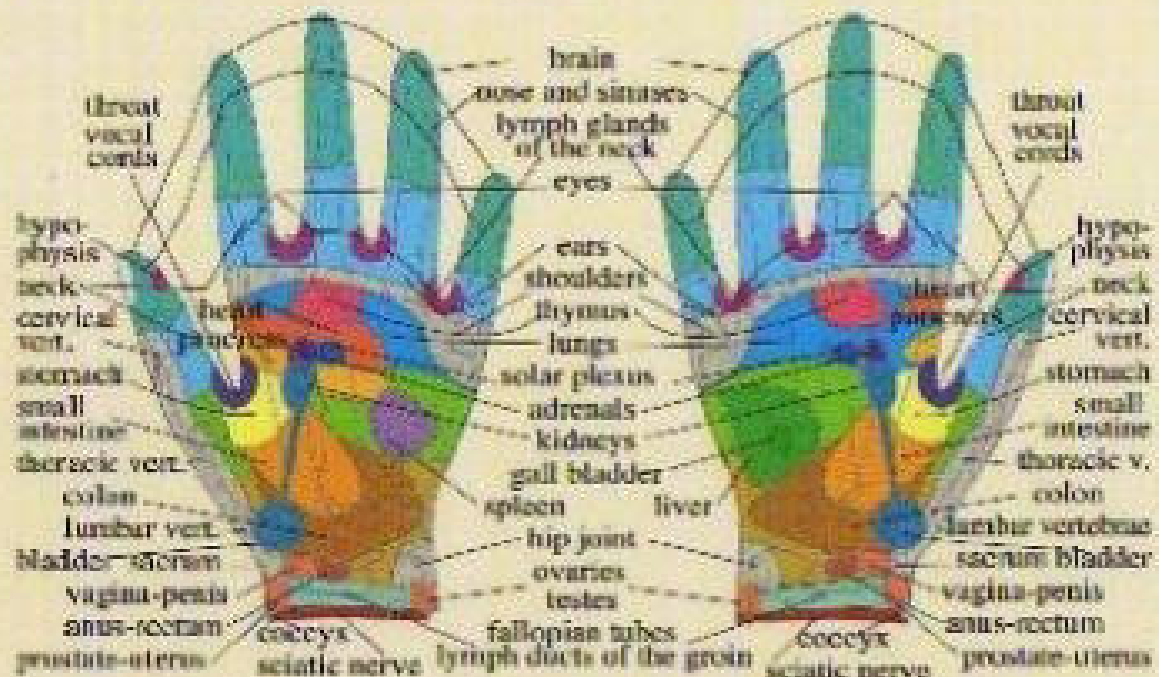
Hand According to TCM, following hand points are recommended for the treatment of headache: anterior headache point (1), posterior headache point (2), crown headache point (3), migraine point (4).

Foot According to TCM, following foot points are recommended for the treatment of headache: Midline of the sole and one thumb-width apart from the edge of heel (1), the web between the big toe and second toe (24), the web between the second toe and third toe (25).



(Source: www.shen-nong.com)

HAND REFLEXOLOGY

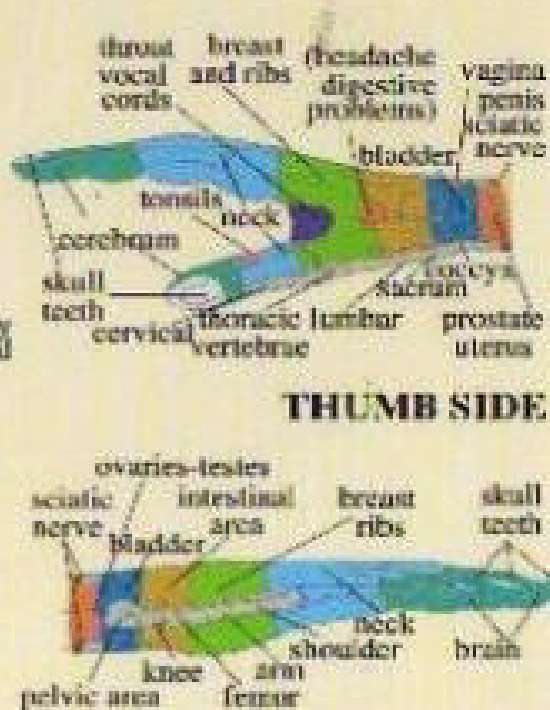


PALM OF LEFT HAND

PALM OF RIGHT HAND



BACK OF LEFT HAND

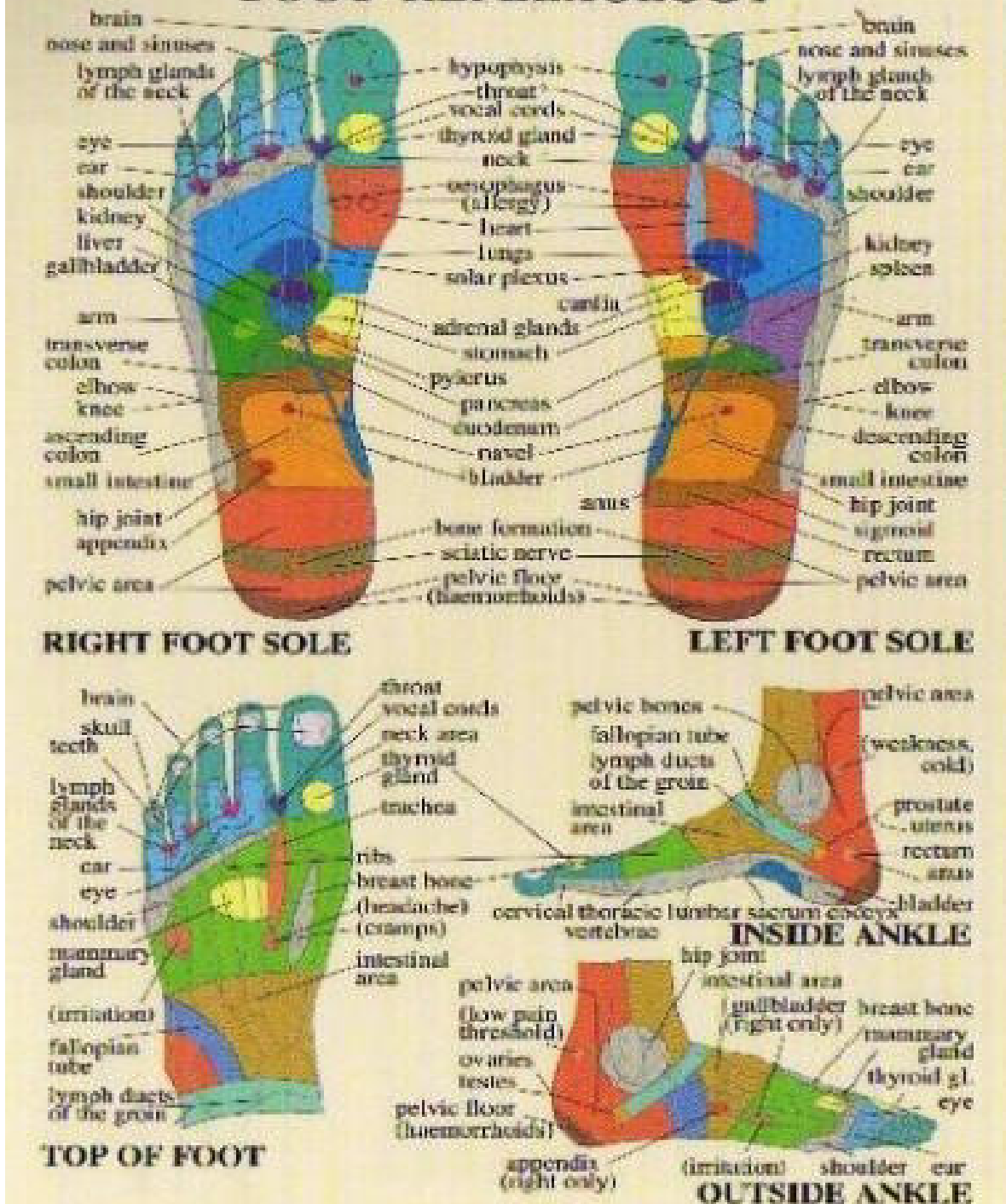


THUMB SIDE

LITTLE FINGER SIDE

(Source: www.shop.acumedic.com)

FOOT REFLEXOLOGY



(Source: www.shop.acumedic.com)

3.4. Cupping Therapy for Headaches

In this type of therapy vacuum is produced inside a cupping glass which is then placed on the selected areas. By the negative pressure of the vacuum the blood circulation is stimulated in the respective skin areas. According to TCM, thereby the flow of blood and Qi should be encouraged.

In the following some examples are given for points which can be used to treat headaches with cupping glasses:

Headaches due to wind-cold: Bl 12), Sj 5

Headaches due to wind-heat: Li 11, Gv 14

Headaches due to liver yang: Ex-Hn 3, Lr 3

Headaches due to turbid phlegm: Cv 12, St 40

Headache due to blood stasis: Bl 17

Headache due to kidney deficiency: Bl 23, Ki 3

3.5. Chinese Health Advice and Food Therapy for Headaches

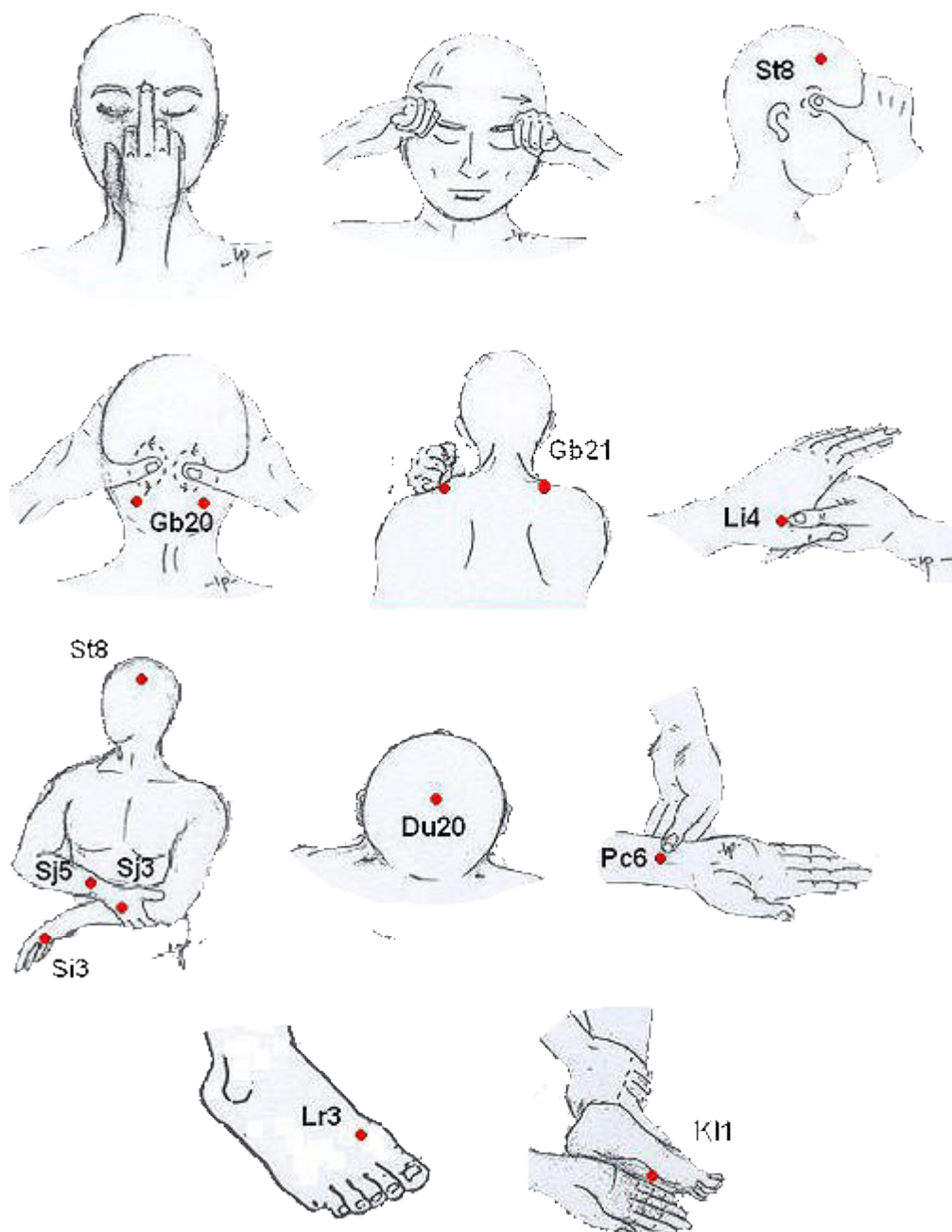
In TCM, there is an important connection between the herbs and the "normal" food. This may be understood by the following sentence: "food and herbs share the same origin" and "diet is linked with healing". The Chinese dietetics is based on the diagnostic scheme of TCM.

On this basis different foods are recommended according to the respective diagnosis. For example, if a physician curated a patient with headache diagnosis wind-cold headaches, he would recommend foods that „activate blood and Qi, relieve headaches, replenish brain marrow and warm the stomach“. A hot/warm soup with herbs in accordance with the following recipe could be recommended in this case: Sichuan lavage (6g), Dahurian angelica root (6g) and a big fish head (about 500g), proper amount of green onion, fresh ginger, salt and pepper..

3.6. Massage to relieve headache

Chinese massage is primarily used in order to treat headaches relating to muscular tension, migraines and flu.

The following figure shows examples of areas that should be treated with massage. The massage can be performed by the patient, the therapist or another person. Massage treatment should be based on TCM diagnosis.



(Source: www.shen-nong.com)

3.7. Qigong/Sport Practice to Alleviate & Prevent Headaches

From the perspective of TCM, slight sporting movement such as jogging, walking or movement patterns such as Qigong or Tai Ji Quan are recommended. Very intense physical activity should be avoided.

3.8. Medicinal hot compress to relieve headaches

In previous China this form of therapy are called "hot ironing therapy". For this, the body is wrapped in a sheath of heat (eventually filled with herbs). Then massage, rub- and pressing-techniques were applied. This method was used especially for strong cold or pathogen and dampness, Qi stagnation, blood stasis and weaken organs.

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XVIII.

Myofascial trigger points / “Muskelverhärtung” / myogelosis / AH-SHI-points and tension-type headache

Conclusion and Summary of this Chapter:

An active trigger point is a spot in the muscle which causes pain under normal atmospheric pressure. Trigger points can be divided into two categories: active and latent. Active trigger points cause sensations of pain even without pressure being applied. Passive trigger points cause pain only with applied pressure (2.).

„AH-SHI points“, which are used for treatment in TCM, have the same physiological basis as trigger points (2.), but also “normal acupuncture points” partly behave like trigger points. Trigger points are important in headaches and they correspond to acupuncture points. Examples for them are: “Gb 21 in the trapezius, Dü 12 in supraspinatus, Dü 11 in the M. infraspinatus, Dü 14 in the levator scapulae, Ma 6 in the masseter muscle, and Ma 8 in M. temporalis. (5.)

Acute overload, overwork fatigue, radiculopathy and gross trauma, as well as indirect stimuli (e.g. stimuli from other trigger points), visceral disease, joint dysfunction, and emotional distress can lead to trigger points. (3.)

The theory behind trigger points is the „theory of the energy crisis“. This energy lack is caused by contraction knots, which narrow capillaries and reduce blood flow in the muscle. This reduction in blood flow leads to a lack of oxygen in the tissue, inducing localized pain by super sensitization of nociceptors (3.).

Trigger points can cause „referred pain“, and the physiological mechanisms for this are located in the spinal cord, the brain stem, the thalamus, and the cerebral cortex. Unfortunately the exact mechanisms are only partially known. (4.)

Chronic tension-type headache (CTTH) is associated with trigger points in the sub occipital muscles, the upper trapezius, sternocleidomastoid, and temporalis muscles. (5.)

People with active trigger points have more frequent and stronger headaches than people with latent trigger points. (5.)

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1. ICD-Classification

Myalgia is the medical term for muscle pain. In the **ICD-10 classification myalgia** is encoded with **M79.1**.

2. What is a trigger point?

A trigger point is a spot in the **muscle which is painful under normal atmospheric pressure**. Furthermore, when you press a trigger point “**referred pain**” can occur. Referred pain means that the pain is not felt at the same location as the trigger point, but instead at a different location. When a trigger point with the same location is irritated in different people, they usually feel the same referred pain patterns. Trigger points can be located in muscles or in fascia, in which case they are called myofascial trigger points. Trigger Points can be felt as a nodular structure, they usually have 2 to 5 mm in diameter. (1)

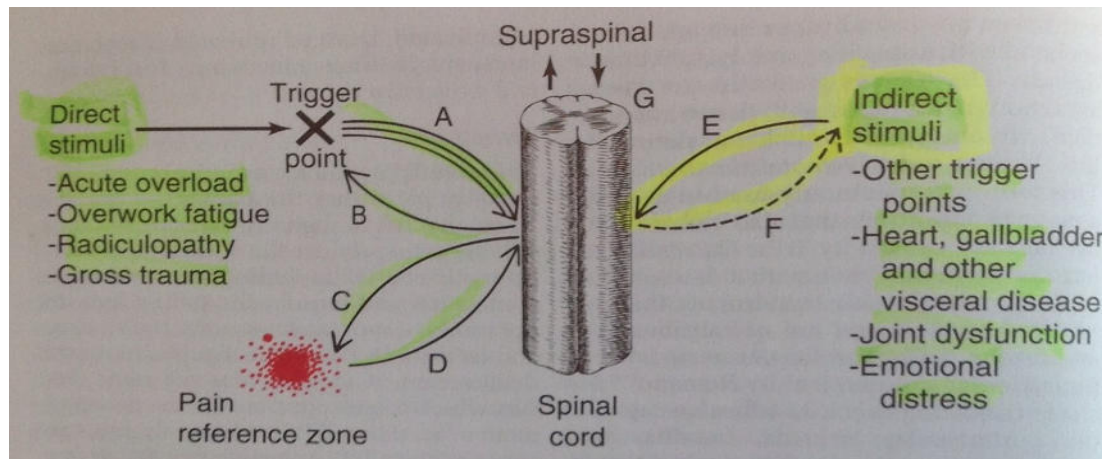
They can be **divided into active and latent trigger points**. **Active trigger points** cause **sensations of pain at rest, without extra pressure applied**. **Passive trigger points only cause pain, when pressure is applied**. (1) However, both **active and passive TP reduce the motility and the power of the muscles**. In active TP there are increased values of bradykinin, serotonin, substance P etc. (18)

20% of the trigger points are located in the area of acupuncture points. Certainly, when practitioners in Ancient China were using the term „**AH-SHI points**“, they were referring to, what we call trigger points today. (13)

Treatment options for trigger points are: specific manual physiotherapy techniques, stretching, and treatment by acupressure, needling the trigger point with acupuncture needles (dry needling), stretch and cold spray, injection of a local anaesthetic into the trigger point, trigger shockwave therapy, and stretching exercises. (13)

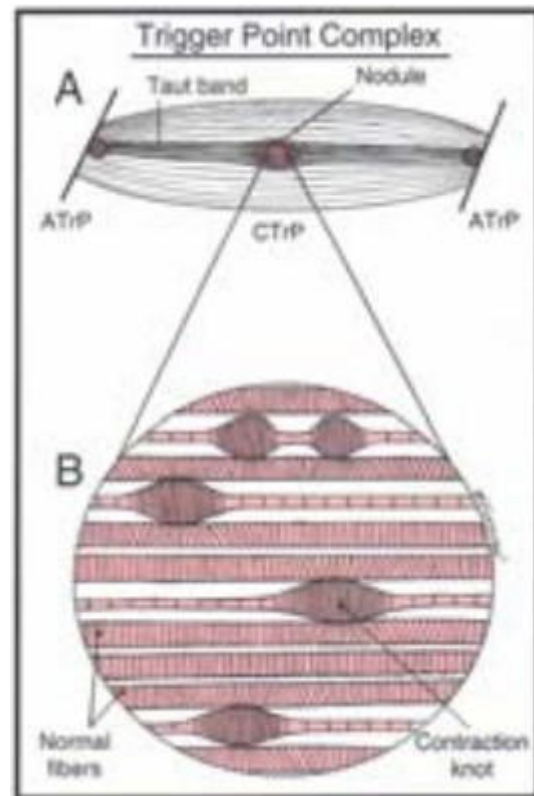
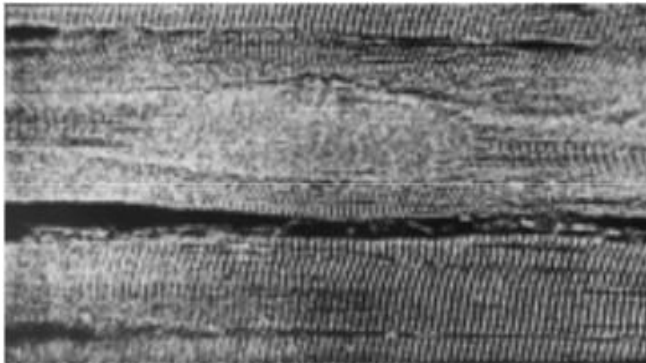
3. Pathophysiology of trigger points

The following figure shows the pathophysiological mechanism and influencing factors of trigger points. Direct stimuli like **acute overload**, **overwork fatigue**, **radiculopathy**, and **gross trauma**, indirect stimuli like stimuli from other trigger points, **visceral disease**, **joint dysfunction**, and **emotional distress** can cause trigger points. (1)



The following figure shows a **contraction knot**. Contraction knots of muscle fibres are one physiological occurrence in trigger points. A contraction knot appears as a shortened part of a muscle fibre with increased diameter. In this part, the sarcomeres are extremely contracted.

Contraction knots narrow capillaries and reduce blood flow in this area (**theory of the energy crisis**). (1)

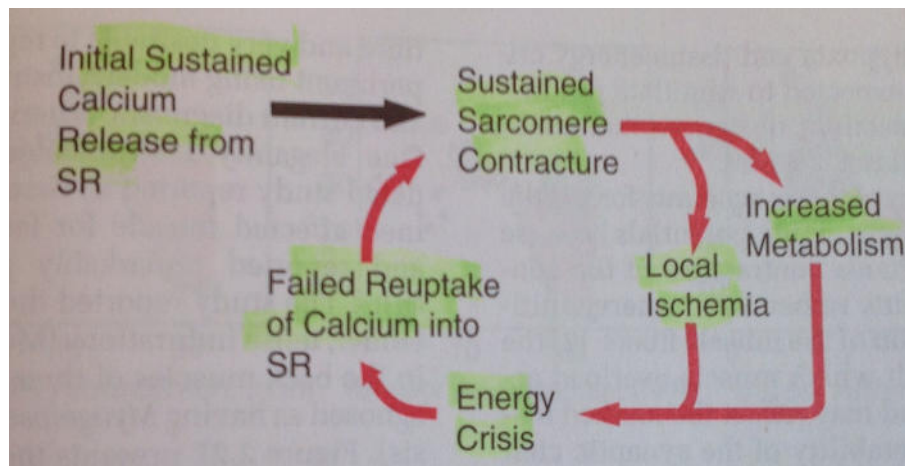


In the capillary system the pressure ranges from 35 mm Hg (arterial side) to 15 mm Hg (venous side). During „normal“ muscle contraction, the blood flow is interrupted, as a result of the contraction of muscle fibres. This is a normal physiological process. In the relaxation phase, blood circulation reappears. Contraction and relaxation causes the so called „muscle pump“. **Muscle contractions over 10% of the maximum contractile force of a muscle can already lead to an impairment of the blood supply.** At trigger points, these values can be equal or exceeded. (14)

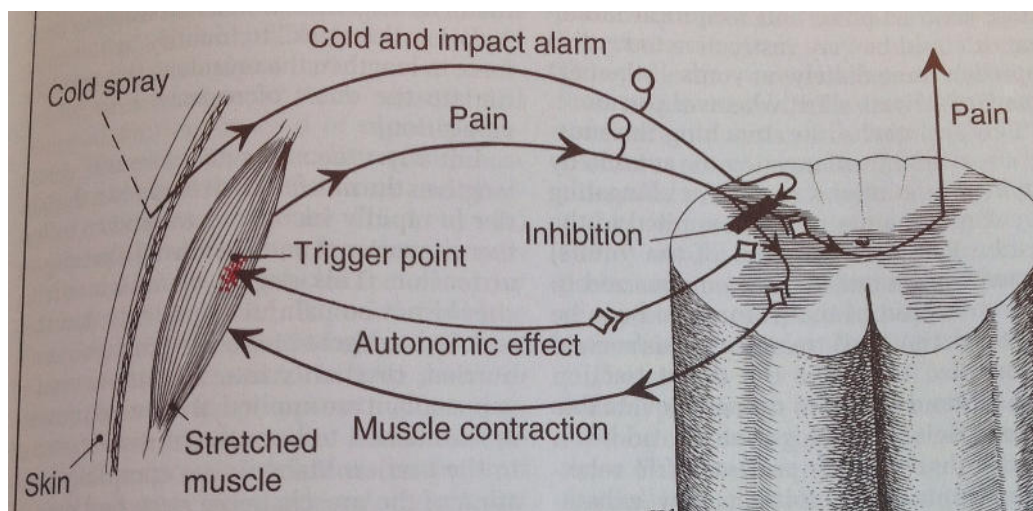
A permanent discharge of acetylcholine in the neuromuscular junction causes a permanent release of calcium from the sarcoplasmic reticulum. Consumption of ATP and the contraction of muscle fibres causes a localized ischemia. Various **pain-inducing substances** (prostaglandin, bradykinin, substance P, CGRP, K⁺, serotonin and histamine, etc.), released due to the energy crisis, **induce localized pain by super sensitization of nociceptors** in the affected muscles. (1)

Because the **blood supply for muscles is reduced during the night**, due to a reduced cardiac output, **pain** caused by trigger points often occurs **during the night**. (8)

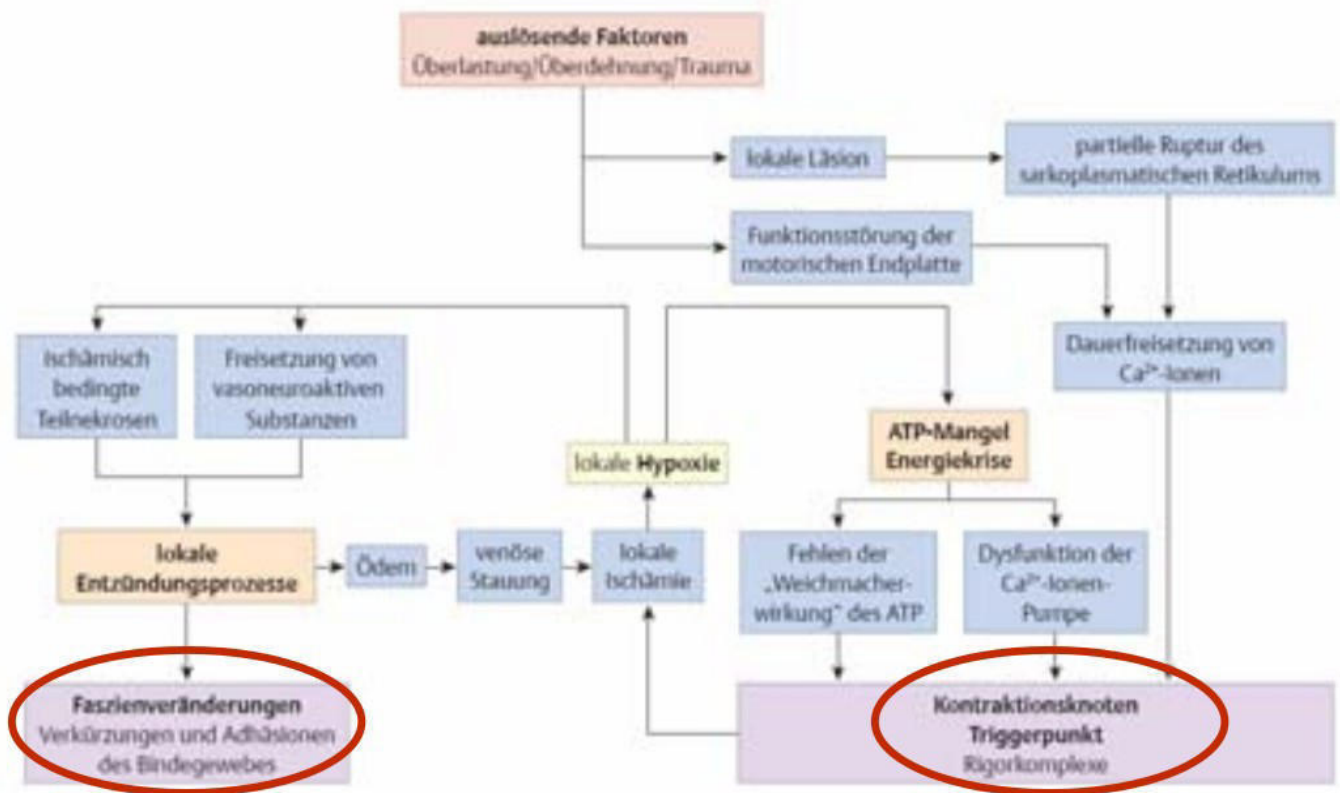
Chronic cases may lead to connective tissue changes of the affected muscle areas. (15)



Therapies for trigger points can influence the affected muscle in different ways, each with varying degrees of efficiency. There are, for example, specific manual physiotherapy techniques, acupressure treatment, needling the trigger point with acupuncture needles (dry needling) or by injection of a local anaesthetic into the trigger point, stretching, trigger shockwave therapy, and cooling and heating applications. The following figure shows an application of cold spray application to achieve relaxation of trigger points. The cold stimulus leads to a relaxation of the affected muscles. (1)



The following figure from Gautschi (16) shows a **flowchart of the pathogenesis of trigger points**. In conclusion: **pathogen factors cause fascia changes and contractions of muscle fibres**.

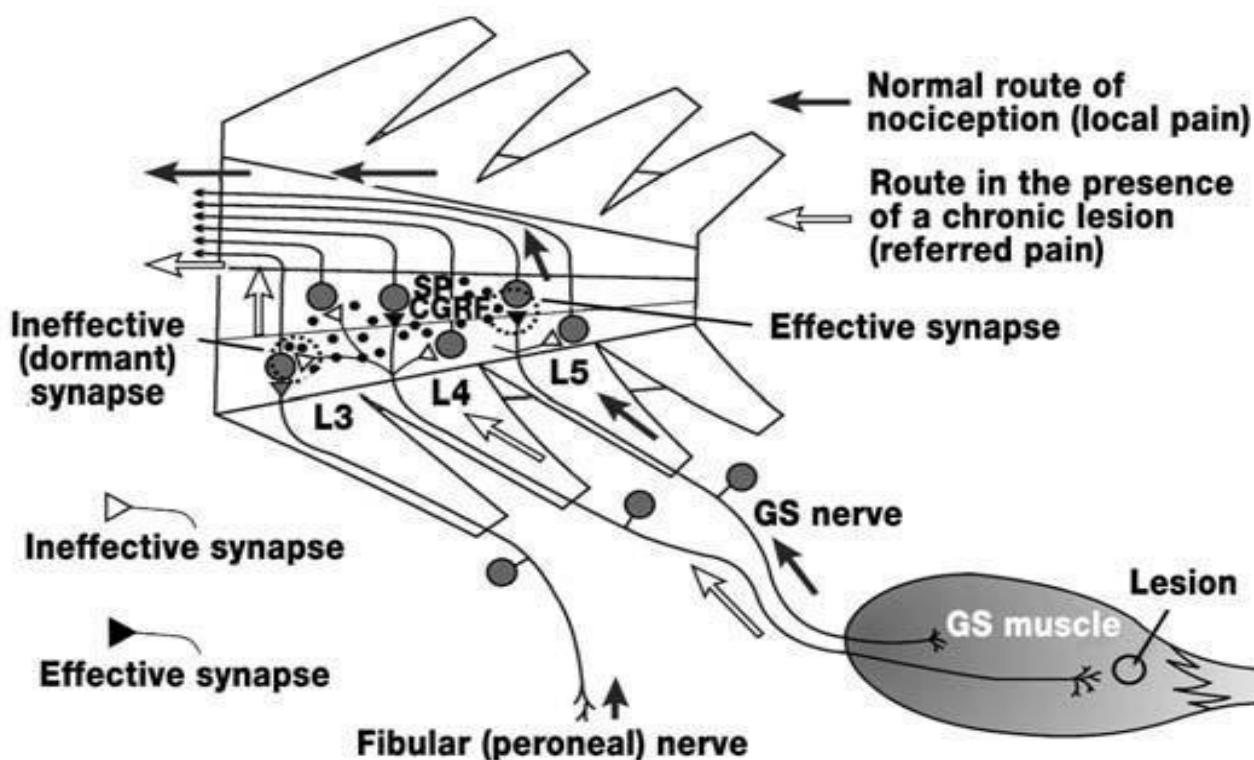


4. Referred pain and transmission of muscle pain

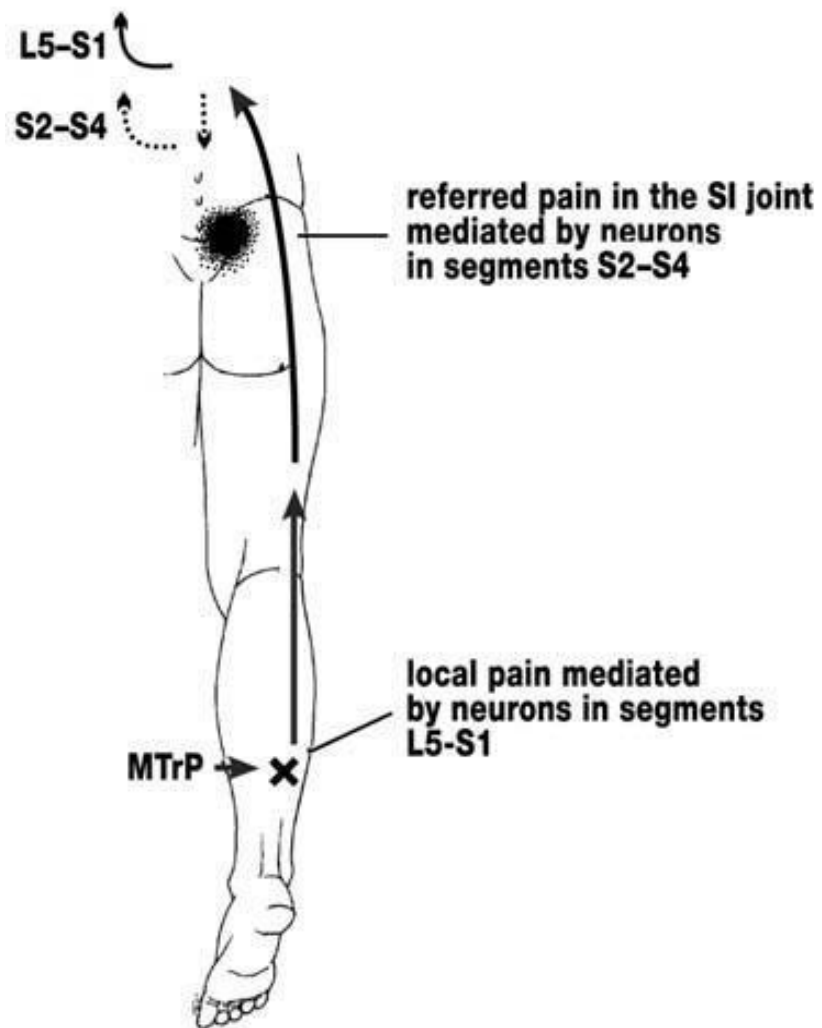
In the following lines referred pain processes are explained in more detail.

There are a variety of different physiological reasons for referred pain, from pain impulses in the muscles to the perception in the cerebral cortex. The **first interconnection of neurons occurs in the spinal cord**. Further possibilities of **interconnection** of neurons can be found **in the brain stem**, the **thalamus** (17), and the **cerebral cortex**. Referred pain in these areas is still largely unexplored.

The following illustration by Mense (7) shows the „**emergence of referred muscle pain**“ in the **lumbar region**. A pain sensitive area is located in the GS region (GS, gastrocnemius soleus-muscle). Normally, the GS nerve only sends information to the **L4 and L5** segment, and therefore a postsynaptic excitation is only caused in L4 and L5. The black arrows indicate the transmission of excitation. In an **inflamed GS muscle the excitement is spreading to the L3 segment**. One important factor for this mechanism is the substance P (SP) release which diffuses into the region of L3. The white arrows show the expanded signal routing in the L3 segment, **thereby pain is felt in a different area**.



The following figure shows another example, also explained in the article by Mense (7). A trigger point in the soleus muscle causes pain in the sacroiliac (SI) joint. Because of the ischemia caused by this trigger point, nociceptors in the soleus are excited. This excitation is referred to the segment L5-S1 (black arrows). According to the chronic pain situation, “sleeping” connections in the area S2-S4 are activated, causing an activation of neurons in the region of the SI joints. This leads to pain transmission into this area (dashed arrow).



5. Tension-type headache and trigger points

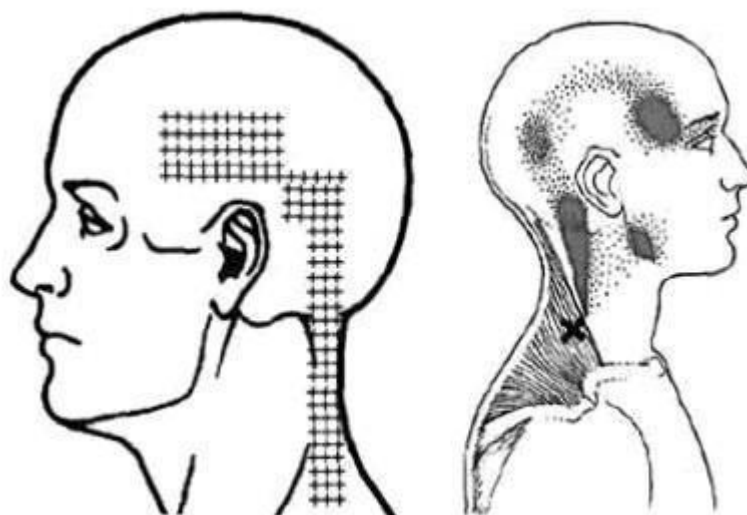
According to Arendt-Nielsen et al., **chronic tension-type headache (CTTH)** is **associated** with **trigger points** in the **sub occipital muscles** (100%), the **upper trapezius** (76% on the right side, 56% on the left), **sternocleidomastoid** (64% on the right side, 48% on the left) and **temporalis muscles** (80% on the right side, 60% on the left). The values in parenthesis shows how often trigger points are found in CTTH. **More than half of these trigger points cause a pain referred pattern.** People with **active trigger points** have **more frequent and stronger headaches** than people with **latent trigger points**. (18)

In the manifestation of CTTH there are a variety of other mechanisms that play an important role, like **hyperalgesia in the affected muscles**. Another important factor is **hyperplasia of pain processing regions in the cerebral cortex**. (18)

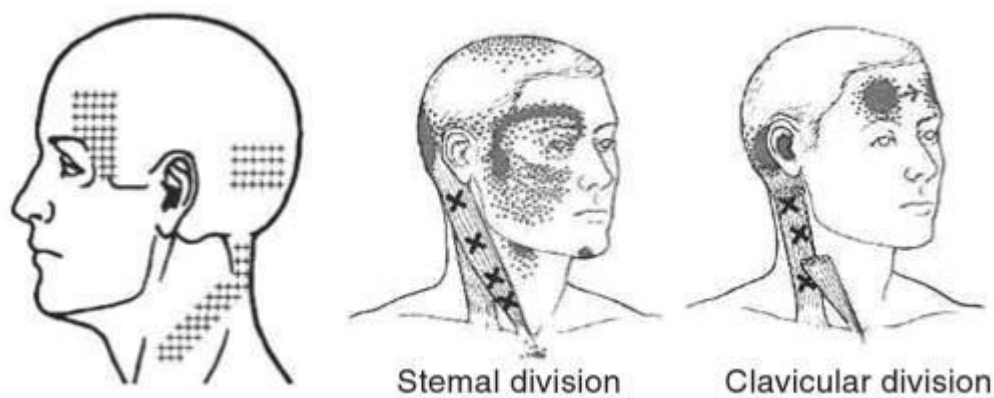
Nerve roots from **C1-C3** conduct afferents from the **sub occipital muscles, upper trapezius, sternocleidomastoid and temporalis muscles into the spinal cord**. These impulses **converge with impulses from the n. Trigemini**. Probably this process plays an important role in TTH as well. (18)

Many acupuncture points correlate according to their location with myofascial trigger points. Peng showed a high correlation of trigger points with acupuncture points. **92% (235/255) of the acupuncture points were in the same location** (19). **Examples in TTH are:** "Gb 21 in the trapezius, Dü 12 in supraspinatus, Dü 11 in the M. infraspinatus, Dü 14 in the levator scapulae, Ma 6 in the masseter muscle, Ma 8 in M. temporalis. (18)

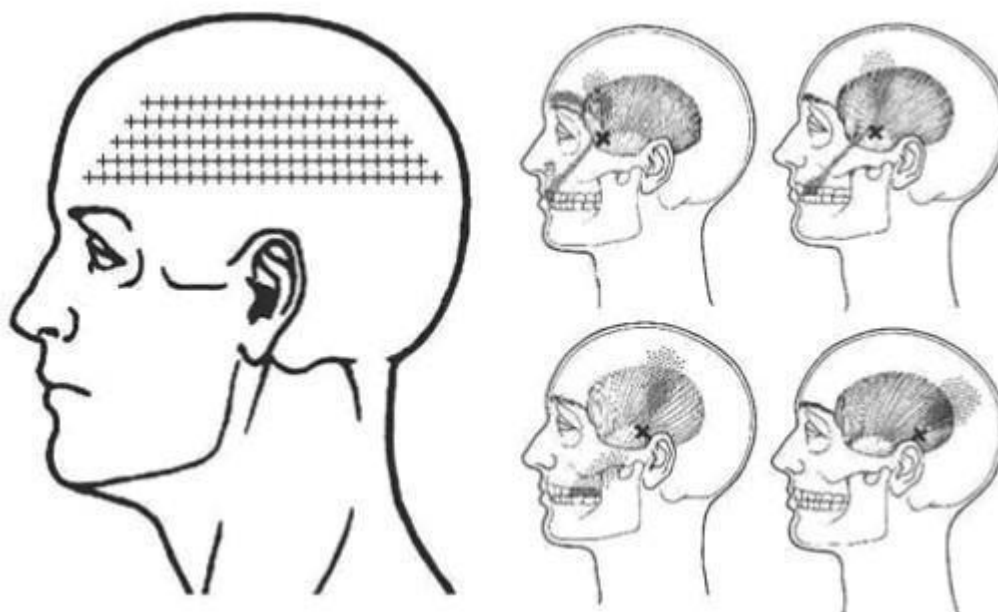
The **following muscles play an important role in TTH**. They are shown with their referred pain pattern. (18)



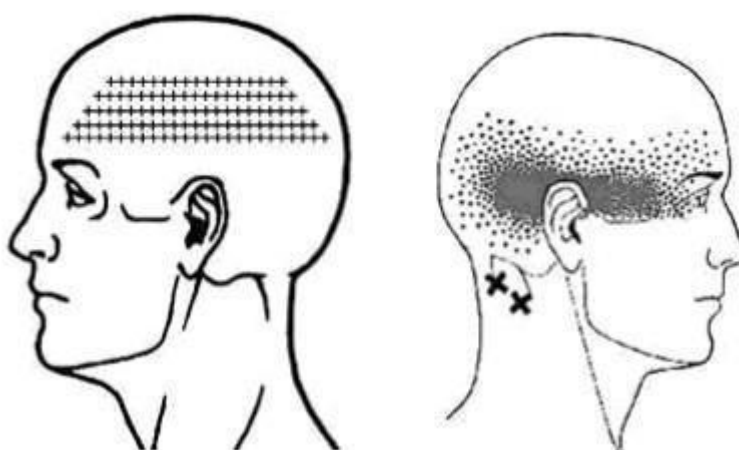
Trigger point in the upper trapezius and their referred pain pattern.



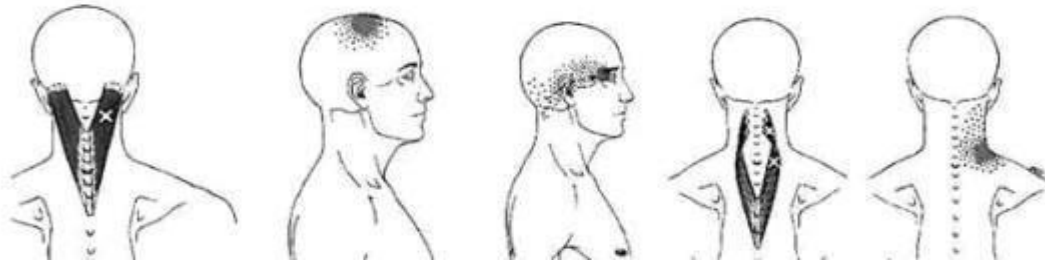
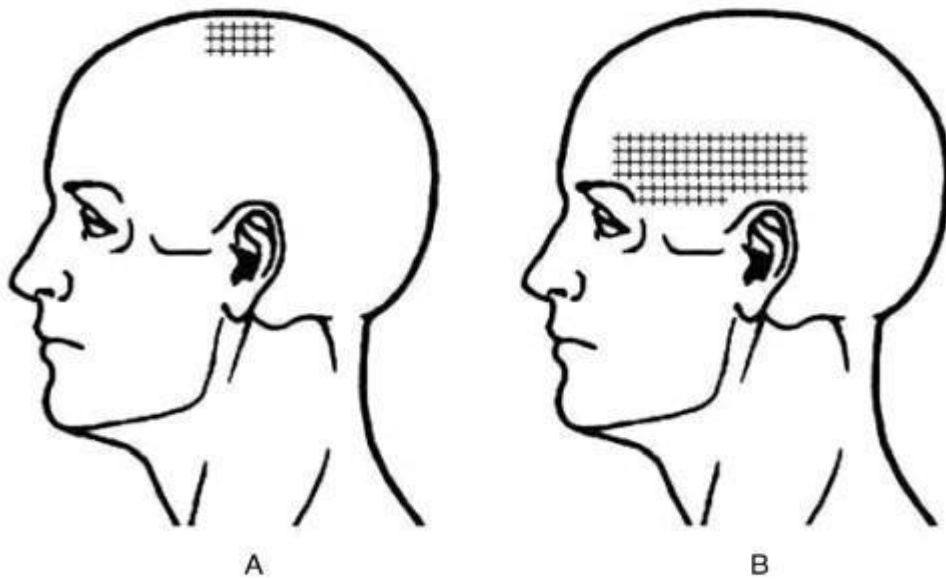
Trigger points in the sternocleidomastoid and their referred pain pattern.



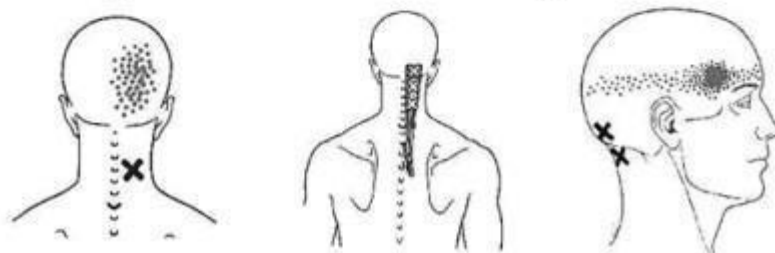
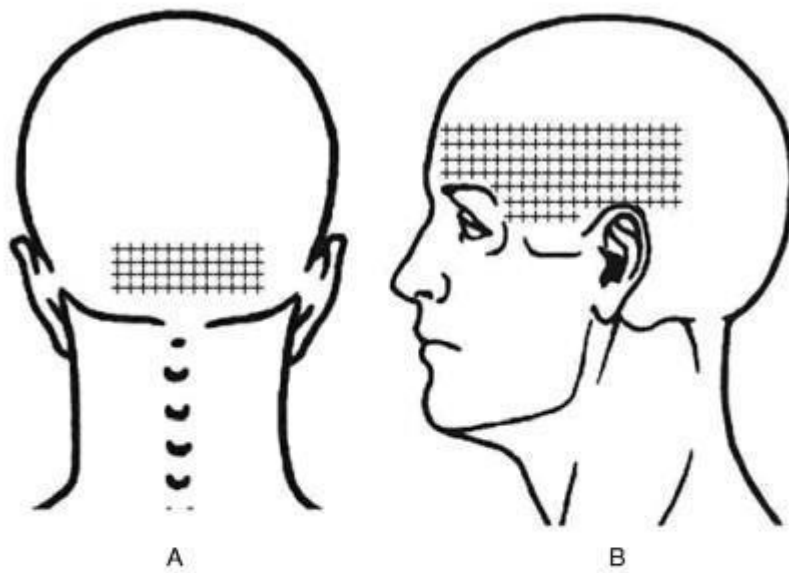
Trigger points in the temporalis and their referred pain pattern.



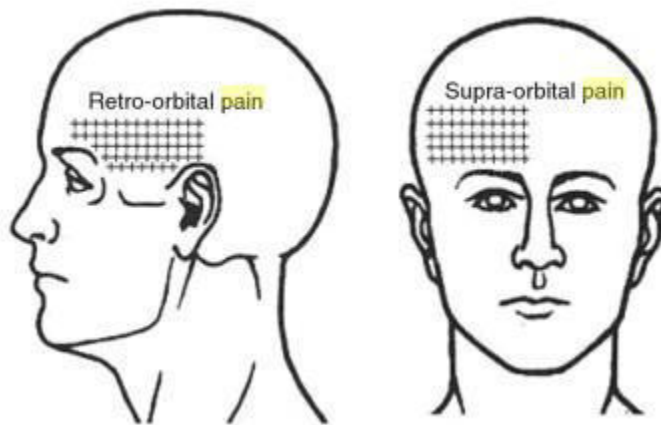
Trigger points in the sub occipital muscle and their referred pain pattern.



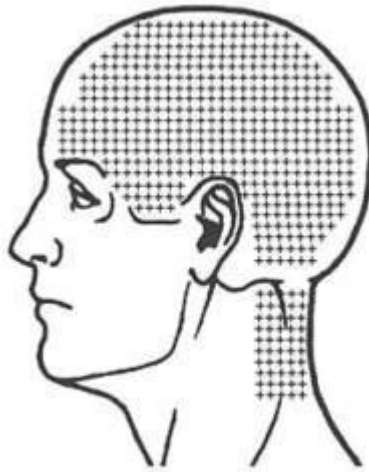
Trigger points in the splenius capitis and cervicis muscle and their referred pain pattern.



Trigger points in the semispinalis cervicis muscle and their referred pain pattern.



Trigger points in the superior oblique and the lateral rectus muscle and their referred pain pattern.



Composite pattern of tension type headache.

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