The Use of Acupuncture in Dentistry: 
a Systematic Review

Palle Rosted

Summary
Published controlled studies on the analgesic effect of acupuncture in dentistry are still relatively few, but those which fulfill predefined methodological criteria are reviewed to assess if acupuncture is effective in this field. A literature search identified 74 papers published between 1966 and 1996, and 18 are reviewed. Only 15 of the papers fulfill a number of predefined criteria: having a reference group, randomisation, blinding, appropriate statistics, sufficient follow-up, etc. Of the 15 papers only one study meets more than 85% of the criteria, five meet 70-84%, three studies meet 60-69%, and six do not reach 60% of the predefined criteria and are thus considered unreliable.

Eleven out of the 15 studies were in favour of acupuncture and showed standard acupuncture to be more effective than placebo, non-standard (sham) acupuncture, or showed it to be able to produce better or similar results to an accepted treatment procedure. The higher the standard of the paper, the more likely it was to have a positive result in favour of acupuncture: all those in the excellent or good categories gave a favourable result. Acupuncture proved effective in 73% of the reviewed papers for the treatment of Temporomandibular dysfunction or as an analgesic, and should be considered as a reasonable alternative or supplement to current dental practice in these areas.

Key words
Acupuncture, Controlled studies, Dental analgesia, Dental pain, Facial pain, Systematic literature review, TMJ-dysfunction.

Introduction
Acupuncture is a technique, originating in China more than 3,000 years ago, in which disease is treated by inserting needles at various points on the body - acupuncture points. Alternatives to the basic acupuncture are now available, for example electroacupuncture, ear-acupuncture and transcutaneous electrical nerve stimulation. The most common use of acupuncture is in pain management, for which a number of studies (1) have shown it to be effective, particularly in the treatment of musculoskeletal pain. There have also been suggestions that acupuncture may enhance the immune response (2), and reduce feelings of stress and anxiety (3). Anxiety related to dental treatment is rife, and there is a clinical impression that acupuncture can offer an alternative to the sedative drugs commonly used, although no controlled studies are available.

Like other clinical disciplines, dentists sometimes meet problems which do not respond to orthodox treatment. Facial pain may give rise to diagnostic difficulties, sometimes through failure to consider musculoskeletal causes. Orthodontic treatment may involve surgery, for example on the sinuses, trigeminal nerve ablation, or removal of teeth, occasionally unnecessarily. There are many causes of facial pain, and there is often a musculoskeletal component, but in general a high percentage respond to acupuncture clinically.

Temporomandibular joint (TMJ) dysfunction is commonly seen in dental practice. There is no standard treatment, but tranquillisers, physiotherapy, occlusal splint and counselling are treatments commonly tried. Here too acupuncture can be of clinical benefit. More rarely seen is Sjøgren syndrome, which is a decrease in saliva flow associated with painful rheumatoid arthritis. Conventionally, treatment is limited to artificial saliva and analgesics. Again, acupuncture is found to be clinically helpful.

In recent years interest in acupuncture for dentistry has increased, at least partly because of published results of its efficacy. However, the literature is not extensive and the results recorded vary considerably: from no effect to significant improvement. The aim of this article is to discuss and review methodically the published clinical trials to determine whether clear conclusions can be obtained for the use of acupuncture in dentistry.

Methodological considerations
In a controlled trial, the diagnostic criteria used for the selection of patients must be clear. Subjective symptoms should be measured in an acceptable manner, such as a visual analogue score for pain, well-being, etc., and the objective changes should be suitably investigated: e.g. blood tests, intake of medication, etc. To ensure prognostic similarity as a baseline for the subpopulations allocated to active or placebo treatment, the study population should be fairly homogeneous. Change in subjective symptoms are often the main outcome of a treatment and a certain amount of improvement might be expected in the control group. Therefore a
relatively large number of patients in both the treatment group and the placebo group is required for a valid assessment of efficacy. Depending on the expected outcome of the study, it is statistically possible to estimate the minimum number of patients which should be allocated to each group. Generally speaking, one can say that the smaller the number of subjects the less confidence we will have in the validity of the study and the outcome: i.e. a small study can erroneously appear to demonstrate a statistical lack of efficacy for a particular treatment, whereas a large scale study would have demonstrated the opposite (a Type II statistical error). To ensure reasonable methodological soundness of the involved studies, only randomised and blinded studies are included. Unfortunately, double-blind studies are nearly impossible in acupuncture. The person who inserts the needles will in most cases know if he is inserting the needles in standard acupuncture points or in non-standard points. In an effort to minimise this problem the assessment should be by an independent assessor, as has been done in a number of studies.

Placebo treatment for acupuncture trials has given rise to a lot of discussion. At one time it was believed that inserting needles in non-standard acupuncture points, or in points with no traditional relevance to the treated disease, could be regarded as a placebo. To day we know (4) that inserting needles in any part of the body will have a physiological effect, although normally less than the effect achieved by inserting the needles in traditional acupuncture points. In all the quoted studies where sham acupuncture has been used needles were inserted in non-standard points or acupuncture points regarded as having no effect on the treated disease.

Search strategy and inclusion criteria
This study is based on a computer search of papers published between 1966 and 1996 performed at The Royal Society of Medicine, London, The University Library, Copenhagen, and the Research Council for Complementary Medicine (RCCM), London. The following databases were searched: Biological Abstracts, Ciscom, Embase, Excerpta Medica, Medline and Science Citation Index. The search words were: acupuncture or electro-acupuncture and randomised controlled trials and dental pain or postoperative dental pain or pain relieved by acupuncture in dentistry or dental analgesia. Your reviewer was able to deal with papers in the following languages: Danish, English, German, Norwegian and Swedish.

<table>
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<tr>
<th>Table 1</th>
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</tr>
</tbody>
</table>

Acupuncture in Medicine

May 1998 Vol 16 No 1
A total of 74 papers were discovered in Danish, English, German, Swedish, Italian, French and Russian. Among the listed papers 48 were reviewed; 11 papers were excluded before review for the following reasons: the abstract clearly indicated that the paper was not a randomised controlled trial, the paper was of a more general nature or it had no relevance to acupuncture, e.g., was concerned with hypnosis, homoeopathy etc., and another 15 papers were omitted because they were written in French, Italian or Russian, which your reviewer is unable to translate.

This review includes papers which fulfil the following criteria:

i. Acupuncture needles were used; studies of TENS or laser acupuncture were excluded. Studies on electroacupuncture were included if needles were used.

ii. A control group was used: either placebo, non-standard acupuncture, or another treatment modality.

To assess the methodological quality, all included papers were scored on the basis of a list of predefined criteria (Table 1). Every paper was scored on each of 23 parameters as: Very good (4 points), Good (3 points), Fair (2 points), Not satisfactory (1 point), or Poor (0 points), as suggested by Vickers (5). Very good indicates that the quality standard had been met adequately and the results must be considered valid. Good indicates that the major requirements were met adequately and the results have not been affected. Fair indicates that requirements have not been fully met, but the results have probably not been affected. Not satisfactory indicates that some of the major criteria have not been met adequately and that this might have affected the outcome of the study, and Poor that the criteria have not been met and that this has probably influenced the outcome of the study.

A total of 92 points could be achieved. On the basis of this scale, papers achieved an overall assessment as: excellent (85-100%), good (70-84%), fair (60-69%), and bad (<60%). The data must be considered as valid and reliable; the paper contains minor methodological errors without importance for the outcome; fair (60-69%) there are medium methodological errors which are not likely to have influenced the results significantly; or bad (<60%), major methodological deficiencies are evident which are likely to have influenced the outcome.

Results

Among the 48 reviewed papers, 33 were rejected for the following reasons: the paper contained only anecdotal material (6-11); it was of a general nature (12-23); of an experimental nature (24-32); or involved non-acupuncture techniques (33-36). The remaining 15 papers (37-52) were found to fulfill the inclusion criteria with the results shown in Figure 1. Three papers (43-45) deal with the same study and have been counted as one. Only one study fulfilled more than 85% of the required criteria (37). Five studies fulfilled between 70% and 84% of the criteria (39-41, 43-45, 48); three met 60% to 69% (38, 46, 52) and six studies met less than 60% (42, 47, 49-51, 53). Eleven out of the 15 studies were in favour of acupuncture and 4 demonstrated no effect. It is particularly interesting to notice that the studies which scored the highest points were all in favour of acupuncture. The results are related to the quality of the study in Figure 2.

Direct comparison of results is possible regarding the use of acupuncture for dental analgesia. Seven studies dealt with extraction of teeth, in particular impacted 3rd molar. Of these papers three (49, 50, 53) did not meet the criteria, scoring less than 60%. Among the papers which did meet the criteria, three were in favour of acupuncture (37, 48, 52) and one (38) was not.

Regarding the treatment of facial pain and TMJ-dysfunction the outcome of the papers is more clear. Four studies (39-41, 43-45) which meet the criteria with only minor methodological flaws all demonstrate a positive effect of acupuncture.

<table>
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<th>Quality of study</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
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<td>Excellent (85-100%)</td>
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</tr>
<tr>
<td>Good (70-84%)</td>
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<tr>
<td>Fair (60-69%)</td>
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<td>2</td>
<td>3</td>
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<tr>
<td>Bad (&lt;60%)</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>4</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

Discussion of the individual papers

Sung et al. in their comparison of the effects of acupuncture and codeine on postoperative dental pain (37) fulfil the majority of the requirements for a scientific paper, and the general impression is that the presented data is valid and the conclusion drawn is appropriate. The outcome was in favour of acupuncture as a valid treatment for postoperative dental pain. Never the less two conditions in the study need comment. The weak point in this study is the number of patients: 40 were included in the study and randomly allocated to one of four treatment modalities; as a consequence, only ten patients were included in each group. Although the results were subjected to a careful statistical analysis, the study would have been more powerful if the number in each group had been larger. The patients were randomly allocated prior to the surgical procedures, but unfortunately the method is not described in detail.

Ekblom et al. (38) fulfil many of the requirements in their investigation of acupuncture for post-operative dental pain, and the overall impression is that the information is reliable, although a few comments need to be made. The outcome was not in favour of acupuncture. Again the procedure for randomisation was not described and it is difficult to assess if the randomisation method could have influenced the outcome. A full list of exclusion criteria is missing and, despite a sufficient number of patients (110 in total), the numbers allocated to the two treatment
groups (25 in each) differs from the control group (60) which is more than double either treatment group. It is likely that this factor influenced the outcome. Moreover, the two treatment modalities are compared to a non-treated group. The study would have been improved if a placebo procedure had been used and if the total number of patients had been allocated to equal sized groups.

Jonasson et al. (39) fulfil most of the required criteria in their paper on acupuncture in the treatment of facial muscular pain, and the general impression is very good. Like all the other papers, the randomisation has not been described in detail, but it is not likely that this has had any influence on the outcome. Because of the nature of the study it was not possible for either the subject or therapist to be blind to the form of treatment, but an independent observer was used which strengthened the study. The outcome, which was in favour of acupuncture, must be considered valid.

The outcome in the study by Lister et al. of acupuncture and occlusal splint therapy in the treatment of craniomandibular disorders (40) is also in favour of acupuncture. The only serious complaint about this study is again the lack of a full description of the randomisation. Again, because of the nature of the study, blinding of the subject and therapist was impossible, but the use of an independent assessor together with the high score certainly makes the data valid and reliable. A one year follow up (41) demonstrates that a year after termination of treatment the effect of acupuncture was still beneficial compared to occlusal splint. The quality of the follow up is in line with the initial study.

In a study by Scarsella et al. of electro-acupuncture treatment for post-operative pain in oral surgery (42) several major criteria are not fulfilled. In particular, the lack of inclusion and exclusion criteria is important and could have affected the result. Patients act as their own control and no placebo or control group has been used, which weakens the study. Moreover, the paper does not inform the reader about follow-up. On the positive side, blood was taken from 20 patients and tested for beta-endorphin and a significant rise after acupuncture was found. This finding is interesting, but the results would have been more powerful if a blood test had been taken immediately after operation and again after acupuncture. As it stands, the increase in beta-endorphin could have been at least partly due to the surgical procedure.

Three papers by Raustia et al. (43-45) discuss aspects of a single study of acupuncture compared with stomatognathic treatment for TMD dysfunction, which fulfills the majority of the required criteria. In particular, all subjective and objective variables are discussed in detail. The results show acupuncture to be a useful treatment.

The placebo controlled study of acupuncture in operative dentistry by Taub et al. (46) does not find in favour of acupuncture. Although the authors have taken great effort to ensure blinding of the patients and the two therapists, the study has some major deficiencies. The only inclusion criteria were the need for drilling teeth and that patients had previously required analgesic for a similar treatment. No exclusion criteria were mentioned. The patients were treated by two dentists and it is interesting to see the difference in results from one dentist to the other. Nearly all participants in both the acupuncture and placebo groups found that the treatment gave excellent or good analgesic. There were thus no differences between the treatment and placebo groups but, surprisingly, 70% of patients treated by one dentist indicated complete pain relief, while only 32% of those treated by the other dentist claimed complete relief. This may have been due to different qualities of the two dentists, a different approach to treatment, different interpretation of results, etc. Moreover the inclusion criteria seem to be of importance. Normally, the drilling of teeth is not associated with severe pain and it is likely that there is a significant element of placebo in the quoted results. The substantial difference between the results from the two dentists might be due to a positive bias. The general impression of the paper is that it contains some vital methodological errors and the stated results must be questionable.

The paper on acupuncture anaesthesia in dentistry by Lee et al. (47) is encumbered with major methodological defects like lack of inclusion and exclusion criteria, lack of blinding, small number of patients, etc. The results are in favour of acupuncture, but the data cannot be considered reliable.

The weakness of a paper by Lao at al. on the efficacy of Chinese acupuncture on post-operative oral surgery pain (48) is the number of patients. Otherwise the paper fulfills the majority of the criteria. It is important to notice that all patients are undergoing the same surgical procedure, removal of 3rd molar, which can be a painful operation. The study demonstrates a pain free period twice as long after traditional acupuncture as after placebo acupuncture. Moreover, in this study an acupuncture-like non-invasive placebo was used, which certainly makes the study reliable and the data valid.

A weak point in the study by Lapere et al., on acupuncture analgesia for postoperative dental pain (49), is again the number of subjects. Patients were allocated to either acupuncture or conventional treatment. There was no blinding of the patient or the therapist and there might have been some bias, either positive or negative, due to this. Unfortunately, no independent assessor was used which would have reduced the possibility of bias and made the data more valid.

The outcome of a study by Hansson et al. of acupuncture as the sole analgesic for oral surgery (50) was negative. A total number of 26 patients were included in the study and allocated to 5 different groups with only five or six patients in each group. Despite a lot of positive elements in the design of this study, there is no doubt that the low
number of patients could have produced a wrong conclusion (Type II statistical error).

Another study by List and Helkimo of acupuncture in chronic facial pain and mandibular dysfunction (51) is positive, but there were only 10 patients and they acted as their own controls with no blinding. On the positive side it must be mentioned that much effort was taken to assess the outcome of the treatment. None the less, the results can be considered only as an interesting pilot study.

A small study by Lao et al. (52) fulfills a number of the criteria, but unfortunately there are only 10 patients, which makes it too small for statistical analysis. This was the pilot for a full study on the efficacy of acupuncture on post-operative oral surgery pain (48).

A study by Baraschkow and Stosch (53) has several methodological errors. For example no criteria for inclusion of patients are mentioned and no blinding is used. This study cannot be considered reliable.

General discussion
Despite three good quality papers (37,48,52) being in favour of acupuncture for post-extraction dental analgesia, the interpretation of these findings should be cautious, and further, more rigorous studies with sufficient numbers of patients are needed before a definite conclusion can be drawn. Moreover the practical value must be questioned. Modern techniques to produce analgesia in dentistry are cheap, easy to administer, and work reliably within minutes, in most cases without side effect. In contrast, acupuncture is more difficult to administer, less reliable and often requires stimulation of between 20 and 30 minutes before becoming effective.

The one paper (38) finding increased postoperative pain and consumption of analgesics following acupuncture for dental extraction only just passed the critical score with 61% and is encumbered with methodological errors, even so it is not likely that these errors influenced the outcome significantly. The authors discuss their unexpected result and suggest that there may be vasodilatation due to the acupuncture, followed by a faster wash-out of the local anaesthetic thereby shortening its analgesic effect. Another reason could be that the wrong acupuncture points had been used, although this explanation is not very likely as a segmental approach had been used which is known to produce the best results. Moreover the total sample size in this study was bigger, at 110 subjects, than any of the other studies, which varied between 10 and 40 subjects. Furthermore it has not been possible to identify any difference in the treatment among the four papers which meet the criteria. In general the same points were needled, and in all cases manual stimulation was used and the needles were left in situ for approximately the same length of time. Therefore it is unlikely that this can account for the contradictory results.

The positive results of all the four good quality studies on facial pain and TMJ-dysfunction (39-41, 43-45) suggest that acupuncture could be considered as a valid alternative to orthodox treatment, including occlusal splint. The treatment is simple and cheap, and benefit is often seen after only a few treatments, whereas the occlusal splint has to be used for a considerable length of time.

It appears from the presented papers that acupuncture is effective in reducing dental pain. We are still without a full understanding of acupuncture's mode of action in pain relief, however there are some suggested theories.

Acupuncture is known to stimulate small myelinated nerve fibres in muscle which send impulses to the spinal cord and then activate three centres: the spinal cord, the midbrain and the pituitary-hypothalamus; it has been shown that enkephalin, beta-endorphin, dynorphin, serotonin and noradrenaline are involved in this process (4).

Conclusion
Eleven out of 15 papers were in favour of standard (traditional) acupuncture, having been shown to be more effective than non-standard (sham) acupuncture or to have a similar effect to conventional treatment. The value as an analgesic for surgery is questioned, but the beneficial effect in treating TMJ-dysfunction and facial pain seems real, and in this area acupuncture could be a valuable alternative to orthodox treatment. Never the less the number of good quality randomised controlled trials are few and more studies are required.

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References

Rejected papers


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doi: 10.1136/aim.16.1.43

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