

Complementary Medicine

Practical recommendations for the use of acupuncture in the treatment of temporomandibular disorders based on the outcome of published controlled studies

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OBJECTIVE: The objective is to analyse the treatment procedures used in the individual studies to identify any similarities of therapeutic approaches and subsequently present recommendations for a standard acupuncture procedure for the treatment of temporomandibular disorders (TMD).

MATERIALS: Literature searches performed by the Royal Society of Medicine and the University Library, Copenhagen were able to identify 74 publications regarding the use of acupuncture in dentistry. Among them 14 papers concerned the use of acupuncture in the treatment of TMD. To ensure reasonable methodological soundness of the involved studies, only randomised and blinded studies were included, which reduced the number of papers to six. Among these six papers three concerns the same study and were counted as one. One paper was a follow-up of a previous study and for this purpose counted as one.

METHODS: All publications were analysed for the following information: acupuncture points used, type of stimulation, number of treatments, duration of the individual treatment and the interval between the individual treatments.

MAIN OUTCOME: Acupuncture has in three out of three randomised controlled trials (RCT) proved effective for the treatment of TMD. The following local acupuncture points are recommended for the treatment of TMD: ST-6, ST-7, SI-18, GV-20, GB-20, BL-10. As a distant point LI-4 is recommended. After inserting the needles they should be manipulated manually to achieve the De-qui sensation and left *in situ* for 30 min. Treatment should be given weekly and a total number of six treatments is recommended.

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Introduction

Acupuncture is a part of a whole system of medicine that originated in China more than 3000 years ago. By this method diseases are treated by inserting needles in different parts of the body—‘acupuncture points’. Today, additional techniques are available, for example, electroacupuncture and earacupuncture. As it is practised in the West the main target for acupuncture treatment is pain management, and acupuncture has in a number of studies (Richardson and Vincent, 1986) proved effective particularly in the treatment of pains of musculoskeletal origin including temporomandibular disorders (TMD) (List and Helkimo, 1987). Moreover it has been suggested that acupuncture might be able to improve the immune system (Lundberg, 1993) and to reduce the level of stress and anxiety (Tao, 1993).

Facial pain is a major problem which often gives rise to diagnostic difficulties. There are reported cases where patients have been misdiagnosed and mistreated because of a lack of knowledge of the musculoskeletal component of facial pain. The orthodox treatment may involve surgical intervention, eg, on the sinuses, partial ablation of the Trigeminal nerve and removal of teeth. Many patients have had a number of healthy teeth removed. There are several possible reasons for facial pain such as trauma, TMD, neuralgia, headache, migraine, sinusitis, middle ear diseases and primary myogenic pain (Johansson *et al.*, 1991). The pain in TMD is probably often of myogenic origin and it appears that some patients respond favourably to acupuncture (List *et al.*, 1992). TMD is a common condition in a dental practice and appears to be of multifactorial aetiology.

There are a multitude of classifications for TMD based upon: the frequency of presentation (Ogus and Toller, 1986), aetiology (Feinmann and Harris, 1984), or anatomy (American Academy of Orofacial Pain, 1993). All have their advantages and their weaknesses mainly because the diagnostic criteria vary and, as a consequence, the classification. Furthermore, in giving a diagnostic label it is often not possible to categorise a patient into only one of the common temporomandibular disorders because there is a considerable overlap of signs and symptoms.

Broadly, TMD is a generic term used to describe a number of related diagnoses of the temporomandibular joints,

masticatory muscles, and associated structures, the majority of which have some common symptoms such as pain and limited mouth opening (Dimitroulis, 1998). However, I will choose to use the classification suggested by Gray *et al* (1994) who classified TMD based on frequency of presentation of symptoms. This classification incorporates three major conditions:

Pain dysfunction syndrome (PDS), which includes: pain on palpation of the temporomandibular joint and of associated masticatory muscles, limitation or deviation of mandibular movement. Joint sounds and headache may also be present.

Osteoarthritis, which includes joint sounds, limitation of the jaw movement and pain located in the pre-auricular region.

Internal derangement, of the temporomandibular joint is characterised by a displacement of the intra-articular disc with or without reduction and the signs and symptoms include clicking of the joints and at a later stage pain located at the temporomandibular joint.

The prevalence of PDS is unknown but epidemiological studies have shown that 20–25% of the population in the Western world have symptoms and 3–4% seek treatment for it (Gray *et al*, 1994). The disease is equally distributed between men and women, but women seek treatment five times more frequently than men (Gray *et al*, 1994).

There is no standard treatment for temporomandibular PDS. The use of drugs often can be the primary approach to treating PDS, and antidepressants, benzodiazepines, muscle relaxants, nonopioid analgesics have been suggested (Dione, 1995). However, the supporting evidence for using these drugs is not overwhelming, the long-term administration should be balanced against their potential side effects. There could be several reasons for this lack of evidence of the therapeutic effect following drug treatment. One important feature is probably the population with TMD is a heterogeneous group of patients. Another factor that may affect the evaluation of drug therapies is the fluctuating nature of orofacial pain, which may undergo remission and exacerbation independent of the treatment. Other therapeutic approaches for TMD could be various physical treatments such as deep tissue massage, muscle stretching and relaxation, Transcutaneous Electrical Nerve Stimulation (TENS), triggerpoint injection, and occlusal splint therapy (Clark *et al*, 1995). While the latter approach has been subject to thorough scientific discussion (Davies and Gray, 1997a, 1997b, 1997c) for the other techniques, the scientific evidence of their therapeutic value is meagre.

However, acupuncture has in a few of studies claimed to be effective in the treatment of PDS (Johansson *et al*, 1991; List and Helkimo, 1992; List *et al*, 1992). The aim of this paper is to analyse the treatment approaches in the published papers to identify similarities and, if possible, subsequently present recommendations for a standard acupuncture procedure for the treatment of PDS.

Method

A recent scientific review of published papers identified 74 manuscripts describing the use of acupuncture in dentistry (Rosted, 1998). Among them 14 concerned the use of acupuncture in the treatment of TMD or to be more precise PDS (Roydhouse, 1973; Coros and Bradwein, 1976; Foreman, 1985; Raustia *et al*, 1985a, 1985b; Raustia and Pohjola, 1986; List and Helkimo, 1987; Johansson *et al*, 1991; Ho and Bradley, 1992; Kefei, 1992; List *et al*, 1992; List and Helkimo, 1992; Rowe, 1992; Merchant, 1995).

To ensure reasonable methodological soundness of the involved studies, only randomised and blinded studies were included. Furthermore, only studies where acupuncture needles were used were included. Of the 14 studies listed above those studies using laser or TENS were therefore excluded in the present analysis, but where needles were used for electroacupuncture these were considered. To assess the methodological quality of the papers, all those included were scored on the basis of a list of 23 predefined criteria as defined in an earlier study (Rosted, 1998). These included a control group, randomisation, precise description of the treatment, adequate follow-up's, etc. Based on this objective scoring system the papers were assessed as: Excellent (85–100%), the data must be considered as valid and reliable; Good (70–84%), the data must be considered valid but contains minor methodological errors without importance for the outcome; Fair (60–69%), medium methodological errors which are not likely to influence the results significantly; Bad (<60%), major methodological deficiencies which are likely to have influenced the outcome.

Of the 14 publications on PDS, those by Johansson *et al* (1991), List *et al* (1992), List and Helkimo (1992), Raustia *et al* (1985a, 1985b), Raustia and Pohjola (1986) fulfilled the list of predefined methodological criteria with a score between 77% and 84%. The three papers of Raustia *et al* (1985a, 1985b) and Raustia and Pohjola (1986) concerned the same study and was therefore counted as one paper. Study by List and Helkimo (1992) was a follow-up study of a previously published study (List *et al*, 1992) and was counted as one study. The remaining papers by Rowe (1992), Roydhouse (1973), Foreman (1985), Kefei (1992), Merchant (1995), Ho and Bradley (1992), Coros and Bradwein (1976), List and Helkimo (1987) failed to meet the methodological criteria; these scored less than 60% and were excluded from the analysis. All remaining papers ($n = 8$) were in favour for the use of acupuncture for the treatment of PDS.

The papers that satisfied the stated criteria ($n = 6$) were examined for the following information: acupuncture points used, type of stimulation, number of treatments, frequency of treatment, duration of the individual treatment, the total duration of the treatment, outcome and follow-up.

Results

To ensure a reasonable basis for comparison between the six selected studies (Johansson *et al*, 1991; List *et al*, 1992; List and Helkimo, 1992; Raustia *et al*, 1985a, 1985b; Raustia and Pohjola, 1986), the criteria for inclusion and

assessment were analysed. All patients were treated in Departments of Stomatognathic Physiology at a university clinic. In all papers both subjective variables, such as Visual Analogue Scale (VAS) for pain, a dysfunction index based on objective variables such as the extent of movement of the mandible, function of the mandible, tenderness with palpation of the temporomandibular joint and muscles of mastication were recorded at entry and exit. The selected studies did not utilise any patients with major psychogenic disease or pathologic conditions affecting the temporomandibular joint. As controls, occlusal splints, a recognised form of treatment (Davies and Gray, 1997a, 1997b, 1997c) were used as a reference guide in all selected studies. In two studies (Johansson *et al*, 1991; List *et al*, 1992) an additional non-treated control group were included as well. Based on information on subjects provided by these authors it is reasonable to judge that the three studies selected here used inclusion criteria appropriate for PDS. The assessment

of the patients were very similar and the reference procedures were the same. Therefore, it is possible to attempt a comparison of the methodology used and the results. Where information in the published reports was insufficient, this was clarified by personal communications with authors concerned.

Selection of points, type of stimulation, number of treatments, frequency of the individual treatment, duration of the individual treatment and the total treatment time are shown in Table 1. A total of 27 acupuncture points have been used in these studies for the treatment of PDS.

The location of the acupuncture points used in the three selected studies are shown on Figures 1 and 2. In all cases local points on the face were mainly located over the temporomandibular joints or in close proximity (Figure 1). Two of the authors (List *et al*, 1992; Raustia *et al*, 1985a) used a few additional points located on the neck (Figure 1). In all studies, a point between first and second metacarpal

Table 1 Summary of the individual studies on the selection of acupuncture points, type of stimulation, number of treatments, frequency and duration of treatments, follow-up time for PDS

Acupuncture points	List <i>et al</i> (1992)	Johansson <i>et al</i> (1991)	Raustia <i>et al</i> (1985a)
Located on the face			
LI-20			Occasional
BL-2	+		
ST-5		+	
ST-6	+	+	+
ST-7	+	+	+
ST-8		+	
SI-18	+	+	+
GV-23			+
GV-26			Occasional
EX-2	+		
EX-3			+
SI-19	+		
GB-1			+
GB-2	+		
GB-3		+	
GB-14			Occasional
TE-22		+	
TE-23		+	Occasional
Located on the neck			
LI-18			+
SI-17			+
GV-14			+
GV-20	+		+
GB-20	+		+
BL-10	+		+
Distant points			
LI-4	+	+	+
ST-36	+		Occasional
BL-60			+
Regime used			
Number of treatments	Manual/electrical 6-8	Manual 6	Manual 3
Frequency of treatment	Weekly	Weekly	Weekly
Duration of treatment	30 minutes	30 minutes	20 minutes
Additional stimulation	None used	3 times a session	None used
Duration of treatment	6-8 weeks	6-8 weeks	4 weeks
Follow up time	1 year	3 months	3 months
Number of patients	80	45	50

Location of points on the face are within the innervation of the trigeminal nerve. Location of points on the neck are located within the innervation of C2 and C6. Location of distant points are located either on the arm or leg. Explanation to the abbreviations for the acupuncture points: LI, Large Intestine; BL, Bladder; ST, Stomach; SI, Small Intestine; GV, Governor Vessel; EX, Extra point; GB, Gall Bladder; TE, Triple Energizer. + indicate that the point has been used in the study as a standard point. Occasional = that the point has been used sometimes and not as a standard point in the study

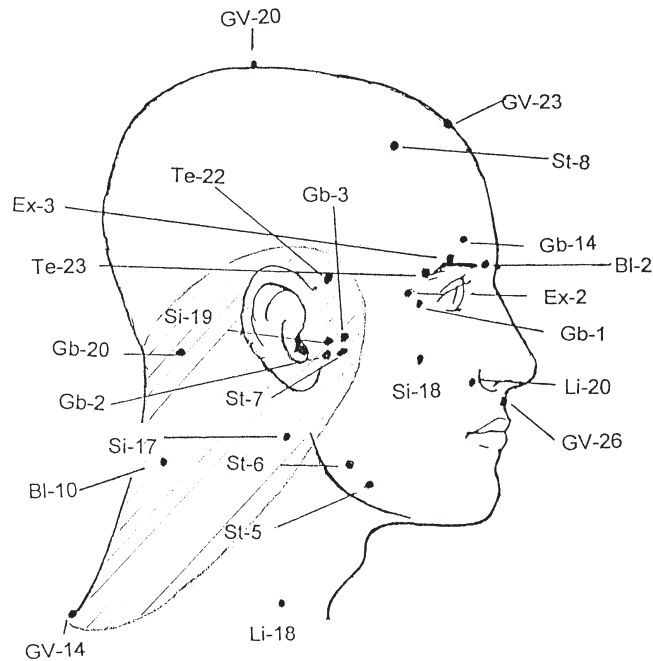


Figure 1 Location of local acupuncture points on the face and neck for the treatment of PDS. Location of the points on the face are within the innervation of the trigeminal nerve. Location of points on the neck are located within the innervation of C2 and C6. The shaded area shows the localisation of points related to PDS used in most subjects. Explanation to the abbreviations for the acupuncture points: LI, Large Intestine; BL, Bladder; ST, Stomach; SI, Small Intestine; GV, Governor Vessel; EX, Extra points; GB, Gall Bladder; TE, Triple Energiser

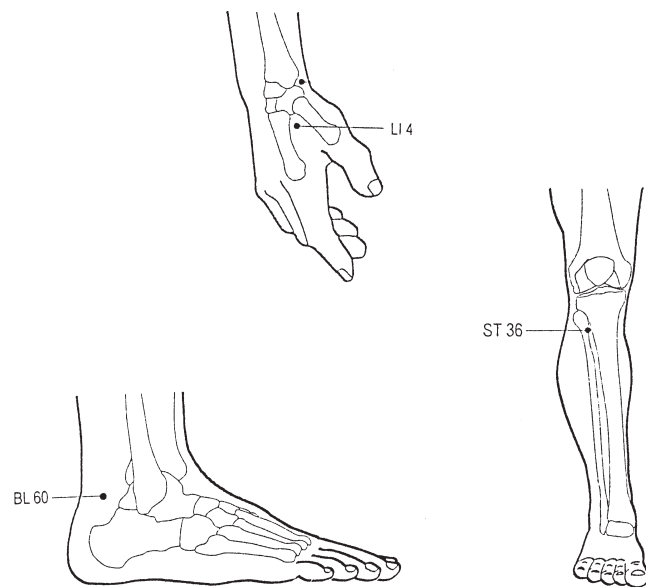


Figure 2 Location of distant acupuncture points for the treatment of PDS. Explanation to the abbreviations for the acupuncture points; LI, Large Intestine; ST, Stomach; BL, Bladder

bone (LI-4) (Figure 2) was used as the distant point. In two studies by List *et al* (1992) and by Raustia *et al* (1985a), an additional distant point (ST-36), located just below the knee was used. However, the point (ST-36) was only used as a standard point in the study of List *et al* (1992), whereas

it was used as an occasional supplement in the study of Raustia *et al* (1985a). Finally, Raustia *et al* (1985a) used a point located between the Achilles tendon and the lateral malleol (Figure 2).

Manual stimulation was used in all studies, where the needles were rotated clockwise and anticlockwise until a De-qui sensation was obtained (a feeling of a dull ache in the region, occasionally radiating, eg, along the arm). In one study (List *et al*, 1992) additional electrical stimulation (2 Hz) was given during the last three treatments. In one study (Johansson *et al*, 1991), the needles were manipulated three times during the 30-min long session. In the other two studies no information was given regarding additional stimulation.

Regarding the number of treatments, there were variations from three treatments used by Raustia *et al* (1985a) to six to eight treatments used by List *et al* (1992). The duration of treatment regime lasted between 4 to 8 weeks. All three studies demonstrated beneficial effects similar to conventional occlusal splint treatment (Table 2).

Discussion

The purpose of this paper is to analyse the treatment protocol of previously published papers and if possible recommend a standard acupuncture treatment for PDS.

The selection of local points in one paper (List *et al*, 1992) is quite clear, whereas in the other two studies it is not as precise. In the paper of Raustia *et al* (1985a) it is stated: 'The puncture points were chosen individually on the basis of a clinical interview and examination. Both local and distant points known empirically to influence the musculoskeletal, psychophysiological, and autonomic nervous system were used'. Furthermore, the paper states: 'Acupuncture were performed according to the principles described by Bischko (1978)'. The other paper Johansson *et al* (1991) states: 'Needles were inserted in the painful area (local points) and in a strongly reacting site (distant point) ... The points used were those considered to be effective for treatment of headache and/or facial pain', according to Mann (1987). However, in both papers it was stressed that local tender spots in the region were treated, and it is generally accepted that myofascial triggerpoints correlate anatomically with classical acupuncture points in 70% of the cases (Melzack *et al*, 1977). Unfortunately, the lack of precise information regarding selection of points weakened the information given in these papers. To obtain the precise information the authors of the two papers (Johansson *et al*, 1991; Raustia *et al*, 1985a) were approached and the actual points used were verified.

In all studies local points were used and despite small variations, the selection of the local points must be considered logical because all points are located within the same segment. A segmental approach has in a number of studies (Lundeberg *et al*, 1987; Kjartansson *et al*, 1988) proved more effective than a non-segmental approach. Despite the fact the points GB-20 and BL-10 are located outside the segment, it must be considered a good choice because these points are some of the most useful points in the treatment of headache (Mann, 1987). The acupuncture point GV-20 has probably been selected by two of the

Table 2 Outcome and comparison between occlusal splint treatment and acupuncture in the three selected studies by Dysfunction-index

Technique used	<i>Raustia et al (1985a)</i>		<i>Johansson et al (1991)</i>		<i>List et al (1992)</i>	
	Before	3 months	Before	3 months	Before	3 months
Splint	52	28	58	27	38	22
Acupuncture	56	36	55	26	38	22
Untreated control	None used	None used	60	52	None used	None used

Dysfunction index incorporate a number of subjective and objective variable. In the study of *Raustia et al*, and *List et al*, the maximal obtainable score were 25, whereas in the study by *Johansson et al* the maximal obtainable score were 100. To make comparison possible the score obtained in the study of *Raustia et al* and *List et al* are multiplied by four

authors because it is considered to be one of the most relaxing points, which could be beneficial in the treatment of PDS which is considered to be stress induced.

Regarding the use of distant points all papers gave a clear description of the acupuncture points used. In all studies the point LI-4 was used. This acupuncture point seems to have a specific effect on dental pain (*Andersson et al*, 1973) which makes it a logical distant point. Finally, the distant point ST-36 were used as a standard in one study (*List et al*, 1992) and for selected cases in another study (*Raustia et al*, 1985a). In one study *Raustia et al* (1985a) occasionally used an additional distant point (BL-60). The selection of ST-36 and BL-60 are probably based on tradition as ST-36 in TCM reflect the most important distal point for abdominal disorders and BL-60 main indication is sciatica and pains in the ankle joint (*Stux and Pomeranz*, 1987). This is unlikely to be based on scientific knowledge as to a specific effect on PDS.

In general, all acupuncture points used in these three studies must be considered relevant for treating PDS. However, to clarify the selection of the most commonly used acupuncture points a summary is presented in Table 3. This summary is based on the fact that all, or at least two of the

authors have used the point as a standard point in the treatment. A complete list of all points used is provided in Table 1.

The number of treatments varied between three and eight. A multi-centre study (*Rosted*, 1996) was able to demonstrate that six treatments on average were sufficient to either cure or control a disease and six treatments seems to be the agreed number of sessions used by most authors. Regarding the frequency of treatments, once weekly treatment seems reasonable.

The duration of the individual treatment varied from 20 min to 30 min and 30 min treatment seems to be the recommended treatment time. The opinion on this subject is divided for treatment of other disorders. Thus, *Hansen* (1997) in the treatment of neck and shoulder pain was able to show that patients treated with acupuncture for 5 min, compared to patients receiving the same treatment for 20 min, did not show any significant difference in the benefits at termination of the treatment or at a 6-month follow-up. However, the study is the only one of its kind and needs to be reproduced. Regarding additional treatment during the session *Johansson et al* (1991) stimulated the needles manually three times during the session. Unfortunately, we

Table 3 Summary of the selection of acupuncture points based on the fact that either all or at least two authors have used the point as a standard treatment. In the bottom panel the regime used, number of treatments, frequency and duration of treatments for PDS are given

<i>Acupuncture points</i>	<i>List et al (1992)</i>	<i>Johansson et al (1991)</i>	<i>Raustia et al (1985a)</i>
Located on the face			
ST-6	+	+	+
ST-7	+	+	+
SI-18	+	+	+
Located on the neck			
GV-20	+		+
GB-20	+		+
BL-10	+		+
Distant points			
LI-4	+	+	+
Regime used	Manual/electrical	Manual	Manual?
Number of treatments	6-8	6	3
Frequency of treatment	Weekly	Weekly	Weekly
Duration of treatment	30 minutes	30 minutes	20 minutes
Additional stimulation	None used	3 times a session	None used
Duration of treatment	6-8 weeks	6-8 weeks	4 weeks

Location of points on the face are within the innervation of the trigeminal nerve. Location of points on the neck are located within the innervation of C2 and C6. Location of distant points are located either on the arm or leg. Explanation to the abbreviations for the acupuncture points. LI, Large Intestine; BL, Bladder; ST, Stomach; SI, Small Intestine; GV, Governor Vessel; EX, Extra point; GB, Gall Bladder; TE, Tripple Energizer. + indicate that the point has been used in the study as a standard point

do not have any data to support the beneficial effect of additional stimulation, and it is an obvious subject for further research.

In all these studies the duration of the whole treatment were between 4 and 8 weeks. These findings are supported by Rosted (1996), who found an average duration of 5 weeks acupuncture therapy was sufficient in most cases to obtain pain relief.

In all studies it was reported that acupuncture had a similar outcome to occlusal splint therapy. These findings are supported by the follow-up study of List and Helkimo (1992) who were able to demonstrate a significant effect after both acupuncture and occlusal splint therapy 1 year after termination of the treatment. In their follow-up study, it was found that occlusal splints were able to provide a slightly better outcome than acupuncture. However, the reason for these findings is probably that patients allocated to the occlusal splint group were able to use the splint in the whole follow-up period, whereas the patients receiving acupuncture did not have any additional treatment in the follow-up period. In future studies involving acupuncture it is thus important to evaluate the effect by repeating acupuncture, eg every 3 months, so that the follow-up period is extended and made comparable to splint therapy.

Conclusion

Acupuncture has in three out of three randomised controlled studies proved effective for the treatment of PDS. Based on the information so far available acupuncture must be considered as a valuable alternative/supplement to conventional treatment. On reviewing the available literature, local points on the face and neck: ST-6, ST-7, SI-18, GV-20, GB-20, BL-10 are recommended. As a distant point, LI-4 is recommended. Treatment should be conducted every week to a total of six treatments and continued once in 3 months until remission of symptoms. After inserting of the needles and an initial stimulation to achieve the De-qui sensation, the needles should be left *in situ* at the acupuncture site for 30 min. Further trials into this subject will clarify its use in the treatment of PDS.

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