Acupuncture for Treating Temporomandibular Disorder: Retrospective Study on Safety and Efficacy

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Abstract
This study aimed to retrospectively examine the efficacy and safety of acupuncture for the relief of pain originating from temporomandibular joint disorder and trigeminal neuralgia. Participants included patients suffering from trigeminal neuralgia or temporomandibular joint disorder with osseous pathology ruled out by panoramic X-rays. Participants received a series of 8–10 weekly acupuncture treatments and rated their pain via a visual analogue scale. From assessment of a total of 39 patients, analysis of pain severity before and after treatment showed that acupuncture intervention was highly beneficial for patients with temporomandibular joint disorder (88.6%, $p<0.01$), compared with patients with trigeminal neuralgia in which there was only a minor effect (25%). The data also demonstrated that acupuncture was both efficacious in acute patients (91%, $p<0.01$) and chronic patients (70%, $p<0.05$) and elicited no side effects during the course of treatment. Acupuncture treatment was a safe and efficient methodology for relieving the pain of patients suffering from temporomandibular disorder with no detectable osseous joint component. Based on these results, a randomized clinical trial is being initiated at the Stomatologic Clinic at the Tel Aviv Sourasky Medical Center to assess the role of acupuncture in treating temporomandibular joint disorder.

1. Introduction
Temporomandibular disorders (TMDs) comprise a nonhomogeneous group of conditions characterized by pain and/or dysfunction of the temporomandibular joint, masticatory muscles, or both. The syndrome has been variously classified into three basic types: masticatory muscles disorder, soft tissue disorder, such as disk displacement, and joint hard tissue disorder, such as osteoarthritis and osteoarthrosis [1,2].

Patients usually exhibit a combination of these three types with each patient having their own specific TMD. The etiology of TMD is complex and undetermined, with both central and peripheral mechanisms having been proposed [3,4]. Local factors have been suggested; among them, trauma to the face or neck, occlusal trauma, prolonged mouth opening, “intubations,” habits that involve heightened/persistent pressure to the chewing mechanism (e.g., chewing gum or nail biting), bruxism, or clenching [5–7]. Systemic factors are primarily mental
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stress, anxiety, depression [8–10], fatigue or sleep disturbance [11], and systemic illnesses such as rheumatoid arthritis or fibromyalgia [12]. It seems to us that, also with respect to etiology, each patient has his or her own specific etiology.

The signs and symptoms of TMD are usually facial pain or pain in the temporomandibular joint during movement or at rest, pain on palpation of the masticatory muscles, limitation or deviation of the jaw movement, joint sounds or clicking, earache, and headache. The primary complaint of patients seeking treatment is pain and, despite the fact that approximately 75% of the affected population exhibit at least one symptom, only 5% require treatment.

There is no standard management of TMD and the various approaches generally include a combination of occlusal splint, medications (nonsteroidal anti-inflammatory drugs, muscle relaxants, tricyclic antidepressants), physical therapy (heat and ultrasound), and behavioral treatment, such as changing habits that overload the chewing mechanism [13]. Counseling and surgery are also offered, albeit rarely [14]. Treatment aims to alleviate pain, return function, improve the quality of life, and prevent recurrence. Conventional treatment often fails, whereupon acute cases become chronic and have with a bleaker prognosis.

Acupuncture is a 2500-year-old therapeutic tool that originated in the Far East. In the 1970s, it was reported to suffice as a full analgesia during surgical procedures and as an efficient supplement or alternative to conventional treatments for a wide variety of problems that only received a partial solution using conventional treatment [15]. Concurrently, there has been an increase in the number of studies, especially in the last decade, aimed at understanding acupuncture operational mechanisms and to show the efficacy thereof, pursuant to conventional medicine norms. Today, pain clinics have been increasingly combining conventional treatment with acupuncture to treat pain deriving from a muscular or neurological source. In 1997, the National Institutes of Health determined the efficacy of acupuncture in treating postoperative dental pain and stated that it could constitute a beneficial complementary or alternative treatment for fibromyalgia, myofascial pain, and osteoarthritis [16]. In 2002, the World Health Organization reported that chronic myofascial pain has a good reaction to acupuncture treatment [17].

In Traditional Chinese Medicine (TCM), acupuncture is performed by inserting very thin needles into certain points, with a precise anatomic position, on the skin surface along energetic lines called “meridians” to harmonize energy flow (Qi) and stimulate natural healing mechanisms of the body and soul [18]. Many studies “translate” this Chinese definition into biological, biochemical, and neurophysiobiological impact terms. It has been shown that, at the time the needle is inserted, β-endorphin, endomorphin, enkephalin, serotonin, and dopamine levels rise in the blood and brain, whereby administering naloxone prevents such rises [19]. Additionally, with needle insertion there is a release of immune-modulators which enhance the lipolytic process and have an impact on adrenaline and noradrenaline release [20].

The above described phenomena are the basis for using acupuncture to treat pain, anxiety and depression, gastrointestinal disorders, and rehabilitation after stroke [21,22]. The analgesic effect experienced is produced by a general body response via mild brain and hypothalamic activation and a direct inhibition at the spinal cord level. This appears to be a partial explanation for the effect of acupuncture in trigeminal neuralgia (TN), fibromyalgia, osteoarthritis and migraines; thus it constitutes a valuable tool in modern neurology [22].

Research in the field of acupuncture treatment for TMD comprises many methodological and ethical problems which only recently have been resolved and, as a result, the clinical success of acupuncture reported in previous studies appears to be lacking a solid, scientific basis. With the purpose of examining the efficacy of acupuncture only, through studies having acceptable methodological quality, several literary reviews have been performed. As early as 1989, Patel et al [23] executed a meta-analysis of 14 randomized controlled trials which concluded that most studies of acupuncture treatment were beneficial for chronic pain. Later, Rosted [24] examined publications describing acupuncture in dentistry and found that only 15 of the 74 studies were methodologically admissible and that 11 of them confirmed that acupuncture was beneficial for analgesia in treating TMD disorders. It was noted that the studies that are weaker in methodology are the ones that never proved the benefits of acupuncture.

In 1998, Ernst and White [25] found, using their own criteria, only three randomized, controlled studies with adequate methodological standards. The three studies [26–28], performed in Sweden, tested the efficacy of acupuncture in treating TMD. The first study, conducted by Raustia and Pohjola in 1985 [26], compared two random groups of 25 TMD patients. One group was administered weekly acupuncture treatment and the second given conventional treatment using an occlusal splint for a month. Results were evaluated using the Helkimo Index, which was used in the 1980s, and a parameter scale for the temporomandibular joint, which included joint movement range, pain during movement, and pain on palpation of the joint and masticatory muscles. The results showed substantially more immediate improvement in the acupuncture group with
respect to movement disorder and less with respect to pain compared with the group that was administered conventional treatment. The observed differences disappeared after 3 months and the two groups reported similar improvements in all of the value measurements; it is noted that a more significant improvement was observed among patients whose condition was worst upon starting the acupuncture treatment [26–28].

The second study, conducted by Johansson et al in 1991 [29], examined 45 patients suffering from craniomandibular dysfunction (CMD), randomly assigning them to one of three groups. The first group was treated by 6 weekly acupuncture treatments, the second group received an occlusal splint, and the third group was on a waiting list for treatment and served as a control, and the values measured included the visual analogue scale (VAS), objective measurements, and subjective reports. Similar to the studies by Raustia and Pohjoa [26], it was found that acupuncture treatment was beneficial and yielded results identical to the occlusal splint [29].

The third study, conducted by List et al in 1992 [30], was of a similar design to the second and followed a group of 110 patients suffering from CMD over an average of 4 years. The immediate reports pointed to a significant improvement in the group treated with acupuncture but, 1 year later, the improvement was identical in both groups. It was noted that, with respect to the subjective values and quality of life, the acupuncture treatment was found to be more beneficial than the occlusal splint [30]. Two additional studies are noteworthy in this context: In 1987, List et al [31] examined the impact of acupuncture in 10 patients suffering from chronic (>13 years) CMD who did not respond to conventional treatment and observed, after eight acupuncture treatments, both objective and subjective improvements in 9 patients (substantial improvement in 3, slight improvement in 6), an effect that persisted as long as 7 months after treatment [31]. Elsharkawy and Ali [32], from the Cairo University, conducted a study with 100 patients and compared acupuncture treatment, occlusal splint, a combination of the two, and a control group and observed similar results in the splint and acupuncture groups, and a combination of both yielded excellent clinical results. The Egyptian team recommended starting with acupuncture treatment and, if need be, supplementing the treatment with a splint.

The disadvantage of studies conducted up to 2002 was the lack of a comparative placebo group, a deficiency which has contributed to academic reservations in using acupuncture for TMD. In 2002, Park et al [33] found a treatment method that allowed for a double blind experimental design and a valid placebo group via use of a Park Sham device, dramatically improving the methodological standards. Subsequently, a randomized, controlled study was constructed by Smith et al in 2006, examining the efficacy of acupuncture in 27 patients suffering from TMD from a muscular cause. Subjects were assigned to two groups, with the first receiving a real acupuncture treatment and the other a placebo Park Sham treatment, and results measured as subjective values, gauging pain through the VAS, pain distribution, lateral opening and movement range, joint and muscular sensitivity, noises from the joint, and headaches. Statistically significant improvements were found in the level of pain, functional disorder, and movement range within the real acupuncture group, while the placebo group experienced no statistically significance improvements. Therefore, the authors concluded that acupuncture had a positive effect upon signs and symptoms characterizing TMD from muscular source and that the Park Sham Device was reliable for future studies [34].

Concurrent with efforts to establish a credible and standard study protocol, there are many reports in the literature pertaining to clinical trials pointing to the benefits of acupuncture to treat TMD. Among them is a study, published by Goddard et al in 2006 [35], of 29 patients suffering from chronic facial pain, all of whom had in the past received conventional treatment, including drugs, behavioral treatment, physical treatment, and splint therapy, without any significant improvement. The degree of pain, measured before and after acupuncture treatment using the VAS, revealed a statistically significant improvement (p < 0.001) in the degree of pain in the short term [35].

2. Materials and Methods

2.1. Study design and patients

The extent to which facial pain was alleviated in patients suffering from either TN or TMD was examined retrospectively after they had received a series of 6–10 weekly treatments at the Stomatologic Clinic at the Tel Aviv Sourasky Medical Center over 18 months. The indications for referral to acupuncture treatment in this study were the failure of conventional treatments in chronic cases (i.e., symptoms for >3 months), an alternative to conventional treatment in acute cases at the patient’s request, or a first treatment while waiting to undergo physiotherapy; patients with radiological signs of osteoarthritis, osteoarthrosis or idiopathic condylar resorption were excluded. All participants signed an informed consent form prior to receiving nonconventional treatment.
2.2. Measurements

The primary outcomes, as changes in pain level, were graded on a VAS of 0–10 (0 = no pain, 10 = strongest pain), with pain level being measured before starting a series of treatments and at every visit before treatment. The difference between the first and last VAS values was examined and the results divided into three categories: major pain alleviation, a difference of 80–100%; partial alleviation, 30–80%; and no alleviation, 0–30% (up to 30% chosen here to minimize a possible placebo effect).

2.3. Treatment

The treatment protocol included local acupuncture points in the TMJ region and masticatory muscles, regional points in the head and neck, and distal points on the upper and lower limbs. Frequently, the local and regional points were identical to the trigger points used for pain relief [36]. The distal points affect the sympathetic nerve system and various pain gates, thereby enhancing the impact of local acupuncture. The distal points were chosen according to TCM or the Five Elements Theory.

According to TCM, pain is conceived of as Qi stagnation and the purpose of the treatment is to remove the stagnation and regulate a smooth flow of Qi through the meridians. Therefore, the LI-3 point, located in the foot on the liver meridian, responsible for the smooth flow of Qi through the body and soul, were used in many cases. LI-3 also has an impact upon mental stress, a very common risk factor for TMD. LI-4, located on the hand, was also often used, being an empirical point with a strong analgesic impact. Additional points on the head and neck were specifically chosen for each patient based on his/her clinical condition.

Very thin, disposable needles were inserted until reaching the De Qi sensation, which is described as a tingling, numbness, and other unique feelings, occurring after an acupuncture needle has been properly placed in the body and disappearing after several seconds, and retained in place for approximately 30 minutes. All treatments were conducted by one of the authors (M.N.) who is a certified dentist and an accredited acupuncture practitioner.

2.4. Statistical Analysis

The difference between the pain levels at the beginning and end of the treatment was evaluated by a one-way Student t test using an SPSS software package (SPSS Inc., Chicago, IL, USA). Statistical significance (p < 0.05) was established by a post hoc Turkey’s pairwise comparison.

3. Results

The study group consisted of four patients with TN and 35 patients with TMD. Seventeen patients were diagnosed as having chronic conditions (>3 months), 4 with TN and 13 with TMD; 22 patients diagnosed as having acute conditions (<3 months), all with TMD. The average number of treatments was 7.3. Table 1 lists the baseline characteristics of these patients.

Pain reduction was reported by 32 (82%) of the 39 patients treated in acupuncture, with major pain alleviation (>80%) observed in 28 patients (71.7%), while the remaining 4 patients reported a partial pain alleviation (30–80%). Analysis of the treatment impact after differentiating between patients with TMD and TN revealed that 31 of the 35 TMD patients, but only 1 of the 4 TN patients reported significant pain improvement (Figure 1A). Dividing the study group into acute and chronic cases revealed that 91% of the former and 70% of the latter reported significant improvement (Figure 1B). Notably, the average number of treatments necessary to achieve such improvement was 5.8 in acute cases compared with 8.1 in chronic cases. No side effects were observed during the course of treatment administration to any patients, regardless of diagnosis and severity of symptoms.

4. Discussion and Conclusions

The results of this study showed that Chinese acupuncture was safe as administered here and was efficient in alleviating pain in patients suffering from TMD not caused by an osseous source. In approximately 90% of these patients, a statistically significant pain alleviation was observed, with the pain completely gone in most patients.

Despite the fact that many studies have illustrated the efficacy of acupuncture in treating TN, the results of this study do not support this conclusion. It should be noted that the present cases were all chronic and underwent other treatments.

<table>
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<tr>
<th>Table 1 Baseline data on patients receiving acupuncture</th>
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<tbody>
<tr>
<td>Patients (n)</td>
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<tr>
<td>Mean age (yr)</td>
</tr>
<tr>
<td>TMD patients</td>
</tr>
<tr>
<td>TN patients</td>
</tr>
<tr>
<td>Chronic disease (&gt;3 mo)</td>
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<tr>
<td>Acute disease (&lt;3 mo)</td>
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<td>Average no. of treatments</td>
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TMD = temporomandibular disorders; TN = trigeminal neuralgia.
Additionally, it appears to us that there was a range of VAS within “hands reach” of acupuncture being VAS up to 7, i.e., slight to moderate pain. There are researchers of the opinion that stronger pain requires stronger stimulation by electropuncture [37].

The difference between significant improvement in acute cases (90%) after an average 5.8 treatments and chronic cases (70%) after an average 8.1 treatments, demonstrated the effectiveness of early treatment with acupuncture and thus our conclusions here do not support the contention that the acceptable approach must be to first try conventional treatments. These results go hand in hand with the importance of preventing simple acute pain involving peripheral mechanisms, from becoming more complex, chronic pain involving central mechanisms.

Similar to earlier studies [27−31], local and distant acupuncture points were combined in the treatment protocol. Despite the fact that no specific histological structure has been identified for acupuncture points, different organizations of vascular or muscular cutaneous nerve endings have been found. It has been proposed that the distant acupuncture points produce a nonspecific analgesic response via mechanisms on a cortical and hypothalamic level, while the local points activate additional, more specific analgesia via inhibition at the spinal level. In this study, acceptable points from other studies were used to treat TMD, as recommended by Rosted [37] and other researchers [26−28]. Additionally, in certain cases in which the mental stress was significant, an acupuncture method was used that is based on the Five Elements theory with its included psychological diagnosis.

Contrary to most studies in this field, the number of treatments was not limited to six [38]. Some patients received up to ten treatments to benefit them from the treatment set, as acceptable with classical acupuncture. In our opinion, there is reason to consider an additional set after an appropriate break and considering that, at that time, there is already some relief from the first set; this is based on a “rule of thumb” in acupuncture—a month of treatment for every year of the illness. In addition thereto, we recommend, in agreement with Rosted [37], maintenance treatment every 3 months.

Here, TMD pain was addressed without adhering to the various TMD classifications, except for clear osseous changes of the condyle head, for two reasons: (1) pain was the primary complaint for most patients suffering from TMD and was the cause of physical and psychological distress far harsher than the movement restriction; the reason why Cooper and Kleinberg [39] suggest constructing a new classification for TMD by splitting pain levels; and (2) a parallel is drawn between pain properties and acupuncture effectiveness, as illustrated in Table 2. This parallel is probably the physiological basis for acupuncture’s effectiveness and it appears to us that the more we understand pain mechanisms, the better we will understand acupuncture mechanisms and vice versa.

Additionally, acupuncture directly impacts mental stress and sleep quality, factors that have been demonstrated as risk factors for TMD and pain in general. The holistic approach in acupuncture allows

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**Figure 1** Change in pain levels in patients treated by acupuncture. (A) Pain alleviation of trigeminal neuralgia (TN) and temporomandibular disorder (TMD), (B) pain alleviation of acute and chronic conditions, statistical significance between pain levels at treatment beginning and end evaluated by one-way Student t test.

**Table 2** Parallel between pain experience and acupuncture impact

<table>
<thead>
<tr>
<th>Acupuncture impact level</th>
<th>Pain experience</th>
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<tbody>
<tr>
<td>Peripheral and spinal</td>
<td>Sensory experience</td>
</tr>
<tr>
<td>Hypothalamic</td>
<td>Emotional sensory</td>
</tr>
<tr>
<td>Cortical</td>
<td>Cognitive</td>
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us to handle ancillary factors as well as the holistic problems, such as headaches, neck ache, mental stress, and sleep quality, with the purpose of achieving a physical and mental balance.

In this study, no side effects were observed with respect to acupuncture treatment, which was in concordance with other studies which have demonstrated that Chinese acupuncture is a treatment method characterized by very low rates of side effects [40]. This being said, we recommend using acupuncture treatment only administered through certified and experienced acupuncture therapists to achieve the maximum therapeutic potential.

In conclusion, we demonstrated here that Chinese acupuncture is safe and can be efficient in alleviating pain in patients suffering from TMD without clear joint pathology. Next, with the existence of a reliable acupuncture placebo, we intend to conduct a randomized, controlled study in Tel-Aviv Medical Center to examine the efficacy of acupuncture in treating TMD of any origin and with emphasis on the initial pain level.

References

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