

# Acupuncture: An Alternative Therapy in Dentistry and Its Possible Applications

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## ABSTRACT

**Background:** Traditional Chinese acupuncture has a history of more than 2500 years and is one of the best-known complementary and alternative therapies. Acupuncture stimulates the nervous system and alters the processing and perception of pain signals and also releases natural painkillers, such as endorphins and serotonin in the nervous system. Acupuncture's successful use for various dental conditions has been proven. Thus, it is important for the dental clinicians to be familiar with the applications of acupuncture for dental disorders.

**Objective:** One aim of this article is to review related articles in the literature that have focused on acupuncture and its applications in dentistry. Another aim is to provide a quick sketch of acupuncture use in dentistry for dental clinicians.

**Materials and Methods:** A detailed search was performed to identify systematic reviews and research articles, using PUBMED and the Cochrane Database of Systematic Reviews. Language was restricted to English. Key search terms were acupuncture in dentistry, myofacial pain, temporomandibular disorders, xerostomia, dental pain and gag reflex.

**Results:** All of the current the authors independently extracted data for analysis and review. Two independent reviewers screened the titles and abstracts of all the articles for eligibility. When the reviewers noted that an abstract or title of an article indicated that the article was potentially useful, full copies were retrieved. Ultimately, 40 articles underwent full-text review.

**Conclusions:** The research to date certainly offers valid applications of acupuncture in dentistry. Meanwhile, practical strategies with the highest success rates are needed to use in further interventions.

**Key Words:** Acupuncture, Myofacial Pain, Temporomandibular Disorders, Xerostomia, Dental Pain and Gag Reflex

## INTRODUCTION

**A**CUPUNCTURE MEANS "TO PUNCTURE WITH A NEEDLE." The term *acupuncture* is comprised of two different words from Latin: *acus* means *needle* and *puncture* means *insertion*.<sup>1</sup> Traditional Chinese Medicine (TCM) defines acupuncture as:

the stimulation of certain points on or near the surface of the human body through any technique of point stimulation with or without the insertion of needles, these include the use of electrical, magnetic, light and sound energy, cupping and moxibustion (the burning on or over the skin of selected herbs), to normalize physiologic functions or to treat various conditions of the human body.<sup>2</sup>

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Traditional Chinese acupuncture has a history of more than 2500 years but is still popular and is one of the most well-known complementary and alternative therapies.<sup>3</sup>

The term *acupuncture* can also be used in its broad sense to include:<sup>4</sup>

- (1) Traditional body needling
- (2) Moxibustion
- (3) Photo acupuncture
- (4) Electroacupuncture (EA)
- (5) Microsystem acupuncture, such as ear, face, hand, and scalp acupuncture
- (6) Acupressure (the application of pressure at selected sites on the body).

In 1979, the World Health Organization (WHO) endorsed the use of acupuncture to treat 43 symptoms, which was later discussed by Wong.<sup>5</sup> In 1996, this was extended to 64 conditions. In the Geneva WHO 2003 report, pain in dentistry (including dental pain and temporomandibular dysfunction), facial pain and postoperative pain were listed among the conditions for which acupuncture has been proven to be successful through controlled trials, to be an effective treatment.

In dentistry, the ability of acupuncture has been proven for managing various chronic orofacial disorders. There are numerous reports of randomized controlled trials on the analgesic effect of acupuncture for postoperative pain caused by various dental procedures and by other chronic disorders.<sup>6</sup> According to the literature, acupuncture is more effective than a placebo or sham acupuncture. Thus, acupuncture can be considered as a sensible alternative or supplement to current dental practice, both as an analgesic and for addressing various dental disorders.

A detailed search was performed to identify systematic reviews and research articles (40 articles underwent full-text review) using PUBMED and the Cochrane Database of Systematic Reviews.

## MECHANISM OF ACTION

Acupuncture works by stimulating the body at certain points. During therapy, thin steel needles are inserted into the areas of interest and then manipulated gently by hand or with light electrical stimulation. These points can also be pressed (acupressure) or warmed (moxibustion).<sup>7</sup> Modern research has shown that acupuncture can work on most of the body's systems. Acupuncture mainly acts by stimulating the nervous system, changing the way the nervous system processes pain signals and releasing natural painkillers, such as serotonin and endorphins in the nervous system.<sup>8</sup> Modern scientific researchers have revealed the following actions of acupuncture:

- Regulating various physiologic functions
- Inducing analgesia

- Modulating the limbic–paralimbic–neocortical network
- Increasing local microcirculation
- Protecting the body from infections.

The therapeutic action of acupuncture is brought about through its regulatory actions on various systems, so it can be regarded as a nonspecific therapy with a broad spectrum of indications, particularly in functional disorders.<sup>8</sup>

## ACUPUNCTURE IN DENTAL DISORDERS

Acupuncture can be used to manage a wide range of disorders in dentistry. Acupuncture may provide new hope for patients with disorders that cannot be managed with conventional treatment modalities. Some of the conditions for which acupuncture can be used effectively include:

- Dental pain
- Dental anxiety and gag reflex.
- Temporomandibular joint (TMJ) pain or temporomandibular disorder (TMD).
- TMJ clicking and locking.
- Chronic muscle pain or spasm
- Atypical facial pain
- Headache (tension headache, migraine)
- Xerostomia (dry mouth)
- Nerve pain (neuralgia, especially trigeminal neuralgia, neuropathic pain, nerve injury)
- Paresthesia or anesthesia of the oral and paraoral structures.

## REVIEW OF CLINICAL TRIALS

### Acupuncture for Dental Pain

There is a complex network of nerve fibers in the dental pulp within the tooth and the periodontium surrounding it, and pain is elicited quickly when stimuli activate these nerve endings. Managing dental pain includes identifying and eliminating the etiology (such as caries, gingivitis, and/or periodontitis), followed by administering or prescribing analgesic medication, if required.

The role of acupuncture in dental pain may not involve removing the cause of the pain, but rather, serving as an adjunct in achieving pain relief. The National Institutes of Health (NIH) Consensus Statement on Acupuncture of November of 1998, states that promising results have been shown for postoperative dental pain.<sup>9</sup>

A systematic review by Ernst and Pittler<sup>10</sup> assessed the effectiveness of acupuncture for treating acute dental pain. This review included 16 controlled trials, most of which implied that acupuncture was effective in dental analgesia. The reviewers concluded that acupuncture could alleviate dental pain.

In contrast to these studies, a randomized controlled trial was conducted by Goddard and Albers.<sup>11</sup> to determine if dry needling acupuncture at a specific acupoint could reduce the dental pulp sensory threshold produced by electrical pulp stimulation of incisor teeth. A total of 40 healthy adults who had never received acupuncture nor had any incisor dental restorations were given real or sham acupuncture (the latter with a blunt needle that only touched the skin without penetrating it). No significant differences in pain reduction were noted between the volunteers who received verum acupuncture and those who received the sham acupuncture. The researchers concluded that acupuncture did not reduce dental pulp sensory threshold.

Chapman et al.<sup>12</sup> found that the tooth pain threshold to electrical stimulation was significantly raised by acupuncture. Acupuncture has also been shown to produce short-term analgesia.

Acupuncture may help relieve dental pain by:<sup>13</sup>

- Stimulating the nerves located in muscles and other tissues, which leads to release of endorphins and other neurohumoral factors (e.g., neuropeptide Y, serotonin)
- Changing processing and perception of pain in the brain and spinal cord
- Reducing the cardiovascular reflex elicited by toothache (this is associated with the adrenergic system)
- Increasing the release of adenosine, which has anti-nociceptive properties
- Modulating the activity of the limbic–paralimbic–neocortical network
- Reducing inflammation, by promoting release of vascular and immunomodulatory factors
- Increasing local microcirculation, which helps disperse swelling.

### Acupuncture for Dental Anesthesia

Acupuncture can act as an adjunct for achieving anesthesia during dental procedures. Studies have shown that the onset time for regional anesthesia after administration of prilocaine hydrochloride is ~2 minutes. A study was conducted by Rosted and Bundegard<sup>14</sup> in 2003, to investigate if the induction time of a local anesthetic can be reduced if acupuncture is administered before injection. In the group who received local acupuncture before injection of an inferior alveolar nerve block (with prilocaine hydrochloride), the induction time was 62 seconds versus ~2 minutes in the control group in whom only the nerve block was administered. Findings from this study suggested that regional acupuncture can accelerate the induction time after a nerve block is administered.

Simmons and Oleson<sup>15</sup> evaluated auricular electrical stimulation and dental pain threshold. A modified double-blinded evaluation of naloxone reversibility of dental analgesia produced by auricular electrical stimulation (AES)

was examined in 40 subjects assigned randomly to one of four groups: (1) AES followed by saline (AS); (2) AES followed by naloxone (AN); (3) placebo AES followed by saline (PS); and (4) placebo AES followed by naloxone (PN). Dental pain threshold was tested using a handheld dental pulp tester. A repeated measures analysis of variance revealed significant differences among the four groups. The AES groups had a statistically significant 18% elevation of pain threshold, whereas the two placebo-stimulation groups (PS and PN) remained essentially unchanged. The mean pain threshold increased to >23% for group AS, but fell to <12% for the subjects in group AN, who were given naloxone. These findings suggested a small but significant elevation of pain threshold by AES, an effect partially blocked by naloxone, signifying an endogenous opioid system as one mechanism for AES analgesia.

### Acupuncture for Postoperative Dental Pain

Surgical removal of impacted mandibular third molars is one of the routine aspects of oral–maxillofacial surgery and is well-known to result in morbidity, including pain, swelling, and trismus, which are associated with an intense inflammatory response.<sup>16</sup>

Postoperative pain and swelling after third-molar surgery are usually controlled by administering drugs to patients before and after surgery. Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used to produce an inhibitory effect on the cyclo-oxygenase enzyme. However, these drugs are associated with increased bleeding tendency, gastric ulcerations, and other adverse effects.<sup>17,18</sup>

Evaluation of analgesic effects of EA on postoperative third-molar surgery was performed by Kitade and Ohyabu.<sup>19</sup> These researchers found either an increased tendency for pain—though not significant—or a decrease in pain, depending on the difficulty of tooth removal. The researchers also concluded that application of EA after and before surgery had a slightly more marked analgesic effect than only postoperative EA treatment.

Tavares et al.<sup>16</sup> evaluated the efficacy of EA on postoperative pain control after mandibular third-molar surgery. Twenty-four young patients with symmetrically impacted mandibular third molars were selected. Each patient was submitted to two separate surgical procedures under local anesthesia. On one side, extraction was carried out, using both prior (24 hours) and immediate postoperative application of EA, while on the contralateral side surgery was carried out without any EA treatment. Postoperative pain intensity (rated on a 10-cm visual analogue scale [VAS]) was significantly lower for the EA side and analgesic intake decreased for all evaluated periods. The researchers concluded that EA controlled postoperative pain following mandibular third-molar surgical removal.

Conversely, there are studies showing increase, or statistical similarity in postoperative pain after third molar

surgeries. Ekblom et al.<sup>20</sup> concluded that acupuncture application before or immediately after surgical removal of impacted mandibular third molars raised pain levels during postoperative period. However, acupuncture treatment was applied either before or after surgical procedure and electrical stimulation was not used in this study.

### Anti-Inflammatory Action

A review article by Zijlstra et al.<sup>21</sup> suggested a hypothesis for the anti-inflammatory action of acupuncture. According to the authors, the insertion of acupuncture needles stimulates release of  $\beta$ -endorphins (calcitonin gene-related peptide [CGRP] and substance P). While high levels of CGRP have been shown to be proinflammatory, CGRP in low concentrations produces potent anti-inflammatory actions. Therefore, a frequently applied “low-dose” acupuncture treatment could provoke a continuous release of CGRP with anti-inflammatory activity, without stimulating pro-inflammatory cells.

### Dental Anxiety and the Gag Reflex

Various controlled trials have shown that ear acupuncture is as effective as intranasal midazolam for reducing dental anxiety and reducing the gag reflex. A randomized controlled trial conducted by Karst et al.<sup>22</sup> assessed auricular acupuncture for addressing dental anxiety. This study compared the efficacy of verum auricular acupuncture with intranasal midazolam, sha, acupuncture, and no treatment for reducing dental anxiety in patients undergoing dental extractions. Compared to the control and sham acupuncture groups, the verum auricular acupuncture and midazolam groups were significantly less anxious. In addition, patient compliance assessed by the dentist was significantly improved with auricular acupuncture and intranasal midazolam. The researchers concluded that auricular acupuncture and intranasal midazolam were equally effective for treating dental anxiety.

In 2010, Rosted et al.<sup>23</sup> examined the effect of acupuncture administered prior to dental treatment on patients' level of anxiety. Eight dentists submitted 21 case reports regarding their treatments for dental anxiety. Anxiety levels were assessed by the Beck Anxiety Inventory (BAI). BAI score was assessed before and after acupuncture treatment. All patients received an acupuncture treatment for 5 minutes prior to the planned dental treatment. There was a significant reduction in median value of BAI scores after treatment with acupuncture (26.5 reduced to 11.5;  $P < 0.01$ ), and it was possible to perform the planned dental treatment in all 20 cases after acupuncture treatment.

A clinical study by Sari and Sari<sup>24</sup> assessed the role of acupuncture for treating orthodontic patients who experienced a gag reflex. The study investigated two acupuncture approaches for orthodontic patients with the gag reflex. Each patient had an upper dental alginate impression taken

and that patient's gag reflex was evaluated using the Gagging Severity Index (GSI). After acupuncture was administered, a second impression was taken, and the Gagging Prevention Index (GPI) was used to evaluate the patient's gag reflex. A significant decrease in GPI values, compared to GSI values, was observed in the treatment groups, compared with a placebo group. The researchers concluded that acupuncture points used were effective in controlling the gag reflex in orthodontic patients.

The antigagging point located on the ear corresponds with the skin of the external acoustic meatus (innervated by the auricular branch of the vagus nerve) and that adjacent to the auricle (innervated by the auriculotemporal branch of the mandibular division of the trigeminal nerve). Both the vagus and trigeminal nerves have branches responsible for the sensory and motor function of the larynx, pharynx, and palatal region. It can be postulated that stimulation of the antigagging auricular acupuncture point may inhibit the muscular activity, thus reducing the gag reflex.<sup>9,25</sup>

### TMJ Pain TMDs

The TMJ joint is the most complex joint in the body. The TMJ is often predisposed to degenerative changes and pathologies as seen in other synovial joints, as a consequence of the frequent and repetitive stresses that the TMJ undergoes. Symptoms commonly associated with TMD include pain at the TMJ, generalized orofacial pain, chronic headaches and ear aches, jaw dysfunction, including hyper- and hypomobility, limited movement or locking of the jaw, painful clicking or popping sounds with opening or closing of the mouth, and difficulty with chewing or speaking. TMJ disorders are classified into the following 3 categories: (1) masticatory muscle disorder; (2) TMJ internal derangement; and (3) TMJ degenerative joint disease.

While acupuncture therapy may not be useful for eliminating the cause of TMD resulting from structural anomalies, such as degenerative changes and disc displacement, acupuncture mainly helps relieve the pain and discomfort associated with the conditions. It has been documented that acupuncture can help muscle relaxation and reduce muscle spasms, if the spasms are indeed muscular in origin.<sup>5</sup>

### TMJ Clicking

Anterior disc displacements are thought to be the most common cause of joint sounds, specifically clicking. Demonstration of the lateral pterygoid's attachment to the anterior articular disc has led to the theory that some anterior disc displacements may be related to lateral pterygoid-muscle dysfunction. The theory suggests that hyperactivity of the superior head of the muscle is capable of pulling the disc forward from its normal position over the mandibular condyle. Acupuncture helps minimize TMJ clicking by

relaxing the lateral pterygoid muscles and thereby reducing the anterior displacing force on the meniscus of the TMJ.<sup>5,26</sup>

### Acupuncture for Myofascial Pain

Myofascial pain is characterized by localized, hypersensitive spots in palpable taut bands of muscle fibers (myofascial trigger points). These trigger points may result from muscle overload from trauma or repetitive activities that cause abnormal stress on specific muscle groups. Clinically, patients complain of tenderness, headaches, restricted movement of jaws, muscle stiffness, and weakness.

Park et al.<sup>27</sup> took a more specific approach. These researchers tested 27 subjects who had TMD myofascial pain with six treatment sessions at two acupoints with verum acupuncture or sham acupuncture. The Park Sham Device was used. The researchers found a significant reduction of signs and symptoms of myofascial pain with verum acupuncture but not with sham acupuncture. A significant drawback of this study was the low baseline pain levels of the subjects in sham acupuncture group (an average VAS score of 1.3 cm), which limited the range for change in post-treatment pain levels.

A randomized clinical trial was performed by Shen et al.<sup>28</sup> to evaluate the effectiveness of acupuncture for myofascial pain of the jaw muscles. Twenty-eight subjects > age 18, who were diagnosed with chronic myofascial pain of the jaw muscles, were randomized to receive verum or sham acupuncture. General head and neck pain ratings were obtained before and after treatment on a numerical rating scale. A mechanical pain stimulus on the masseter muscle was administered before and after treatment and rated on a VAS to measure pain-tolerance level. Subjects who received verum acupuncture experienced a significant reduction in jaw pain, jaw/face tightness, and neck pain, and also had a significant increase in pain tolerance of the masseter muscle. Subjects were not able to determine whether they received verum or sham acupuncture. No significant pain reductions were observed in the sham acupuncture group.

### Atypical Facial Pain

Originally, the term *atypical facial pain* was used to describe patients whose response to neurosurgical procedures was not “typical.” The term has been applied to various facial pain problems and has been considered to represent a psychologic disorder, although no specific diagnostic criteria have ever been established.

Acupuncture is generally believed to stimulate the nervous system and cause the release of some neurochemical messenger molecules. These biochemical changes influence the body’s homeostatic mechanisms, thus promoting physical and emotional well-being of patients. Stimulation of certain acupuncture points has been shown to affect areas of the brain known to reduce sensitivity to pain and stress.<sup>10,29</sup>

### Xerostomia

Xerostomia is decreased or arrested salivary secretion caused by various local or systemic factors. The use of acupuncture therapy as an alternative treatment for xerostomia has been documented in Western medicine since the 1980s. Johnstone et al.<sup>30</sup> and Furness et al.<sup>31</sup> found that acupuncture treatment may provide relief for pilocarpine-resistant xerostomic patients following radiotherapy for head and neck malignancies. The mechanism of how acupuncture can help increase salivary flow is still not fully understood, but various researchers have suggested possible hypotheses, including:

- Acupuncture therapy produces a release of neuropeptides, affecting blood flow with anti-inflammatory properties and trophic effects on the salivary-gland acini.
- Neuronal activations; activation of the parasympathetic nerves increases salivary secretion.
- Acupuncture therapy may tap into the neuronal circuit, which activates the salivary nuclei in the pons and, subsequently, the salivary glands via the cranial nerves.

### Neural Disorders

Acupuncture can be used to manage a wide range of neuronal disorders, such as facial palsy, trigeminal and other neuralgias, paresthesia or anesthesia of the lower lip following lower-third molar extraction, postherpetic neuralgias, and other conditions.<sup>32</sup>

Acupuncture for treating Bell’s palsy is based on the TCM concept that needle manipulation at both the local and distal sites can regulate the flow of Qi in the meridians, harmonize Qi–Blood balance, and strengthen the body’s resistance to External Wind pathogens. Acupuncture may also help to increase the excitability of nerves and to promote regeneration of nerve fibers.

Some research has indicated the existence of a relationship between acupuncture and the autonomic nervous system. According to TCM, acupuncture is believed to restore the balance of Yin and Yang; which may correspond to the modern definition that “acupuncture modulates the imbalance between the parasympathetic and sympathetic activity.”<sup>33</sup> Some local acupuncture points used for facial palsy include a point located near the angle of the mandible at the prominence of the masseter muscle and a point located at the depression between the zygomatic arch and the mandibular notch. These two points are found to be anatomically close to branches of the facial nerve.<sup>34</sup>

In a study by Silva,<sup>33</sup> 42 patients with trigeminal neuralgia were given a course of daily low-frequency EA treatments for 10 days. The treatments were repeated three times, with 1 week intervening between treatments. Thirty-six patients experienced complete relief, 4 patients experienced partial relief, and the treatment failed in 2 patients.

## Advantages

Acupuncture has a number of advantages as follows:

- Safe because it is nontoxic
- Minimal adverse reactions, unlike many other conventional treatment modalities
- No dependency as associated with narcotics
- Simple and convenient if performed by a well-trained practitioner.<sup>4</sup>

## Disadvantages

The disadvantages of acupuncture include:

- More time consuming
- In many cases, may fail to bring about complete analgesia
- Not suitable for children, because few children will tolerate the needling
- Cannot be used effectively in needle-phobic patients
- Lack of sufficient literature and scientific evidence.

## DISCUSSION

Acupuncture is a beneficial traditional technique that can be used in dentistry. Numerous studies have shown the benefits of acupuncture applied to multiple conditions affecting the head and neck, especially for chronic conditions such as myofascial pain and TMJ pain. A systematic review of acupuncture used to address dental pain revealed that 16 controlled clinical trials to test the effectiveness of acupuncture showed that acupuncture was effective for inducing dental analgesia.<sup>35</sup> Another systematic review involving 15 randomized controlled trials concluded that acupuncture was effective in 73% of the reviewed articles for treating temporomandibular dysfunction or as an analgesic, and that acupuncture should be considered as a reasonable alternative to, or supplement to, current dental practice.<sup>4</sup> In one study of the role of acupuncture for treating orthodontic patients who have a gag reflex, the researchers concluded that both acupuncture points CV 24 and PC 6 were efficient for controlling the gagging reflex.<sup>24</sup> Karst et al.<sup>22</sup> concluded that auricular acupuncture and intranasal midazolam were similarly effective for the treatment of dental anxiety. Tavares et al.<sup>16</sup> suggested that EA controlled postoperative pain following mandibular third-molar surgical removal; this could be because of efferent vagus-nerve activation and inflammatory macrophage deactivation.

Pomeranz<sup>36</sup> stated that needle activation of A delta and C afferent nerve fibers in a muscle sends signals to the spinal cord, where dynorphin and enkephalins are released and continue to the midbrain, triggering excitatory and inhibitory mediators in the spinal cord. Ensuing release of serotonin and norepinephrine into the spinal cord leads to pain

conduction being inhibited both pre- and postsynaptically in the spinothalamic tract. Finally, these signals arrive at the hypothalamus and pituitary glands, triggering release of adrenocorticotropic hormones and  $\beta$ -endorphin. The above therapeutic effects might occur because of modulation of the limbic–paralimbic–neocortical network. Kavoussi and Ross<sup>37</sup> hypothesized that acupuncture may produce its analgesic, antianxiety, and other therapeutic effects via mediating this intrinsic neural circuit, which play central roles in the affective and cognitive dimensions of pain.

## CONCLUSIONS

Acupuncture is a tried and experienced method of traditional medicine. Acupuncture has been used in China and other Eastern cultures for thousands of years to promote and uphold good oral health. Various clinical trials tested and concluded that acupuncture could play a promising role in complementing conventional treatment modalities because acupuncture is generally safe and nontoxic, and produces very negligible adverse reactions. Research has been performed, and there has been some recognition of acupuncture's therapeutic effects, even though the mechanisms for these effects are still not understood completely. A better understanding of the underlying mechanisms for how acupuncture works with approval of the fundamentals of TCM would permit future researchers to perform large-scale experimental studies with better experimental designs to confirm acupuncture's applications in dentistry and other areas.

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## DISCLOSURE STATEMENT

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