

ACUPUNCTURE AND DENTISTRY

About dentistry and dental pain

In 1998, 87% of people living in the UK had some natural teeth, while 13% had lost all their natural teeth (Kelly 1998). Those with teeth had an average of 1.5 decayed or unsound teeth. Indeed, over half (55%) had at least one such tooth, and every year nearly half the population experiences some form of dental pain or discomfort, with 25% seeking dental treatment as a result. In a UK survey of adults' feelings about going to the dentist, around 64% identified with being nervous of some kinds of dental treatment.

There are various levels of toothache ranging from occasional discomfort caused by early tooth decay, or periodontal (gum) disease, to the more severe, constant pain caused by advanced tooth decay and dental abscesses. Pain is defined as an unpleasant sensory and emotional experience. Pain is also a subjective experience. Acute pain is associated with a brief period of tissue injury (a cut) or inflammation. During a dental procedure, the pain experienced can be due to tissue and nerve damage, but it may also be caused or increased by anxiety.

Effective management of pain from medical or dental procedures involves a combination of pharmacological (e.g. local or general anaesthetics, nerve blocks, sedatives, analgesics), psychological (e.g. hypnosis, relaxation techniques), cognitive-behavioural therapy, and physical treatments (massage, hot and cold packs).

References

Kelly M et al. Adult dental health survey. Oral health in the United Kingdom. Office for National Statistics 1998 [online].

Available: http://www.statistics.gov.uk/downloads/theme_health/AdltDentHlth98_v3.pdf

How acupuncture can help

(Bensoussan 1999, Rosted 1998, Ernst 1998). Controlled trials have shown that ear acupuncture is as effective as intranasal midazolam in reducing dental anxiety (Karst 2007), and that acupuncture is more effective than placebo in the prevention of post-operative dental pain (Lao 1999) and in reducing the gagging reflex (Sari 2010). Evidence from case series suggests that acupuncture can reduce dental anxiety (Rosted 2010) and the gagging reflex (Rosted 2006), and that electroacupuncture can control post-operative pain after wisdom tooth extraction (Tarares 2007). One controlled study found no effect on the pain threshold of dental pulp (Goddard 2009). The systematic reviews are now more than 10 years old and up-to-date ones are called for to better evaluate the evidence.

In general, acupuncture is believed to stimulate the nervous system and cause the release of neurochemical messenger molecules. The resulting biochemical changes influence the body's homeostatic mechanisms, thus promoting physical and emotional well-being. Stimulation of certain acupuncture points has been shown to affect areas of the brain that

are known to reduce sensitivity to pain and stress, as well as promoting relaxation and deactivating the analytical brain, which is responsible for anxiety (Wu 1999).

Acupuncture may help relieve dental pain by:

- stimulating nerves located in muscles and other tissues, which leads to release of endorphins and other neurohumoral factors (e.g. neuropeptide Y, serotonin), and changes the processing of pain in the brain and spinal cord (Pomeranz 1987, Han 2004, Zhao 2008, Zhou 2008, Lee 2009, Cheng 2009);
- reducing the cardiovascular reflex elicited by toothache, which is associated with the adrenergic system (Jung 2006);
- increasing the release of adenosine, which has antinociceptive properties (Goldman 2010);
- modulating the limbic-paralimbic-neocortical network (Hui 2009);
- reducing inflammation, by promoting release of vascular and immunomodulatory factors (Kavoussi 2007, Zijlstra 2003);
- increasing local microcirculation (Komori 2009), which aids dispersal of swelling.

About traditional acupuncture

Acupuncture is a tried and tested system of traditional medicine, which has been used in China and other eastern cultures for thousands of years to restore, promote and maintain good health. Its benefits are now widely acknowledged all over the world and in the past decade traditional acupuncture has begun to feature more prominently in mainstream healthcare in the UK. In conjunction with needling, the practitioner may use techniques such as moxibustion, cupping, massage or electro-acupuncture. They may also suggest dietary or lifestyle changes.

Traditional acupuncture takes a holistic approach to health and regards illness as a sign that the body is out of balance. The exact pattern and degree of imbalance is unique to each individual. The traditional acupuncturist's skill lies in identifying the precise nature of the underlying disharmony and selecting the most effective treatment. The choice of acupuncture points will be specific to each patient's needs. Traditional acupuncture can also be used as a preventive measure to strengthen the constitution and promote general well-being.

An increasing weight of evidence from Western scientific research (see overleaf) is demonstrating the effectiveness of acupuncture for treating a wide variety of conditions. From a biomedical viewpoint, acupuncture is believed to stimulate the nervous system, influencing the production of the body's communication substances - hormones and neurotransmitters. The resulting biochemical changes activate the body's self-regulating homeostatic systems, stimulating its natural healing abilities and promoting physical and emotional well-being.

About the British Acupuncture Council

With over 3000 members, the British Acupuncture Council (BAcC) is the UK's largest professional body for traditional acupuncturists. Membership of the BAcC guarantees excellence in training, safe practice and professional conduct. To find a qualified traditional acupuncturist, contact the BAcC on 020 8735 0400 or visit www.acupuncture.org.uk

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The evidence

Research	Conclusion
Systematic reviews (SRs)	
Bensoussan A. Systematic review of acupuncture in dental pain. <i>Focus on Alternative and Complementary Therapies</i> 1999; 4: 15-6.	A systematic review that looked at the effectiveness of acupuncture in dental pain and involved 16 controlled clinical trials. Most of these trials implied that acupuncture was effective in dental analgesia. However, there was considerable variation in methodological quality, and non-randomisation, insufficient control for placebo effects and small sample sizes were common shortcomings. <u>The reviewers concluded that acupuncture can alleviate dental pain.</u>
Rosted P. The use of acupuncture in dentistry: a systematic review. <i>Acupuncture in Medicine</i> 1998; 16: 43-8.	A systematic review that assessed the effectiveness of acupuncture in dentistry involving 15 randomised controlled trials. Eleven of the trials were significantly 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 positive results in favour of acupuncture: all those in the excellent or good categories gave a favourable result. <u>The reviewers concluded that 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.</u>
Ernst E, Pittler MH. The effectiveness of acupuncture in treating acute dental pain: a systematic review. <i>Br Dent J</i> 1998; 184:443-7.	A systematic review that assessed the effectiveness of acupuncture in dental pain. It included 16 controlled trials, most of which implied that acupuncture is effective in dental analgesia. <u>The reviewers concluded that acupuncture can alleviate dental pain.</u>
Controlled trials	
Sari E, Sari T. The role of acupuncture in the treatment of orthodontic patients with a gagging reflex: a pilot study. <i>British dental journal</i> 2010; 208: E19.	A study that investigated two acupuncture approaches for orthodontic patients with a gagging reflex (GR). The patients had an upper dental alginate impression taken and GR was evaluated using the Gagging Severity Index (GSI). Fifteen patients had red-light soft magnetic field laser stimulation of an acupuncture point (CV 24) for 1 min. Fifteen patients had a combination of the laser stimulation at CV 24 and acupressure on another point (PC 6). The remaining 15 patients formed the placebo group. After the treatments, a second impression was taken, and the Gagging Prevention Index (GPI) was used to evaluate GR. A significant decrease in GPI values compared to GSI values, was observed at the three stages (empty tray, full tray, holding tray in mouth) of the impression taking process in both treatment groups compared with placebo ($p < 0.05$). The average improvement between the GSI and GPI scores was 58.9% after laser stimulation plus acupressure, 37.9% after laser stimulation alone and 11.2% in the placebo group. <u>The researchers concluded that both acupuncture points CV 24 and PC 6 were effective in controlling GR in orthodontic patients.</u>
Goddard G, Albers D. Effects of acupuncture at large intestine 4 (LI 4) on electrical tooth pulp stimulation: A randomized controlled pilot study. <i>Medical Acupuncture</i> 2009; 21: 167-71.	A randomised controlled trial conducted to determine if dry needling acupuncture at a specific acupoint (LI 4) can 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, who were not receiving anticoagulant medication, 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 found between the

volunteers who received real acupuncture and those who received the placebo intervention. The researchers concluded that acupuncture performed at LI 4 did not reduce dental pulp sensory threshold.

Karst M et al. Auricular acupuncture for dental anxiety: a randomized controlled trial. *Anesth Analg* 2007; 104: 295-300.

A randomised controlled trial that compared the efficacy of auricular acupuncture with intranasal midazolam, placebo acupuncture, and no treatment for reducing dental anxiety in 67 patients having dental extractions. Anxiety was assessed before the interventions, at 30 min, and after the dental extraction. Physiological variables were assessed continuously. With the no treatment group as control, the auricular acupuncture and midazolam groups were significantly less anxious at 30 min as compared with patients in the placebo acupuncture group ($p=0.012$ and <0.001 , respectively). In addition, patient compliance assessed by the dentist was significantly improved with auricular acupuncture and intranasal midazolam ($p=0.032$ and 0.049 , respectively). The researchers concluded that auricular acupuncture and intranasal midazolam were similarly effective for the treatment of dental anxiety.

Lao L et al. Evaluation of acupuncture for pain control after oral surgery: a placebo-controlled trial. *Arch Otolaryngol Head Neck Surg* 1999; 125: 567-72.

A randomised controlled trial that evaluated the efficacy of Chinese acupuncture in treating postoperative oral surgery pain. Thirty-nine healthy subjects, aged 18 to 40 years, were assigned to treatment with acupuncture or a placebo group. The main outcome measures were patients' self-reports of time until moderate pain, time until medication use, total pain relief, pain half gone, and total pain medication consumption. Mean pain-free postoperative time was significantly longer in the acupuncture group (172.9 minutes) than in the placebo group (93.8 minutes) ($p=0.01$), as was time until moderate pain ($p=0.008$). Mean number of minutes before requesting pain rescue medication was significantly longer in the treatment group (242.1 minutes) than in the placebo group (166.2 minutes) ($p=0.01$), as was time until medication use ($p=0.01$). Average pain medication consumption was significantly less in the treatment group (1.1 tablets) than in the placebo group (1.65 tablets) ($p=0.05$). There were no significant between-groups differences on total-pain-relief scores or pain-half-gone scores ($p>0.05$). The researchers concluded that acupuncture is superior to the placebo in preventing postoperative dental pain.

Case series

Rosted P et al. Acupuncture in the management of anxiety related to dental treatment: a case series. *Acupunct Med* 2010; 28: 3-5.

A case series that examined the effect of acupuncture given prior to dental treatment on anxiety. Eight dentists submitted 20 case reports regarding the treatment of dental anxiety. Only patients with moderate to severe anxiety (BAI score ≥ 16) were included. The Beck Anxiety Inventory (BAI) score was assessed before and after the acupuncture treatment. All patients received acupuncture treatment for 5 min 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 carry out the planned dental treatment in all 20 cases after acupuncture treatment. Previously this had only been possible in six cases. The researchers concluded that acupuncture prior to dental treatment has a beneficial effect on the level of anxiety in patients with dental anxiety and may offer a simple and inexpensive method of treatment.

Tavares MG et al. Electro-acupuncture efficacy on pain control after mandibular third molar surgery. *Braz Dent J* 2007; 18: 158-62.

A case series that evaluated the efficacy of electro-acupuncture (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 anaesthesia. At one side, extraction was carried out employing both prior (24h) and immediately postoperative application of EA, while on the contralateral side surgery was carried out without any EA treatment. Postoperative pain intensity (rated on a 100 mm visual analogue scale [VAS] between 2 and 72 h) was significantly lower for the EA group ($p<0.05$) and analgesic intake decreased ($p<0.05$) for all evaluated periods ($p<0.05$).

The researchers concluded that electroacupuncture controlled postoperative pain following mandibular third molar surgical removal.

Rosted P et al. The use of acupuncture in controlling the gag reflex in patients requiring an upper alginate impression: An audit. *British Dental Journal* 2006; 201: 721-25.

An audit of a case series that evaluated the use of acupuncture point CV24 in controlling a profound gagging reflex (GR) during dental treatment requiring an upper alginate impression. All patients fulfilling the inclusion criteria for GR had an upper dental alginate impression taken (or an attempt made at it) before acupuncture, and a second upper alginate impression taken immediately after acupuncture of point CV24. The GR assessment was undertaken using the Gagging Severity Index (GSI); and after the acupuncture and impression taking using the Gagging Prevention Index (GPI). Twenty-one dentists submitted 64 case reports, of which 37 fulfilled the inclusion criteria. Prior to acupuncture, all 37 patients were unable to accept the impression taking. After acupuncture of point CV24, an improvement of around 53% for the three stages of impression taking was noticed. Thirty patients (81%) were able to accept the impression taking, whereas seven (19%) remained unable to tolerate the procedure. The researchers concluded that there was a significant decrease in GR scores at all three stages of the impression taking procedure.

Research on mechanisms for acupuncture

Goldman N et al. Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture. *Nat Neurosci* 2010 May 30. [Epub ahead of print]

A study that the neuromodulator adenosine, which has anti-nociceptive properties, was released during acupuncture in mice, and that its anti-nociceptive actions required adenosine A1 receptor expression. Direct injection of an adenosine A1 receptor agonist replicated the analgesic effect of acupuncture. Inhibition of enzymes involved in adenosine degradation potentiated the acupuncture-elicited increase in adenosine, as well as its anti-nociceptive effect. The researchers concluded that their observations indicate that adenosine mediates the effects of acupuncture and that interfering with adenosine metabolism may prolong the clinical benefit of acupuncture.

Hui K.K.-S. The salient characteristics of the central effects of acupuncture needling: limbic-paralimbic-neocortical network modulation. *Human Brain Mapping* 2009; 30: 1196-206.

A study that assessed the results of fMRI on 10 healthy adults during manual acupuncture at 3 acupuncture points and a sham point on the dorsum of the foot. Although certain differences were seen between real and sham points, the hemodynamic and psychophysical responses were generally similar for all 4 points. Acupuncture produced extensive deactivation of the limbic-paralimbic-neocortical system. Clusters of deactivated regions were seen in the medial prefrontal cortex, the temporal lobe and the posterior medial cortex. The sensorimotor cortices, thalamus and occasional paralimbic structures such as the insula and anterior middle cingulate cortex showed activation. The researchers concluded that their results provided additional evidence that acupuncture modulates the limbic-paralimbic-neocortical network. They hypothesised that acupuncture may mediate its analgesic, anti-anxiety, and other therapeutic effects via this intrinsic neural circuit that plays a central role in the affective and cognitive dimensions of pain.

Cheng CH et al. Endogenous Opiates in the Nucleus Tractus Solitarius Mediate Electroacupuncture-induced Sleep Activities in Rats. *Evid Based Complement Alternat Med* 2009 Sep 3. [Epub ahead of print]

An animal study that investigated the involvement of the nucleus tractus solitarius opioidergic system in electroacupuncture-induced alterations in sleep, the findings of which suggested that mechanisms of sleep enhancement may be mediated, in part, by cholinergic activation, stimulation of the opioidergic neurons to increase the concentrations of beta-endorphin and the involvement of the μ -opioid receptors.

Lee B et al. Effects of acupuncture on chronic corticosterone-induced depression-like behavior and expression of neuropeptide Y in the rats. *Neuroscience Letters* 2009; 453: 151-6.

In animal studies, acupuncture has been found to significantly reduce anxiety-like behaviour, and increase brain levels of neuropeptide Y, the brain levels of which appear to correlate with reported anxiety.

Komori M et al. Microcirculatory responses to acupuncture stimulation and phototherapy. *Anesth Analg* 2009; 108: 635-40.

Experimental study on rabbits in which acupuncture stimulation was directly observed to increase diameter and blood flow velocity of peripheral arterioles, enhancing local microcirculation.

Zhao ZQ. Neural mechanism

Review article that discusses the various peripheral and central

underlying acupuncture analgesia. <i>Prog Neurobiol</i> 2008; 85: 355-75.	nervous system components of acupuncture anaesthesia in detail.
Zhou Q et al. The effect of electro-acupuncture on the imbalance between monoamine neurotransmitters and GABA in the CNS of rats with chronic emotional stress-induced anxiety. <i>Int J Clin Acupunct</i> 2008 ;17: 79-84.	A study of the regulatory effect of electro-acupuncture on the imbalance between monoamine neurotransmitters and GABA in the central nervous system of rats with chronic emotional stress-induced anxiety. The levels of serotonin, noradrenaline and dopamine fell significantly, while GABA levels were significantly higher in the rats given acupuncture (P<0.05, or P<0.0). The researchers concluded that the anti-anxiety effect of electro-acupuncture may relate to its regulation of the imbalance of neurotransmitters.
Kavoussi B, Ross BE. The neuroimmune basis of anti-inflammatory acupuncture. <i>Integr Cancer Ther</i> 2007; 6: 251-7.	Review article that suggests the anti-inflammatory actions of traditional and electro-acupuncture are mediated by efferent vagus nerve activation and inflammatory macrophage deactivation.
Jung JY et al. Effects of acupuncture on c-Fos expression in brain after noxious tooth stimulation of the rat. <i>Am J Chin Med</i> 2006; 34: 989-1003.	An animal study to elucidate the antinociceptive mechanism of acupuncture and the mechanisms underlying cardiovascular reflex elicited by toothache. Expression of c-Fos, a neuronal activation marker, and phenylethanolamine-N-methyltransferase (PNMT) were examined 1.5 hours after noxious intrapulpal tooth stimulation. Manual acupuncture was performed 20 min before noxious intrapulpal stimulation. All acupuncture significantly suppressed Fos-IR neurons in all Fos-expressed brain areas (except the inferior olivary nucleus) and attenuated the increases in arterial blood pressure and heart rate seen after noxious intrapulpal stimulation. Its Fos-suppressive effects were mostly blocked by naloxone, an opioid antagonist, suggesting the involvement of opioid neurotransmitters such as endorphins. The effect of acupuncture in reducing the cardiovascular reflex elicited by tooth pulp pain appears to be associated with the adrenergic system.
Han JS. Acupuncture and endorphins. <i>Neurosci Lett</i> 2004; 361: 258-61.	A literature review of studies relating to the release of endorphins by acupuncture.
Zijlstra FJ et al. Anti-inflammatory actions of acupuncture. <i>Mediators Inflamm</i> 2003; 12: 59-69.	An article that suggests a hypothesis for anti-inflammatory action of acupuncture: Insertion of acupuncture needles initially stimulates production of beta-endorphins, CGRP and substance P, leading to further stimulation of cytokines and NO. While high levels of CGRP have been shown to be pro-inflammatory, CGRP in low concentrations exerts potent anti-inflammatory actions. Therefore, a frequently applied 'low-dose' treatment of acupuncture could provoke a sustained release of CGRP with anti-inflammatory activity, without stimulation of pro-inflammatory cells.
Wu MT et al. Central nervous pathway for acupuncture stimulation: localization of processing with functional MR imaging of the brain--preliminary experience. <i>Radiology</i> 1999 ; 212: 133-41.	An experimental study using MRI to characterise the central nervous system pathway for acupuncture stimulation, which found that acupuncture activates structures of descending antinociceptive pathway and deactivates areas mediating pain modulation.
Pomeranz B. Scientific basis of acupuncture. In: Stux G, Pomeranz B, eds. <i>Acupuncture Textbook and Atlas</i> . Heidelberg: Springer-Verlag; 1987: 1-18.	Needle activation of A delta and C afferent nerve fibres in muscle sends signals to the spinal cord, where dynorphin and enkephalins are released. Afferent pathways continue to the midbrain, triggering excitatory and inhibitory mediators in spinal cord. Ensuing release of serotonin and norepinephrine onto the spinal cord leads to pain transmission being inhibited both pre- and postsynaptically in the spinothalamic tract. Finally, these signals reach the hypothalamus and pituitary, triggering release of adrenocorticotrophic hormones and beta-endorphin.

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