Comparative evaluation of acupuncture and anesthetic efficacy in preventing tooth hypersensitivity

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ABSTRACT

Background: Acupuncture is an important component of traditional Chinese medicine that consists of applying pressure, needling, heat, and electrical stimulation. The theory of acupuncture anesthesia and analgesia was put forward by the Chinese in 1960, and it emerged as a popular treatment for pain relief in the 1990s. Aim and Objective: To evaluate and compare the efficacy of acupuncture and infiltration of local anesthesia in preventing tooth hypersensitivity. Materials and Methods: The study involved 30 healthy individuals in the age group, 20–40 years. For 15 subjects (LA group), local anesthetic - lidocaine 2% with adrenaline 1:200,000 was administered as a nerve block. Heat test was done after 2 min on a sound, vital tooth. Teeth with restoration or caries were excluded from the study. Response to heat was noted down by means of a visual analog scale every 2 min for up to 6 min. For the other 15 subjects (ACU group), the acupuncture needles were placed in the acupuncture points - SI 18 (Quan Liao), ST 3 (Juliao), GV 26 (Shui Gou), and LI 4 (He Gu). Heat test was done every 2 min up to 6 min and the response was noted. Results were statistically evaluated. Results and Conclusion: There was no statistically significant difference in effectiveness of lidocaine and acupuncture in preventing dentin hypersensitivity.

KEY WORDS: Acupuncture, Local anesthetic, Hypersensitivity, Lidocaine, Dentistry

INTRODUCTION

Anesthesia was discovered by Horace Wells with nitrous oxide in 1844[1,2] and William Thomas Green Morton with ether in 1846,[3] both were dentists. Hence, it is to be noted that anesthesia was found by a dentist rather than a doctor as it emphasizes on the importance of pain control in dentistry which leads to the discovery of anesthesia.[1] Most of the commonly performed dental procedures demand patient cooperation. Complete patient cooperation is possible only if pain control is achieved. Apart from patient cooperation, the other advantage of pain control is that there is decreased probability of stress situations for the patient. This ultimately leads to decreased levels of fatigue in the dentist. Furthermore, the dentist’s skills can be used to the fullest.

However, the early anesthetics found by the dentists had side effects which left the doctors in search of a better alternative. Cocaine became popular in 1884 when Carl Koller used it as a local anesthetic while operating on a glaucoma patient.[4] Due to its overuse, reports of side effects of the drug increased with 13 deaths attributed to the drug were recorded between 1884 and 1891.[5] Decline in the popularity of cocaine was followed by the discovery procaine which was a weak anesthetic and did not fully satisfy the needs of surgeons.[6,7] Around 1946, Nils Löfgren and Bengt Lundquist introduced lidocaine. This xylidine-based local anesthetic which was proved effective and safe.[8] The first article on articaine as a local anesthetic appeared in 1972.[9] Now, local anesthesia is used in pain control for many procedures in dentistry which include extractions, minor surgeries, root canal treatment, and tooth preparation. The local anesthetic usually used is lidocaine 2% HCl or articaine with epinephrine1:100,000 or 1:200,000.[10] Before the discovery of anesthesia, there is evidence of surgeons carrying out operations such as mastectomy, leg amputation, and even dental extractions under mesmerism. Mesmerism or animal magnetism is a precursor to modern hypnotism, and the mesmeric sleep is said to induce anesthetic effects. The discovery of ether and it is ease of use as an anesthetic agent unlike mesmerism which can be performed only by

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mesmerists lead to decline in the use of mesmerism for anesthesia.\[11\]

Acupuncture first originated in China about more than 3000 years ago.\[12\] In Latin: Acus: Needle and puncture: Insertion. It involves insertion of gold, steel, or silver needles into specific acupuncture points. Acupuncture is based on the concept of “de qi” or the life energy. This life energy in the body along the meridians and it is believed that any blockade in the flow of “de qi” leads to diseases. The blockade can be cleared on needle stimulation of the acupuncture points. The acupuncture points are situated in the meridians that run along the body connecting the extremities to the trunk. There are 12 major meridians present. There are also submeridians to these major meridians.\[13\]

Acupuncture has gained popularity over a recent few decades due to significant success rates of controlled trials. It has been proven effective in the treatment of musculoskeletal pain\[14\] and in reducing anxiety and stress.\[15\] It is also said to enhance the functioning of the immune system.\[16\]

Attempts are being made to fully understand the mechanism of acupuncture. Our knowledge so far accounts for only analgesic effect of acupuncture which is due to the activation of A-delta fibers leading to release enkephalins, endorphins, and serotonin. The release of serotonin accounts for the reduced pain, stress, and anxiety in the subject.\[17\] However, scientific basis for the therapeutic effects of acupuncture in asthma, nausea, dysmenorrhea, and gastritis remains unexplained.

In dentistry, acupuncture is proven effective in the treatment of temporomandibular dysfunction.\[18-21\] Sjogren’s syndrome,\[22\] trigeminal neuralgia,\[23\] and dental pain.\[24\] It is also useful in the treatment of other ailments such as various types of orofacial pain, muscle spasms, migraine, anxiety, dental fear, gag reflex, and xerostomia.\[25\]

Studies have shown that acupuncture can be used as an adjunct in achieving anesthesia during dental procedures as well as in providing post-operative pain relief. Previous studies suggest that regional acupuncture can accelerate the induction time after an inferior alveolar nerve block. Needle stimulation of the acupuncture points associated with dental pain proved to be effective in decreasing the induction time of anesthetic solution used for the inferior alveolar nerve block.\[26,27\] There are many other studies that show that acupuncture has significant analgesic efficiency in the treatment of musculoskeletal pain and other pain-related issues as mentioned above. However, little is known about the effect of acupuncture in preventing dentin hypersensitivity.

This study evaluates and compares the efficacy of acupuncture and local anesthesia in preventing dentin sensitivity during dental treatments. The use of anesthetics is contraindicated in some patients due to their systemic conditions. In such cases, acupuncture can be used to give anesthetic effect during various procedures such as tooth preparations and restorations that cause sensitivity, which is unpleasant to the patient.

**MATERIALS AND METHODS**

The study involved 30 healthy individuals in the age group, 20–40 years (power analysis for a Chi-square test was conducted in G-POWER and the desired sample size was found to be 15). Individuals who had a history of systemic diseases, those who were suspected to have any dental infection, those who were undergoing orthodontic treatment, and those who were under medication for any other illness were excluded from the study. Heat test was done on a sound tooth to check for the responsiveness to nerve stimulation before needle placement or LA administration, in all the 30 individuals. For 15 subjects (LA group), local anesthetic - lignocaine 2% with adrenaline 1:200,000 (lignocaine hydrochloride and adrenaline bitartrate) was administered as a nerve block [Figure 1]. Heat test was done after 2 min on a sound, vital tooth by placing a heated gutta-percha stick on Vaseline-coated buccal (or labial) surface (middle third) of the tooth [Figure 2]. Teeth with restoration or caries were excluded from the study. Response to heat was noted down by means of a visual analog scale every 2 min for up to 6 min [Figure 3]. For the other 15 subjects (ACU group), AVTC sterile disposable acupuncture needles, 0.25*13 mm, were placed in the acupuncture points - SI 18 (Quan Liao), ST 3 (Juliao), GV 26 (Shui Gou), and LI 4 (Hegu) [Figures 4 and 5]. Heat test was done every 2 min up to 6 min and the response was noted.

V AS scale - the individuals were asked to mark the severity of the pain experienced with a pen on the

![Figure 1: Administration of local anaesthetic solution](image)
10 cm visual analog scale. The severity of pain was then measured with the help of a scale and scoring was done corresponding to the measurement.

Data collection was done on excel sheet and the pain responses were compared and assessed by independent t-test for different VAS scores at specific time intervals for the two groups, with the help of SPSS (version 20) software.

**RESULTS**

Before the placement of needles in the 15 individuals in the ACU group, the mean of pain scores was 61.4. In the 15 individuals of the LA group, the mean of pain scores before administration of LA was 64.6. After 2 min of needle insertion, the mean of pain scores of the ACU group was 41.47. Similarly, after 2 min of lidocaine administration, the mean of pain scores of LA group was 23.29; after 4 min of needle insertion, the mean of pain scores was 22.84 in the ACU group, and after 4 min of LA administration, the mean of pain scores was 16.49 LA group; after 6 min of needle stimulation, the mean of pain scores recorded in the ACU group was 9.64, and after the same time interval, the mean of pain scores recorded in the LA group was 8.87. From Graph 1, decrease in pain intensity is observed in both the groups, with LA group having comparatively lesser mean score in all the 3-time intervals, suggestive of a comparatively higher efficacy in preventing dentin hypersensitivity. However, at the end of 6 min, there is no significant difference in the mean score of the two groups. It is clearly noted that there is significant decrease in the intensity of pain and the resultant decrease in pain scores in both the groups when compared to their respective pain scores recorded before the placement of needles in the ACU group or before lidocaine administration in the LA group. Independent t-tests of the pain scores at different time intervals reveal that there is no statistically significant difference of anesthetic efficacy in preventing hypersensitivity between the ACU group and LA group ($P > 0.05$).

**DISCUSSIONS**

Local anesthesia is the reversible loss of sensation in one part of the body. Local anesthetic agents are chemical agents used in local anesthesia. Local anesthetic agents are classified according to their composition as local anesthetic agents composed of esters and local anesthetic agents that are composed of amides. Some amide-based anesthetic agents are lidocaine, prilocaine, bupivacaine, mepivacaine, and etidocaine. Procaine is a popular ester-based local anesthetic agent. It was one of the earliest anesthetic agents. They are also classified based on their duration of action as short-acting local anesthetic agents, intermediate-acting local anesthetic agents, and long-acting local anesthetic agents. Procaine is a short-acting local anesthetic agent. Lidocaine, prilocaine, and mepivacaine are examples...
of intermediate-acting local anesthetic agents and bupivacaine and etidocaine are examples of long-acting local anesthetic agents. An ideal anesthetic solution should have a rapid onset of action, adequate duration of action, should be reversible, should be chemically stable, and it should cause no systemic toxicity. One more characteristic of local anesthetic solution that should be considered is that the local anesthetic solution is not effective in the low pH conditions, that is, the local anesthetic solution becomes less potent in effecting the neuromuscular blockade when the pH is lowered, as in case of any dental infections such as periapical or periodontal abscesses.\textsuperscript{[29]}

Failure of anesthesia is also quite frequently reported. The success rates of local anesthetic have never been 100%. The failure of the injection of local anesthetic solution can be explained under two broad classifications based on the causes of failure which may be operator dependent or patient dependent. Operator-dependent causes may be errors in choice of technique, errors in choice of solution, and poor technique of administration of the local anesthetic solution while the patient-dependent causes may be anatomical, pathological, or psychological.\textsuperscript{[29]}

The local anesthetic solution is commonly used along with epinephrine (vasoconstrictor) in dentistry for various dental procedures such as extractions, tooth preparations, and root canal treatment. The use of local anesthesia without adrenaline does not provide the operator with sufficient pulpal anesthesia. Furthermore, the effect or the duration of action of the anesthetic solution is short lived. Administration of local anesthetic solution is contraindicated in patients under treatment with beta-blockers - since adrenaline interacts with beta-blockers and leads to significant increase in blood pressure.\textsuperscript{[30]} In such cases, anesthetic solutions without adrenaline are preferred even though it is less effective. Furthermore, the dental anesthetic solution is also known to enhance cardiovascular toxicity.\textsuperscript{[31]} It is because of these contraindications and failures that there is a need for an alternative or adjunct to local anesthetic agents which can be used in situations where local anesthetics cannot be used. This study evaluates the efficacy of acupuncture as an alternative to local anesthetic solution in preventing dentin hypersensitivity.

As mentioned earlier, acupuncture is a form of traditional Chinese medicine that corrects the qi imbalances by needle stimulation of the acupuncture points. These points are located along channels or meridians determined by the flow of qi (the life force) and the 12 principal meridians that run from the limbs to the trunk and face. These Points are designated with names of organs to which the qi flow in the channel. Acupuncture points are located along the meridians in locations where the needle can access the deep tissues. De qi is the effect of needle stimulation that manifests as a characteristic sensation perceived by the subjects as numbness or tingling sensations. It is also felt by the acupuncturist as heavy and tight sensation coming from areas beneath the needle. These sensations in the subjects indicate success and effectiveness of the treatment and the time period for the manifestation of the characteristic sensation during needle stimulation is highly variable depending on the individual’s response to needle stimulation, and hence, the time taken to achieve de qi may range from min up to 5 min. A study which studied the effects of de qi proved that the sensation was associated with significantly increased blood perfusion, tissue displacement, and the amplitude of myoelectricity in the acupoint. The authors suggested that their results may prove as a justification for the therapeutic effects of acupuncture in the treatment of various disorders. The acupuncture points used in this study were LI4 (Hegu) and ST36 (Zusanli). The authors had considered these two points as the two strong and commonly used points with a wide range of pain-related therapeutic effects. It was proved in their study that these points can bring about modulations in the limbic system and the hypothalamus which are the neuromatrices of the nervous system specific to pain.\textsuperscript{[32]} The point LI4 is used in this study along with the other points specific to dental analgesia.

The acupuncture points used in this study, for dental anesthesia are as follows:

- **SI 18** (Quan liao), an acupuncture point located in the small intestine channel, situated directly below the outer canthus of eye in a depression on the lower border of zygoma.
- **ST 3** (Juliao), an acupuncture point that is located in the stomach channel situated directly below the pupil in a depression at the level of ala of nose.
- **GV 26** (Shui Gou), an acupuncture point that is located in the stomach channel situated directly below the pupil in a depression at the level of ala of nose.
- **LI 4** (He Gu), a commonly used acupuncture point that is located in the large intestine channel. It is situated at the highest point when thumb and finger are brought close.

Borzecki and Lee used the points EX1, ST2, ST6, and ST7 for dental anesthesia along with distant points, LI4 and ST44.\textsuperscript{[34,35]} The points LI4, ST2 are proven effective in the treatment of dental pain in a study by Anderson.\textsuperscript{[36]} These studies assessed the efficiency of these points and compared two different methods of needle stimulations. They also briefed on the mechanism and neurophysiology of their result. There are several studies that show that the induction time for prilocaine hydrochloride is 2 min. Two pilot studies were conducted to check if the induction time is reduced after acupuncture needle stimulation.
The results showed that with needle stimulation the induction time of prilocaine hydrochloride was reduced by 57 s.[26,37] Other than decreasing the induction time period, acupuncture can also be used in the treatment of post-operative pain. NSAIDs are associated with gastrointestinal ulcerations,[27] and it is advisable that prescription of systemic analgesics is kept as low as possible. Hence, acupuncture has been proven a significantly efficient alternative in two studies. One study was conducted at the University of Maryland in Baltimore. Acupuncture treatment was given to patients who had undergone third molar extraction. The study also involved a placebo group. It was found that the patients who had undergone proper acupuncture treatment were pain-free for a longer duration of time than the patients who were under the placebo group. The group of patients, who had undergone acupuncture treatment, remained pain-free for 172.9 min while the other group remained pain-free for 93 min only. In a similar study by Lao et al., acupuncture and placebo treatments were given for subjects who had undergone third molar extractions. It was found that the pain-free time experienced by those in the acupuncture group was 181 min while the pain-free time experienced by the placebo group was 71 min.[38] However, no studies report the efficacy of acupuncture in preventing dentin hypersensitivity.

This study compares the effectiveness of acupuncture and local anesthesia in preventing dentin hypersensitivity. In this study, 8 out of 15 in the ACU group did not have sensitivity at the end of 6 min and 11 out of 15 in the LA group did not have sensitivity at the end of 6 min. This indicates the effectiveness of the local anesthetic and acupuncture in these individuals, respectively.

The induction time of dental local anesthesia is approximately between 2 and 2.6 min[39,40] and may extend up to 5 min. The maximum needling time in this study was 6 min, which is comparable to the induction time of local anesthesia. Furthermore, it is to be considered while comparing that the effects of both local anesthesia and needle stimulation are subjective and may vary with different individuals.

CONCLUSION

In this study, both acupuncture and lidocaine were effective in preventing dentin hypersensitivity with lidocaine proving to be clinically more efficient than acupuncture. However, there was no statistically significant difference observed between the two groups \((P > 0.05)\) to conclude that one method is more efficient than the other. Hence, we conclude that acupuncture can be used as an alternative to anesthetic solution in cases where the use of local anesthesia is contraindicated. However, further studies with more participants are needed to confirm the findings.

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