Effect of Warming Anesthetic Solution on Pain Perception During Maxillary Infiltration: A Split Mouth Randomized Control Trial

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ABSTRACT

Objective: To evaluate the effectiveness of using anesthesia at 42°C (107.6°F) for the insight of pain as dental sedative in contrast to its administration at room temperature 21°C throughout the procedure of maxillary infiltration.
Study Design: Double-blind, Split-Mouth randomized clinical trial (Clinical trial number: ISRCTN79560957)
Place and Duration of Study: Department of Armed Forces Institute of Dentistry, Rawalpindi, from Jan to Jun 2021.
Methodology: A total of 38 patients were examined, undergoing maxillary premolar extractions for orthodontic purposes. Group- A received local anesthesia injection with the anesthesia warmed to 42°C (107.6°F) and group- B patients receiving local anesthesia injection with anesthesia at room temperature. The injection point was placed in the mucobuccal fold apically in the middle of maxillary premolars using a 27G short needle and injecting 0.9 mL of the anesthetics at the speed of 0.15 mL/second. Patients were instructed to grade intensity of pain on Visual analogue scale.
Results: According to the Visual analogue scale score, the level of pain perceived with the anesthesia at 42°C (107.6°F) in group-1 was 3.81 ± 1.48 and the level of pain perceived with the anesthesia at temperature 21°C in group-2 was 5.57 ± 1.50 with statistically significant result (p=0.001).
Conclusion: The use of anesthesia at 42°C (107.6°F) significantly reduced the pain during the injection of anesthesia compared to its use at room temperature during maxillary injections.

Keywords: Anesthetic temperature, Clinical trial, Maxillary infiltration, Pain, visual analogue scale (VAS).

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INTRODUCTION

The method of administering anesthesia is a fearful factor in dental treatment. Inherent tissue damaged due to the needle and penetration of injection of anesthetic fluid, causing pro-inflammatory mediators, combining the sub-mucosal tissue pressure and activating the nociception terminals.[1] Slow speed injection administered as one cartridge/min by nerve block techniques and compression of neighboring tissues at the operating site, have been used as optional strategies to lessen the pain at injecting site.[2]

Warming local anesthetic cartridge or solution is one of the procedures used to reduce perception of pain and has variable effects on the reduction of pain. Multiple studies have shown that pre-warming of local anesthetic solution resulted in less pain intra-operatively. According to one study, Tirupathi *et al*, showed that the physiological mechanism of the temperature on pain reduction could be due to a synergic action on the permeabilization of the transient receptor potential vanilloid-1 channels, allowing the passage of anesthetic inside the nociceptors.[3] Aravena *et al*, reported that patients receiving local anesthetic injection at room temperature and at 42°C (107.6°F) temperature experienced different amount of pain during the application of injection i.e. 35.3 ± 16.71 at room temperature while 15 ± 14.67 at 42°C (107.6°F) with a p-value of <0.001.[4] Administering the local anesthetic at 42°C produces a lower pain intensity and shorter onset of action compared to doing so at room temperature.[5] The anxiety levels were reduced while using this method. In addition, the treatment would be more comfortable resulting in a good relationship and confidence building between patient and the dentist.[6] In a study carried out by Zubair *et al*, it was found that patients receiving pre-warmed anesthesia at 42°C (107.6°F) experienced less pain while injecting the anesthetic solution as compared to those patients who received local anesthesia at room temperature.[7] Henceforth, the aim of this study was to evaluate the effectiveness of using anesthesia at 42°C (107.6°F) for the perception of pain in contrast to its administration at room temperature 21°C for maxillary infiltration during extraction of upper premolars for orthodontic purpose.

METHODOLOGY

A randomized clinical trial was conducted at Armed Forces Institute of Dentistry, Rawalpindi, from

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January to June 2021. The current study design and protocol was approved from the Ethical Committee of the Armed Forces Institute of Dentistry. The study was registered under clinical trial no. ISRCTN79560957. All the patient visiting Oral and Maxillofacial Surgery Department, AFID from January 2021 to June 2021, for orthodontic extractions were considered for the study.

Inclusion Criteria: Patients of either gender, with age 13 to 30 years, who had not taken any painkiller (non-steroidal anti-inflammatory drugs) in the two months, with no dental pain or symptoms of infection at the puncture site were included in the study.

Exclusion Criteria: Pregnant women, patients with painful tooth, or with periodontal compromised tooth, patients with the pain of non-odontogenic origin, or with the signs of active infection were excluded from the study.

Sample size of 38 was calculated, by using WHO calculator from the pilot study results (SD:35.3 ± 11.7). Visual analogue scale was used for the assessment of pain perception and to compare the pain with local anesthetic injected at 42°C (107.6°F) and at room temperature. Non-probability consecutive sampling technique was used.

Before starting the study written informed consent was taken. Demographic details were obtained and recorded on the specific data collection forms. Child bottle warmer was utilized in our study as used by the previous researchers.[8] Anaesthetic cartridge was left in the airtight fixed plastic sack apparatus. Maximum power was utilized in order to raise the temperature to 42°C (107.6°F).[8]

The patients were selected according to inclusion criteria and were randomly allocated in the groups. The patients with odd registration slip numbers were assigned to group-A who received warmed local anaesthesia injection at 42°C (107.6°F) and patients with even registration slip numbers were assigned to group-B who received local anaesthesia injection at room temperature, irrespective of the gender and age. Initially injection was applied on the subject's dominant side (left/right) and the temperature was used according to the random number (even=21°C room temperature; odd=42°C (107.6°F)) with the receiving patient blinded to it.

Anaesthetic infiltration to the middle superior alveolar nerve, were administered.[9] The injection point was placed in the mucobuccal fold apically in the middle of maxillary premolars using a 27G short needle and injecting 0.9 mL of the anaesthetic with speed of 0.15 mL/second.

Instantly once the injection was administered, the patient was instructed to grade the intensity of the pain. Patient was instructed to select any of figures of Visual analogue scale according to the severity of pain experience. The pain pointed out with a finger or verbally was documented on the Visual analogue scale.

One-week washout period was given after the initial injection and the second injection was administered on the contralateral side of the maxilla with the other anaesthetic temperature according to the random sequence.

Data was analysed by using Statistical Package for the social sciences (SPSS) version 23. Quantitative variables like age and values of VAS score were measured as mean ± standard deviation (SD). Qualitative variables like gender and pain scale were measured as frequency and percentages. Independent sample t-test was applied to compare the quantitative variables between two groups. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 38 patients were included in the study, with the mean age of 18.94 ± 2.45 years (range: 13-30 years). There were 14 (36.8%) male patients and 24 (63.2%) female patients as shown in Table-I.

Table-I: Demographic distribution.

Demographic Parameters	n (%)
Age (Mean ± SD)	18.94 ± 4.15 years
Gender	
Male	14 (36.8)
Female	24 (63.2)

The level of pain perceived according to the visual analogue scale, at the 42°C (107.6°F) in group-A was 3.81 ± 1.48 that was lesser than in group-B, 5.57 ± 1.50 at room temperature 21°C with the *p*-value of 0.001.

Table-II: Comparison of visual analogue scale.

Visual Analogue Scale Score	Group-A (at 42⁰C)	Group-B (At 21°C)	*p*-value
	3.81 ± 1.48	5.57 ± 1.50	0.001

DISCUSSION

There is difference in pain perception after warming the local anesthesia at 42°C (107.6°F) as compared to local anaesthesia administered at room temperature (21°C). It has been proved that the use of anaesthesia at 42°C (107.6°F) significantly reduced pain

while injecting local anaesthesia by maxillary infiltration technique for tooth extraction. Our study showed mean visual analogue scale (3.81 ± 1.48) for pain at 42°C as compared to (5.57 ± 1.50) at 21°C with significant reduction in pain at raised temperature.

Results of a previous study showed that patients perceived significantly less pain with local anaesthesia at body temperature (p=0.005).[8] Another study showed that injecting 0-5% Procaine at 37°C reduced the discomfort of Bier's blocks, as compared to anaesthesia at room temperature and concluded that pre-warmed local anaesthetic solutions cause less discomfort in general.[9]

A previous study stated that pre-warm local anaesthetic agents used for retro-bulbar and facial nerve injection, greatly decrease patient discomfort, which was similar to the findings of our study.[10]

Aydinbelge *et al,* suggested that heating Lignocaine at 43°C before infiltrative injection for local anaesthesia in arthrography, angiography and other interventional procedures reduces the burning sensation during its administration.[12]

Administration of local anaesthetics have some drawbacks. They are unpredictable in areas of inflammation, tenderness and infection. Due to the acidic nature of anaesthetic agents, burning and stinging sensation are the most common complaint by the patients in dentistry.[13]

Nevertheless, there are studies, that suggest warming anaesthetic cartridges, alter the vasoconstrictor and the medication inside, diminishing its viability.[14,15]

The manufacturers' instructions urge to keep cartridges at room temperature, however there are various analyses that express that Lidocaine can endure sterilization via autoclave.[16,17] Epinephrine can also endure continued warming with no relevant exploitations, up to 51°C which is a remarkable temperature for an added time of 13.25 hours.[18]

Our results were similar to a previous study carried out by Alonso et al, which showed the effect of pre-warming anaesthesia on the perception of pain in the trigeminal ganglion territory. Their results showed a strong relationship between the temperature of the anaesthetic solution and the pain of the injection (p<0.001).[11]

Pahlevan *et al*, in their study concluded that pre-warming local anaesthetic solution causes less pain intra-operatively and enhanced patient comfort during the procedure.[19] They concluded that anaesthesia administered at body temperature causes less pain as compared to injection given at room temperature.

In our study, warming anaesthesia at 42°C (107.6°F) showed diminished pain as compared to anaesthesia at room temperature. This simple strategy can decrease patients' uneasiness and discomfort during dental procedures.

CONCLUSION

The use of anesthesia at 42°C (107.6°F) significantly reduced the pain during the injection of anesthesia compared to its use at room temperature during maxillary injections.

Conflict of Interest: None.

Authors' Contribution

SAS: Critical review, SM: Final drafting, NJB: SPSS Calculation, NAK: Data Collection, NR: Manuscript writing, NAK: Data collection.

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