

Comparison of Jet Injection Technique with Conventional Injection Technique in Patients Undergoing Endodontic Therapy

Abstract

Background: In order to reduce the fear and anxiety of injection during root canal procedures, Madajet injection technique was substituted for the first time among the adult patients to obtain its efficacy and to overcome the painful procedure during the conventional syringe technique. **Aim:** The aim of this study is to compare the clinical efficacy and level of patient acceptance of jet injections with conventional syringe technique in patients with symptomatic pulpitis. **Methodology:** Seventy patients were randomly divided into needleless pressure injection technique using Madajet XL and conventional syringe technique. The onset of anesthesia was evaluated using the electric pulp tester, and the pain was assessed using the Visual Analog Scale scoring criteria. **Statistical Analysis:** The obtained data were tabulated and subjected to the statistical analysis using the Chi-square test. **Results:** Needleless pressure injection technique (Madajet XL) proves to be effective in patients with symptomatic irreversible pulpitis during endodontic procedure. **Conclusion:** It can be concluded that the needle-less pressure injection technique (Madajet XL) promises to be a viable mode of pain control during endodontic procedures as it converts the solution to a tiny droplet which is then carried by the myelin sheath.

Keywords: Jet pressure, Madajet XL, needleless injection technique

Introduction

“Needle-Phobia” or “Blenophobia” fear of dental injection is the stressful aspect for an average dental patient.^[1-3] Any endodontic or surgical dental procedure requires the procedure of local anesthesia. According to Malamed, various injection techniques are present to provide reversible loss of sensation.^[4] Boopathi *et al.* has elaborated on various supplementary injection which can provide better anesthetic efficacy.^[5] These procedures are considered unpleasant from physical, chemical, and psychological standpoints as the patient will undergo dental injection twice.

Working on the principles of pressure dynamics, jet injection are generally well accepted by the patients as it reduces the phobia of facing needles. Needleless jet injector assures to be a sustainable mode of pain control during various dental procedures.^[6] Madajet XL is one such jet injection which exerts high pressure that causes the anesthetic solution to infiltrate the tissue in tiny droplet form, which is

immediately taken up by the myelin sheath of the nerve.^[7] Makade *et al.* compared the acceptance, preference, and efficacy between needleless pressure anesthesia and classical needle infiltration anesthesia for dental restorative procedures.^[8] However, there was no study comparing the efficacy of jet injection (Madajet XL) technique with conventional injection technique in patients with symptomatic irreversible pulpitis.

Hence, this study compares the clinical efficacy of jet injections with conventional syringe technique in patients with symptomatic pulpitis, for the level of patient acceptance and comfort with jet injections both by patient and dentist and the onset of pulpal anesthesia. The null hypothesis stating that there is no significant difference seen among the two groups.

Methodology

The study protocol was approved by the Institutional Review Board of SRM dental College, (Ramapuram campus) SRM Institute of Science and Technology. Seventy patients aged 18–50 years who

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were diagnosed with symptomatic irreversible pulpitis in maxillary anterior and premolars with the presence of healthy adjacent and contralateral tooth and were about to undergo endodontic treatment, participated in the study. Seventy patients were randomly selected for needleless pressure injection technique Madajet-XL (Made by–Mada Medical Products, INC.625 Washington Avenue, Caristadt, NJ 07072) which delivers a volume of anesthetic solution 1/10 of an ml (Group I) and conventional syringe technique (UNOLOK; 26 gauge needle size, 0.45 mm × 38 mm; Hindustan syringes and medical devices Ltd, LOT Batch No. 638025 USCI, Faridabad, India) where in 1.8 ml solution is given (Group II). Those patients who were allergic to local anesthesia, patients falling under American Society of Anesthesiologists (ASA) III and greater, pregnancy and nursing, and patients who had any analgesic medication within 24 h before the treatment were excluded from the study. The study protocol was explained to the all the participants, and the informed consent was obtained before administering local anesthesia. Before the injections, the experimental tooth and the control tooth were tested two times with the electric pulp tester (EPT) (Digitest™ II Pulp Vitality Tester; Parkell, Inc., 300 Executive Drive, Edgewood, NY 11717, USA) to ensure tooth vitality. The Visual Analog Scale was explained to the patients before the treatment. Patients were asked to assess the pain value during the injection.^[9]

The onset of anesthesia was monitored with the EPT every 30 s after administering local anesthesia, until pulpal anesthesia was achieved.

Results

The data collected from selected patients were entered in the master chart and subjected to statistical analysis. The Chi-square test was used to test the difference between the two groups. The result of $P < 0.05$ was accepted as statistically significant.

From the Table 1, the level of onset of anesthesia for Group I is found to be <1 min 6 patients, less than 2 min for 18 patients, and <3 min for 6 patients. From the results, nearly 86% of patients showed onset of anesthesia within 3 min using Madajet injection technique.

Similarly, the level of onset of anesthesia for Group II patient is found to be <1 min for the entire patient. Thus, complete anesthetic effect was achieved within 1 min using the conventional syringe technique.

Using the Chi-square test, P value is 0.001. Hence, it is clearly evident that the onset of anesthesia is faster for conventional syringe group than madajet injection group.

From Table 2, the level of pain in Group I patients are scaled as 29 patients with no pain and remaining 6 patients with mild pain. Which implies majority (83%) of patients experienced no pain.

Table 1: Comparison of needleless pressure injection method (Group I) and conventional syringe injection method (Group II) using the Visual Analog Scale

Study group	Pain intensity - VAS				Total patients	P
	No pain	Mild pain	Moderate pain	Severe pain		
Group I	29	6	0	0	35	0.000
Group II	0	13	15	7	35	0.000

VAS: Visual Analog Scale

Table 2: Comparison of needleless pressure injection method (Group I) and conventional syringe injection method (Group II) using Visual Analog Scale

Study Group	Onset of pulpal anesthesia in seconds using EPT							Total patients	P
	30	60	90	120	150	180	180-300		
Group I	1	5	10	8	5	1	5	35	0.000
Group II	24	11	0	0	0	0	0	35	0.000

EPT: Electric pulp test

Similarly, for Group II level of pain is scaled as 13 patients with mild pain, 15 patients with moderate pain, and 7 patients with severe pain. This implies that every patient experienced pain during the conventional syringe technique.

Using the Chi-square test, P value is 0.001. Hence, the level of pain experienced is more for conventional syringe technique than the madajet injection technique.

Discussion

The management of pain is often a challenging task in dentistry. The conventional syringe techniques though provides the necessary sensory and motor blockade, the needle-phobia is always left unattended.^[6] The use of pressure syringes or jet injections is used as a therapeutic modality in the medicine and dentistry.^[10] Since 1947 after its invention by Hingson and Hughes, it has been used in both the medical and the dental fields. Margetis *et al.* in 1958 reported the first dental study using the needle-less jet injector.^[11]

Madajet XL is an autoclavable jet injection device that delivers the local anesthetic solution using a mechanical pressure system. The injector consists of a head assembly with glass fill chambers holding up to 4 ml of local anesthetic solution, body with cocking lever and discharge button and extenda-tip and sheath which can be changed between each patient and allows for pinpoint accuracy at the injection site. Each injection of Madajet XL delivers a volume of anesthetic solution 1/10 of an ml at a depth of 2–2.5 mm below the epithelium. At the base of each infiltration a wheal, approximately 6 mm, is formed so that each injection into the tissue forms an inverted cone. The high pressure exerted by the Madajet XL causes the anesthetic solution to infiltrate the tissue in tiny droplet form, which is immediately taken up by the myelin sheath

of the nerve. The onset of anesthesia is approximately 1 ms. This, in turn, reproduces the scenario of a 25 G syringe technique.^[6,12] This study compared the perception of pain on infiltration injection on maxillary anteriors and premolars and onset of pulpal anesthesia. It was impossible to double blind and very difficult to even single blind this study. The operator would be aware of the significant difference between the injection systems. The patients, even if their vision were restricted, would be able to hear the loud, sound made by the Madajet XL. Inferior alveolar nerve block (IANB) is a common technique of anesthetizing the inferior alveolar nerve which involves the deposition of the anesthetic solution near to the mandibular foramen, a region where the inferior alveolar vein, artery and the nerve are present. Though there are various forms of IANB techniques.^[4] Conventional form of injecting the solution is still considered to be effective and a gold standard.

In the present study, patients falling under ASA Classification I where patients with no systemic illness or patients in whom the illness is localized and does not cause any systemic disorder or abnormality and ASA Classification II where patients with moderate but definite systemic disturbance, caused by the existing illness were included to avoid any potential issue. Furthermore, patients under analgesic medication were excluded from the study as the analgesic used before the treatment can influence the outcome of the results.^[13] In this study, EPT was chosen for the assessment of pulpal anesthesia on the basis of the studies by Archer *et al.*^[14] Paul Hobeich *et al.* stated that getting a negative response with EPT after administering local anesthesia and before beginning any dental procedures, will provide the clinician a reliable indicator of pulpal anesthesia.^[15] It was clear in the study that the reduction in patient anxiety was reduced by the use of Madajet XL technique alone, because the Madajet XL is needleless pressure technique, which produced an even greater decrease in anxiety. In addition, the Madajet XL technique was clearly superior in reducing injection pain and promoting a positive overall injection experience.

The results of the study showed that there was a significant difference in pain and the onset on injection while comparing two techniques. The mean onset time for pulpal anesthesia was <1 min in conventional syringe and needle method and <2 min in needleless pressure injection system (Madajet XL) as determined with EPT. During the access opening procedure, only three patients who received needleless pressure technique, complaint of pain. In those patients, conventional syringe and needle infiltration were administered and access opening was done. This is in accordance to the study done by Bennett and Monheim, Smith *et al.* and Savaria and Bush who reported patient acceptance of about 90%, 95%, and 83%, respectively.^[16,17,7]

The overall 86% of patients experienced no pain. This result is in congruent with study conducted by Munshi

et al.^[6] Contrastingly, in this study, the use of Madajet XL to anesthetize the IANB has an improved success rate. Further study should be done on the efficacy and duration of anesthesia with needleless pressure injection technique.

Conclusion

This study concludes that:

1. Madajet injection technique can also be used in adult patients with symptomatic irreversible pulpitis in maxillary anterior teeth with an evidence of no pain during the procedure
2. On comparing with conventional syringe technique, though the onset of anesthesia is gradual, the patient cooperation during the operative procedure is proved to be high.

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Conflicts of interest

There are no conflicts of interest.

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