



## COMPARATIVE EVALUATION OF POST-ENDODONTIC PAIN USING ULTRA – X AND MANUAL DYNAMIC IRRIGATION IN SINGLE ROOTED TEETH AFTER SINGLE VISIT ENDODONTICS – RANDOMIZED CLINICAL STUDY.

### Endodontics

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### ABSTRACT

**Aim:** Comparative evaluation of post-endodontic pain using Ultra – X and Manual dynamic irrigation in single rooted teeth after single visit endodontics

**Material and Methods:** After institutional ethical approval and informed consent a total of 72 teeth indicated for endodontic treatment were included in this study. They were randomly assigned in two groups (n=36): Group A- Ultra X, Group B- Manual dynamic agitation. In both the groups similar protocols were used for instrumentation, irrigation and obturation with gutta percha. Final irrigation was done using different irrigation systems. Evaluation was done on post-endodontic pain after single visit endodontics in both the groups after 6-hrs, 24-hrs and 48-hrs through a verbal rating scale.

**Results:** The results of the study, analysing the VRS, showed statistically significant difference in post-endodontic pain between the groups at 6h, 24 h and 72 h ( $p < 0.05$ ).

**Conclusions:** Ultra X has played a significant role in reducing post-operative pain as compared to manual dynamic agitation and can be utilized in irrigation in endodontic treatment.

### KEYWORDS

Ultra X, Manual dynamic agitation, Single visit endodontics

### INTRODUCTION

Post endodontic pain is highly upsetting for both the endodontists and patients. The intensity can vary from mild to very severe and may last from a day to several weeks. Earlier root canal treatment was performed in multiple visits, with intracanal medication between visits aiming to reduce or eliminate microbial load and its toxins from the root canal system.<sup>[1]</sup> As an alternative to the traditional protocol single visit endodontics has been proposed that reduces or eliminates the number of intraoperative appointments thereby eliminating the risk of inter appointment flare-ups.<sup>[2]</sup> Although mechanical instrumentation techniques, are incapable of rendering most of root canal free of bacteria, the intricacies of the root canal system hinder its complete debridement. In this regard, irrigation forms an integral part of chemomechanical preparation by facilitating the removal of bacteria, debris and necrotic tissue, from the inaccessible areas of the root canal.

Manual dynamic agitation (MDA) is a cost-effective technique for cleaning the entire root canal. It involves repeated insertion of a well-fitting gutta-percha cone to the working length (WL) of a previously shaped canal.<sup>[3]</sup> Many irrigation devices have been developed with the aim of improving the irrigant delivery throughout the root canal by using ultrasonic or sonic energy and apical negative pressure.<sup>[4]</sup> A newly introduced ultrasonic irrigant agitation system introduced by Orikam(Eighteeth) is the Ultra – X. It works at 45000 kHz ultrasonic frequencies and utilizes the principle of acoustic microstreaming, agitation and irrigant activation to clean inaccessible areas of the complex root canal system.<sup>[5]</sup>

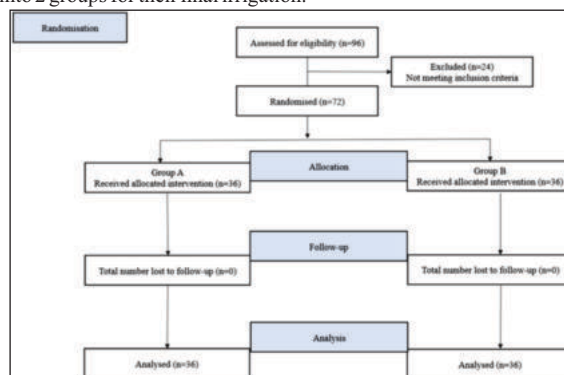
Hence this study aimed at comparative evaluation of post-operative pain after single visit endodontics using Ultra X and Manual dynamic agitation in symptomatic single rooted teeth. Null hypothesis was that there is no significant difference in post-endodontic pain in patients with single rooted teeth when using Ultra – X and Manual dynamic agitation as irrigation activation method after single visit root canal treatment.

### MATERIALS AND METHODS

After obtaining ethical approval from institutional ethics committee, study was registered at Clinical Trial Registry of India CTRI/ 2020/ 09/ 036554. Patients of 19 years age and older with single rooted teeth diagnosed with symptomatic irreversible pulpitis and apical periodontitis and who were willing to give consent to the study were included. Patients with poor oral hygiene, chronic periodontitis, immature apices or root resorption, pregnant women and those who had taken analgesics were excluded. A minimum of 60 (30per group)

patients were taken to estimate mean difference in post-endodontic pain (at 24 hrs) at 10.6 with SD 19.7 at 95% confidence and 80% power. Considering a drop out of 20 % additional 12 samples were added. Hence the final sample size was 72 (n=36/ group).

For Randomisation, each patient was assigned a code that was generated from www.randomizer.org.in and the patient was asked to choose an opaque sealed envelope, containing a piece of paper with a group name and random number. Accordingly, the patients were randomly allocated to either the Group A (Ultra – X) or the Group B (Manual dynamic irrigation) by the first co-investigator who was blinded to subsequent procedures. Access opening was done under local anaesthesia with rubber dam isolation. A glide path was established with a #10 K file (Mani) The working lengths (WL) was determined using a Root ZX mini apex locator and confirmed radiographically. The root canals were instrumented with hand K file or rotary files under copious irrigation with 5.25% sodium hypochlorite (NaOCl) depending upon root canal anatomy. After the biomechanical preparation was completed, the patients were divided into 2 groups for their final irrigation.



**Fig:1 Randomized clinical trial flow chart**

### Group A (Ultra – X)

The canal was flooded with 5.25% NaOCl. The Ultra – X tip was kept 2- 3mm short of WL so that the tip was passively fit in the canal. The solution was activated by the tip using short vertical up and down motion for 30 seconds. The irrigating solution was replenished and the suction was removed to the loose debris. The cycle was repeated for 4-5 times. The device was used gently and with no pressure.

### Group B (MDA)

The canal was flooded with NaOCl solution and activated at the WL using a gutta-percha cone corresponding to the master apical file for 1 minute in each canal.

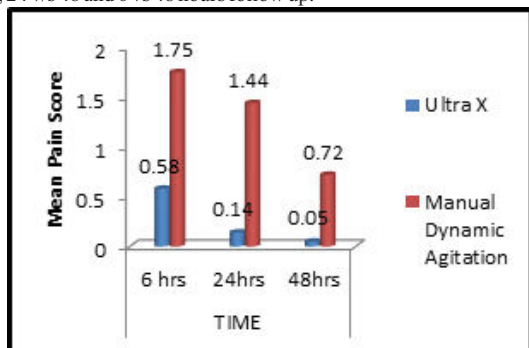
In both groups, the root canals were obturated with cold lateral compaction technique using gutta-percha cones and AH Plus root canal sealer (Dentsply Maillefer). Coronal access cavities were restored with direct composite restorations using dentin adhesives (Single Bond Universal; 3M ESPE,) and universal composite resin (3M ESPE). Patients were instructed to complete VRS<sup>[6]</sup> to determine their postoperative pain scores at 6 hrs, 24 hrs and 48 hrs respectively. Patients were contacted by telephone by one of the investigators other than operator who would be blinded about the two groups and asked whether they experienced any pain or use analgesics and, if so, their VRS scores were recorded to avoid bias.

VRS-0 (the treated tooth felt normal)
VRS-1 (the treated tooth was slightly painful for a time, regardless of the duration, but there was no need to take analgesics.)
VRS-2 (the treated tooth caused discomfort or pain, which was rendered comfortable by taking one tablet of paracetamol.)
VRS-3 (the treated tooth caused discomfort and or pain, which was rendered comfortable by taking two tablets of paracetamol at 6 hour interval)
VRS-4 (the treated tooth caused discomfort and or pain, which was rendered tolerable by taking two tablets of paracetamol at every 6 hour for 3 days.)
VRS-5 (severe pain and or swelling caused by the treated tooth that disturbed normal activity or sleep and paracetamol tablet had little or no effect.)

Fig :2The VRS Scale

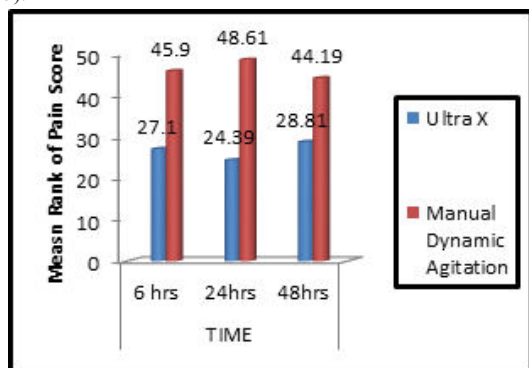
### RESULTS

The data obtained was analysed with IBM SPSS 20 for windows. Wilcoxon's sign rank test was used for intra group comparison and Mann Whitney U test for intergroup comparisons at 5% level of significance. Out of the 72 patients there were no dropouts. The intra group comparison of group A was statistically significant at 6 versus 24 hours follow up and 6 v/s 48 hours follow up ( $p = 0.00$ ). The intra group comparison of Group B was statistically significant ( $p < 0.05$ ) at 6 v/s 24, 24 v/s 48 and 6 vs 48 hours follow up.



Graph 1: Mean pain scores of Ultra X and Manual dynamic agitation group

On inter group comparison there was statistically significant difference at 6-hour, 24 hour and 48-hour follow up between Groups A and B ( $p < 0.05$ ).



Graph 2: Inter group comparison of pain scores using Mann Whitney U test

### DISCUSSION

Postoperative pain is unpleasant and is described as discomfort experienced by patients; with a high prevalence rate ranging between 3 and 58%.<sup>[7]</sup> The causes of postoperative pain are classified as mechanical, chemical and/or microbiological. Bacterial toxins, enzymes, and noxious metabolic by-products of the microbes from the root canal system can perfuse into the periradicular tissues and can give rise to post endodontic pain.<sup>[8]</sup> These persistent microorganisms colonize dentinal tubules, accessory canals, isthmuses, and apical deltas, making their eradication difficult. The elimination of persisting microorganisms in the intricacies of the root canal system is thus a major challenge in today's treatment regimens and is crucial for the long term preservation of the endodontically treated tooth.<sup>[9]</sup>

Root canal irrigation plays a key role in cleaning, debriding and disinfecting areas where the instrument cannot reach during canal preparation. The most commonly used irrigant, NaOCl, has germicidal properties and the ability to dissolve soft tissues of the dental pulp. The tissue dissolving capabilities of NaOCl are better at higher pH (pH = 12). Physical agitation increases the contact between the fluids and the root canal walls and also increases the temperature of the fluids, which in turn enhances its chemical actions.<sup>[10]</sup>

Another way of enhancing root canal disinfection is NaOCl activation, promoting its penetration on most aspects of the root canal system (RCS). The more convenient and cost-effective method of NaOCl activation is MDA, where small size instruments, such as K-files or well-fitting gutta-percha cones, are passively inserted in the canal to WL and agitated up and down with a 2–3 mm amplitude. Agitating the irrigant solution does not improve its reaction rate but increases its surface contact with the canal walls and also reduces the vapor lock effect.<sup>[11]</sup>

During Passive Ultrasonic Irrigation (PUI), NaOCl removes significantly more smear layer, pulp tissue or dentine debris from the root canal. The ultrasonic files oscillate at a frequency of 25–30 kHz and act via stream and cavitation of the irrigant thereby disrupting the vapour lock. Ultrasonically activated files enhance effective cleaning root canals via acoustic streaming. Acoustic streaming creates micro cavitation that implodes shaking the solution inside the canal and improving the removal of the smear layer as well as improving the penetration of the liquid into the apical third of the canal. There is enhanced reaction rate due to the rise in temperature of irrigant solution.<sup>[10]</sup> Shorter passive irrigation time of 30 seconds makes it easier for the tip to stay in the centre of the canal and prevents inadvertent damage to the canal wall and also aids in replenishment of fresh irrigants. Hence, Passive Ultrasonic Irrigation was used in the present study.

Single rooted teeth with necrosis subsequent to deep dental caries is one of the most widely and commonly encountered condition in most patients. The wide canals of single rooted teeth made irrigation easier and prevented iatrogenic damage. Hence, Single rooted necrosed teeth were included in the study.

The patients were evaluated for post endodontic pain by the second investigator who was blinded to all the previous procedures done by the primary investigator. Post endodontic pain was evaluated at 6 hours, 24 hours and 48 hours follow up using the verbal rating scale. The verbal rating scale had a score ranging from 0 to 5. This smaller range score makes it easy to evaluate the pain during the follow up period.

Single visit endodontic therapy has become the choice of treatment for most endodontic cases as it achieves all basic objectives of successful endodontic therapy in minimum time. With recent innovation in rotary nickel-titanium systems and improvements in the understanding of irrigation dynamics the mechanical instrumentation and disinfection of the root canal has been greatly facilitated, making single-appointment treatment more convenient and an acceptable treatment regime than before.<sup>[12]</sup>

Fox et al.,<sup>[13]</sup> reported that 90% of teeth treated in a single visit had little or no spontaneous pain at the end of 1 day and 99% had no spontaneous pain at the end of 1 week. Olie<sup>[14]</sup> treated 264 teeth and found 10.6% prevalence of pain following obturation after 24 h and no pain at all after 1 week. These findings are similar to the present study where 36% patients reported mild pain and 12% moderate pain after 1 day; 6% reported mild pain after 1 week.

The success rate of single visit endodontics in single rooted teeth (90.2-96.7%) was higher than the multi rooted teeth (86.2%). The lower success rate of multirooted teeth could be attributed to anatomical complexities.<sup>[12]</sup> Besides single visit endodontics required increased appointment time in multi rooted teeth. Hence in the light of the above in the present study, single rooted necrosed teeth for single visit endodontic treatment were chosen.

Ultra X showed significant difference in post-operative pain ( $p < 0.05$ ) with significantly reduced post endodontic pain at 24 and 48 hrs respectively compared to 6 hrs. The reduced post endodontic pain might be due to tip kept 2-3 mm short of working length that caused lesser irrigant extrusion, better penetration into dentinal tubules and adequate disinfection of the apical terminus.<sup>[5]</sup> In root canals where there is restricted access for instrumentation ultrasonic agitation with irrigants improved penetration and disinfection of the apical delta and the main canal and dissolution of organic tissue by NaOCl. They also promote greater penetration of the irrigation solution in the isthmus and lateral canals.

There was statistically significant difference in post endodontic pain at 6 versus 24, 24 versus 48 and 6 versus 48 hours follow up in MDA group. The higher pain scores maybe due to well-fitting gutta percha up to working length that caused more irrigant extrusion and hence transient apical breakdown leading to transient apical periodontitis.

Boutsoukakis et al<sup>[15]</sup> evaluated the effect of PUI, SA, and MDA on irrigant extrusion and concluded that MDA extruded significantly more irrigant than the EndoActivator and PUI. This might be the reason for higher pain scores in Manual dynamic agitation group.

## CONCLUSION

Within the limitations of the passive ultrasonic irrigation by Ultra X presented with a better clinical performance than manual dynamic agitation at the end of 6, 24, and 48 hours follow up. Hence long-term clinical studies with larger sample size should be done for further acceptable and reliable results.

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