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Original Research

Unveiling Excellence: A Comparative Analysis of Two Distinctive Irrigation Techniques in the Eradication of Smear Layer and Organic Debris from the Root Canal

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ABSTRACT:

Objective- The objective of this study was to assess and compare the efficacy of removing the smear layer and organic debris within the tooth canal using EndoVac, and Endoactivator. **Materials and methods-** In this research, seventy five single-rooted human teeth that had not undergone prior endodontic treatment and had intact apices were utilized. The selection criteria excluded teeth with extensive restorations, root caries, fractures, immature apex, and root length shorter than 10.5 mm. Verification of the presence of a single canal was conducted through radiographs taken in both mesiodistal and buccolingual directions. Data analysis was performed using SPSS**. Results-** The Endo Activator exhibited superior results in total cleansing, surpassing the control group treated with saline solution, which showed the least favourable outcomes. **Conclusion-** Both the EndoVac system and the Endo Activator system exhibited significantly greater efficacy in cleansing root canal walls compared to conventional needle irrigation.

Keywords- irrigation, EndoVac, Endo Activator

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INTRODUCTION

Endodontics, a specialized field, is concerned with the anatomy and function of the pulp and periradicular tissues surrounding a tooth's root canals. The primary objective of root canal therapy is to cleanse infected pulp and periradicular tissues while preventing further infection. Microorganisms, commonly found in the human mouth, are a major cause of pulpal and periradicular pathologies [1]. These oral microorganisms can form biofilms on both hard and soft tissues within the mouth. The key focus of endodontic therapy is to identify and address these underlying causes. The treatment plan involves root canal debridement, irrigation, and biofilm removal to prevent and control endodontic diseases [2].The therapeutic process consists of three main steps: root canal preparation, chemo-mechanical debridement, and obturation. Chemo-mechanical debridement necessitates both instrumentation and irrigation [3]. Instrumentation aims to prepare the canal system for the application of locally utilized drugs and the placement of a root canal filling [4]. Before and during the use of instruments, irrigation serves as a crucial pre-instrumentation phase to eliminate contaminated necrotic tissue. In the last two decades, water irrigation has gained prominence as a vital component of effective root canal therapy. Research and clinical practice have predominantly focused on root canal instrumentation, irrigation, and medication, followed by obturation and the establishment of a coronal seal. In the realm of water purification, instruments shape the canals, while irrigants effectively cleanse. Physically disinfecting or cleaning every part of a root canal system is challenging, and irrigation solutions play a crucial role in effectively cleaning these intricate spaces, including the main canal, lateral canals, accessory canals, and isthmuses [5].

MATERIALS AND METHODS

In this research, seventy five single-rooted human teeth that had not undergone prior endodontic treatment and

had intact apices were utilized. The selection criteria excluded teeth with extensive restorations, root caries, fractures, immature apex, and root length shorter than 10.5 mm. Verification of the presence of a single canal was conducted through radiographs taken in both mesiodistal and buccolingual directions.

The teeth's external surfaces underwent ultrasonic cleaning, and a flat occlusal surface was fashioned to serve as a reference for establishing the working length. Size 10 number stainless steel K-file was inserted into the canal until the file's tip became visible at the apical foramen. To determine the working length, 0.5 mm was then reduced. The coronal section was expanded using Gates Glidden files.

To replicate the clinical scenario, specimens were embedded in silicone to seal the apex. The samples were randomly categorized into two groups. To ensure consistency and minimize intraoperator variability, a single operator conducted all shaping and cleaning procedures.

The root canals were prepared using rotary nickel-titanium ProTaper instruments with a crown-down technique. Apical patency was maintained throughout the procedure using#10 K-file to the working length. Irrigation was carried out after each rotary instrument. In the control group (Group 1, n = 25), saline solution was the sole irrigant. The remaining 25 root canals were rinsed with 2.5 mL of 5.25% NaOCl. The irrigation was delivered using a syringe and a 30-gauge needle inserted as deep apically as possible without binding. Subsequently, the samples from each group underwent different irrigation protocols.

In Group 1 control group (n = 25), designated as the control group, the root canals were treated using the same instrumentation protocol with a syringe and a 30-gauge needle (NaviTip). However, the irrigant used exclusively in this group was saline solution.

In Group 2 (n=25), after the instrumentation, a rinse sequence was performed involving 5 ml of 17% EDTA for 2 minutes and 2.5 ml of 5.25% sodium hypochlorite for 2 minutes. The irrigants were introduced into the root canals using a conventional syringe. Following irrigations, the root canal was pre-filled with EDTA and then with sodium hypochlorite, followed by sonication using the appropriate bits of the EndoActivator system. This sonic activation was designed to prevent contact with the canal walls during use, leaving the tip free to reach up to 1.5 mm from the working length. The EndoActivator device was applied with a short vertical "up and down" movement for 60 seconds. Any remaining irrigant was removed using a syringe with a 30-gauge needle.

In Group 3 (n=25), after the instrumentation process, a comprehensive two-step irrigation strategy was implemented. Firstly, during the macro irrigation phase, 3 mL of 5.25% NaOCl was dispensed over 45 seconds using the master delivery tip. The macro cannula was continuously moved from the cementum-enamel junction to 4 mm from the working length. Subsequently, micro irrigation involved three micro cycles. In the initial micro cycle, 5.25% NaOCl was applied through the micro cannula, spanning from the beginning to the full length of the canal, with a 2.5 mm upward movement every 5 seconds, totalling 45 seconds. The second micro cycle incorporated the use of 17% EDTA, followed by the third micro cycle utilizing 5.25% NaOCl once again. Post-preparation, each tooth underwent sectioning with two grooves along its axis using a diamond disk. The resulting halves were longitudinally split with a chisel, and each root half was preserved in a 2% thymol solution at room temperature. Subsequently, these specimens were mounted on stubs and subjected to examination under a scanning electron microscope.

RESULTS

The EndoActivator exhibited superior results in total cleansing, surpassing the control group treated with saline solution, which showed the least favourable outcomes. In terms of debris removal, the EndoActivator demonstrated the most effective performance, whereas the control group treated with saline solution yielded the poorest results. Conventional irrigation and EndoVac showed intermediate results, with EndoVac being more effective in removing debris than conventional irrigation. Regarding the smear layer, the control group with saline solution did not achieve significant cleansing, while the EndoActivator delivered the best results. Conventional irrigation and EndoVac exhibited similar intermediate cleaning of the root canal, with EndoVac showing a slight advantage.

DISCUSSION

This study aimed to compare root canal debridement effectiveness among different irrigation techniques, specifically focusing on EndoVac and EndoActivator, known for their reduced extrusion of irrigant into the periapical region compared to other systems.[6] The risk of sodium hypochlorite extrusion during root canal irrigation, potentially leading to tissue necrosis and pain, underscores the importance of investigating irrigation methods.. A prior study evaluating the efficacy against Enterococcus faecalis found no statistically significant differences among the two irrigation techniques.[7,8]

The smear layer, composed of organic and inorganic materials containing bacteria and by-products, remains a debated aspect of endodontic therapy. Although no clinical trials explicitly link smear layer removal to endodontic success, many authors advocate its removal for more thorough disinfection and improved adaptation between canal walls and filling materials.

Regarding smear layer removal, the EndoActivator demonstrated superior results throughout the entire length of the root canal, with no statistical differences observed among the coronal, middle, and apical thirds.[9] This suggests that the EndoActivator enhances smear layer debridement not only in the apical region

but uniformly along the entire root canal length.[10] In agreement with Rödig et al., who noted improved smear layer removal with sonic and ultrasonic systems, it is noteworthy that the benefits extend beyond the straight coronal portion to include the curved root canal. The EndoVac system exhibited superior performance in smear layer removal across the apical, middle, and coronal thirds compared to conventional irrigation and saline solution.[11,13,14]

Parente showed that the EndoVac system was more effective than manual dynamic irrigation in the elimination of smear layer and debris in a closed canal system. Furthermore, [15] Saber reported that the EndoVac system removes more smear layer from root canal walls than passive ultrasonic irrigation .The EndoActivator demonstrated superior results across the entire canal area, particularly in the apical and middle thirds. Our findings align with previously published studies, corroborating that sonic activation of the irrigant significantly enhances debris removal and improves obturation of lateral and accessory canals compared to syringe irrigation, especially in straight root canals.[12,13]

In our study, the results revealed that the EndoActivator exhibited superior efficacy compared to both the EndoVac system and conventional irrigation in achieving total cleansing of root canal walls. In our study, the results revealed that the EndoActivator exhibited superior efficacy compared to both the EndoVac system and conventional irrigation in achieving total cleansing of root canal walls.

CONCLUSION

Both the EndoVac system and the EndoActivator system exhibited significantly greater efficacy in cleansing root canal walls compared to conventional needle irrigation. These findings underscore the enhanced performance of advanced irrigation systems in promoting thorough debridement and cleaning in endodontic procedures.

REFRENCES

1. Biofilm in endodontics: new understanding to an old problem. Usha HL, Kaiwar A, Mehta D. *IJCD.* 2010;1:44–51.
2. Mechanical effectiveness of root canal irrigation. Chow TW. *J Endod.* 1983;9:475–479.
3. Chemotherapy of dental plaque infections. Loesche WJ. *Oral Sci Rev.* 1976;9:65–107.
4. Nisha Garg, Amit Garg. *Garg Textbook of Endodontics second edition chapter*. Vol. 16. India: Jaypee Brothers Medical Publishers (P) Ltd; 2010. Textbook of Endodontics, second edition; pp. 16–200.
5. Comparison of the EndoVac system to needle irrigation of root canals. Nielsen BA, Craig Baumgartner J. *J Endod.* 2007;33:611–615.
6. P. Desai, V. Himel.Comparative safety of various intracanal irrigation system.J Endod, 35 (2009), pp. 545-549.
7. R.P. Mitchell, J.C. Baumgartner, C.M. Sedgley. Apical extrusion of sodium hypochlorite using different root canal irrigation systems.J Endod, 37 (2011), pp. 1677-1681.
8. M. Hülsmaan, W. Hahn.Complications during root canal irrigation – literature review and case reports.Int Endod J, 33 (2000), pp. 186-193.
9. S. Seltzer.Pain in endodontics. 1986.J Endod, 30 (2004), pp. 501-503.
10. D.R. Violich, N.P. Chandler.The smear layer in endodontics – a review.Int Endod J, 43 (2010), pp. 2-15.
11. M.S. O'Connell, L.A. Morgan, W.J. Beeler, J.C. Baumg artner.A comparative study of smear layer removal using different salts of EDTA.J Endod, 26 (2000), pp. 739-743
12. B.A. Nielsen, J.C. Baumgartner.Comparison of the EndoVac system to needle irrigation of root canals
13. J Endod, 33 (2007), pp. 611-615
14. J.M. Parente, R.J. Loushine, L. Susin, L. Gu, S.W. Loon ey, R.N. Weller, *et al.*
15. Sel-D Saber, A.A. Hashem.Efficacy of different final irrigation activation techniques on smear layer removal.J Endod, 37 (2011), pp. 1272-1275