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Original Research

Efficacy of different irrigation devices in removal of calcium hydroxide in teeth with simulated internal resorption cavities

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ABSTRACT:
Background: A successful endodontic therapy aims to remove microorganisms, microbial toxins, and necrotic and important pulp tissue remains from the root canal system. The present study was conducted to assess efficacy of different irrigation devices in removal of calcium hydroxide in teeth with simulated internal resorption cavities. **Materials & Methods:** 48 single-rooted mandibular premolars were selected. The ProTaper Gold technology was used to prepare and decoronate teeth up to F5. Resorption cavities were created by buccolingually sectioning the samples. Group I, or the negative control, consisted of 8 specimens. Group II, or the positive control, consisted of 8 specimens. The remaining specimens were split up into four groups, and for one minute, PUI, XP-endo, EA, and E1 were used to activate the NaOCl and EDTA. **Results:** Complete CH paste could not be extracted from simulated internal resorption cavities by any of the evaluated groups. Results from PUI and XP-endo files were better and more efficient than those from any other category. While Endo-Irrigator Plus (EI) demonstrated the least amount of CH elimination, EndoActivator (EA) demonstrated results comparable to XP-endo but significantly different with PUI ($P < 0.05$). Score 0, 1, 2 and 3 in group I was as 100%, in group II was 100%, in group III was 52%, 34%, 14%, in group IV was 53%, 11%, 26% and 10%, in group V was 26%, 15%, 41% and 18%, and in group VI was 5%, 31%, 44% and 20% respectively. The difference was significant ($P< 0.05$). **Conclusion:** No irrigation technique was able to completely eradicate CH in artificial internal resorption voids. In this instance, XP-endo eradicated CH as well as PUI, but more effectively than EA and EI plus, while PUI outperformed all other irrigation technologies.
Keywords: Calcium hydroxide, EndoActivator, irrigation

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INTRODUCTION

A successful endodontic therapy aims to remove microorganisms, microbial toxins, and necrotic and important pulp tissue remains from the root canal system. Numerous studies have shown that a root canal's intricate architecture makes it very difficult to fully debride it utilizing chemomechanical preparation, cleaning, and shaping. In endodontics, calcium hydroxide (CH) is frequently administered intracanally.[1,2] It is advantageous for this use due to a number of characteristics, including as its antibacterial activity, capacity to aid in tissue repair, and alkaline pH, which aids in acid neutralization and root canal system disinfection.[3] In situations of pulp necrosis, periapical inflammation or infection, and as a stopgap medicine in between endodontic visits, calcium hydroxide is frequently administered intracanally. It is especially helpful when the root canal system is not

completely accessible during the initial treatment or when there is a chronic infection.[4] Several studies on mechanical irrigant activation have demonstrated that the best technique for chemical irrigant activation is passive ultrasonic irrigation (PUI). More intracanal medicine can be removed, but not all of the CH.[5,6] The present study was conducted to assess efficacy of different irrigation devices in removal of calcium hydroxide in teeth with simulated internal resorption cavities.

MATERIALS & METHODS

The present study consisted of 48 single-rooted mandibular premolars. The ProTaper Gold technology was used to prepare and decoronate teeth up to F5. Resorption cavities were created by buccolingually sectioning the samples. Group I, or the negative control, consisted of 8 specimens. CH was administered and the root halves were joined in the remaining specimens. Group II, or the positive control, consisted of 8 specimens. The remaining specimens were split up into four groups, and for one minute, PUI, XP-endo, EA, and E1 were used to activate the NaOCl and EDTA. The remaining CH was examined and given the following scores: 0- free of CH debris, 1-less than half filled with debris, 2-more than half filled with debris, and 3-completely filled with debris. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I U1 and U2 value in groups

Groups	U1	U2	P value
PUI-XP	180	218	0.91
PUI-EA	117	285	0.01
PUI-EI	99	341	0.01
XP- EA	132	252	0.05
XP- E1	115	287	0.03
EA- E1	172	235	0.75

Table I, graph I shows that complete CH paste could not be extracted from simulated internal resorption cavities by any of the evaluated groups. Results from PUI and XP-endo files were better and more efficient than those from any other category. While Endo-Irrigator Plus (EI) demonstrated the least amount of CH elimination, EndoActivator (EA) demonstrated results comparable to XP-endo but significantly different with PUI (P < 0.05).

Graph I U1 and U2 value in groups

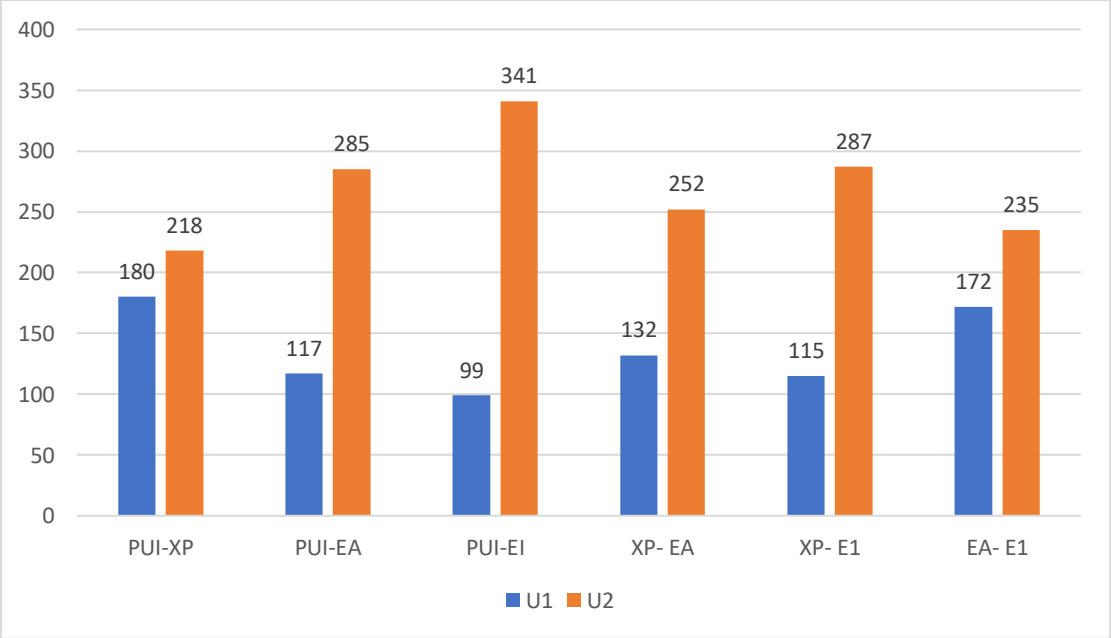

Table II Percentage of CH removal

Groups	0	1	2	3	P value
Group I	100	0	0	0	0.01
Group II	100	0	0	0	0.01
Group III	52	34	14	0	0.05

Group IV	53	11	26	10	0.03
Group V	26	15	41	18	0.04
Group VI	5	31	44	20	0.05

Table II shows that score 0, 1, 2 and 3 in group I was as 100%, in group II was 100%, in group III was 52%, 34%, 14%, in group IV was 53%, 11%, 26% and 10%, in group V was 26%, 15%, 41% and 18%, and in group VI was 5%, 31%, 44% and 20% respectively. The difference was significant (P< 0.05).

DISCUSSION

One crucial stage in the treatment of endodontic infections and inflammation is the intracanal administration of calcium hydroxide. It facilitates a successful root canal procedure, aids in periapical tissue recovery, and disinfects the root canal system.[7] For intracanal calcium hydroxide therapy to produce the best results, proper technique and adherence to established guidelines are crucial.[8,9] The present study was conducted to assess efficacy of different irrigation devices in removal of calcium hydroxide in teeth with simulated internal resorption cavities.

We found that complete CH paste could not be extracted from simulated internal resorption cavities by any of the evaluated groups. Results from PUI and XP-endo files were better and more efficient than those from any other category. While Endo-Irrigator Plus (EI) demonstrated the least amount of CH elimination, EndoActivator (EA) demonstrated results comparable to XP-endo but significantly different with PUI ($P < 0.05$). Shetty et al[10] examined how much apically extruded debris is affected by EndoIrrigator plus, passive ultrasonic irrigation (PUI), and a traditional syringe. A total of thirty removed human mandibular premolars were chosen, and they were divided into three groups at random (n = 10). PUI, EndoIrrigator Plus, and a traditional syringe were used to irrigate the root canals. Debris was gathered using a previously reported experimental model, and sodium hypochlorite was employed as an irrigant. After ten days of evaporating the irrigant in an incubator set at 37°C, the dry debris was weighed. The average debris weight was determined, data were compared using one-way analysis of variance, and post hoc Tukey's test was applied between groups ($P = 0.05$). Compared to the PUI and traditional syringe groups, the EndoIrrigator Plus group ejected noticeably less debris ($P < 0.05$). Additionally, compared to the typical syringe irrigation group, the PUI group extruded considerably less debris ($P < 0.05$).

It was seen that score 0, 1, 2 and 3 in group I was as 100%, in group II was 100%, in group III was 52%, 34%, 14%, in group IV was 53%, 11%, 26% and 10%, in group V was 26%, 15%, 41% and 18%, and in group VI was 5%, 31%, 44% and 20% respectively. Denna et al[11] assessed the effectiveness of various irrigation schedules in removing Ca (OH)2 using the rotary device XP-endo Finisher. For the investigation, sixteen human double-rooted upper premolar teeth were chosen. A ProTaper Next rotary system was used to prepare thirty-two canals up to X3. Ca (OH)2 was then poured into the canals. Microcomputed tomography (micro-CT) was used to assess the volume of Ca (OH)2 inside the canals. The teeth were then divided into two experimental groups, A and B (n = 16 canals), at random. The master apical file (X3) was used to eliminate Ca (OH)2 from group A. Ca (OH)2 was eliminated in group B with an XP-endo finisher. Syringe irrigation (SI) was utilized in half of both groups (n = 8), while the other half underwent passive ultrasonic irrigation (PUI). The volume of Ca (OH)2 that remained after removal was measured. In all groups, the apical thirds of all canals had considerably larger percentages of residual Ca (OH)2 than the middle and coronal thirds ($p < 0.05$). Different files and methods did not significantly differ from one another ($p > 0.05$).

The effectiveness of recently developed irrigation systems, such as the XP-endo Finisher file (XP-endo), EndoActivator (EA), and Endo-Irrigator Plus (EI), in removing calcium hydroxide (CH) from single-rooted teeth with artificially simulated internal resorption cavities was compared by Arora et al[12] with the gold standard passive ultrasonic irrigation (PUI) tip. The ProTaper Gold technology was used to prepare and decoronate 120 single-rooted mandibular premolars up to F5. Resorption cavities were created by buccolingually sectioning the samples. Twenty specimens were used as the negative control, or Group 1. CH was administered and the root halves were joined in the remaining specimens. Twenty specimens were used as the positive control, or Group 2. After randomly assigning the remaining specimens to four experimental groups (n = 20), NaOCl and EDTA were activated for one minute using PUI, XP-endo, EA, and EI. CH's remains were scored. There was no discernible difference between the devices, with PUI and XP-endo removing more CH than the others ($P < 0.05$).

The shortcoming of the study is the small sample size.

CONCLUSION

Authors found that no irrigation technique was able to completely eradicate CH in artificial internal resorption voids. In this instance, XP-endo eradicated CH as well as PUI, but more effectively than EA and EI plus, while PUI outperformed all other irrigation technologies.

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