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Efficiency Of Placement Of Intracanal Medicament In The Apical Third Of The Root Canal Using Reverse Rotary Instrumentation.

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ABSTRACT

Successful root canal treatment necessitates complete disinfection with a combination of irrigants and intracanal medicaments. Calcium hydroxide, being the most common intracanal medicament used, is a strong alkaline substance with lethal effects on the bacterial cells. Although, its successful delivery to the apical third of the root canal is ambiguous. The aim of the present study was to evaluate the efficiency of reverse rotary instrumentation in delivering intracanal medicament at the apical third of the root canals. 30 mandibular premolar teeth indicated for root canal treatment were instrumented to Protaper size F2. Metapex was placed in the teeth accordingly: Group 1: Hand plugger, Group 2: Lentulospirals, Group 3: Reverse rotary instrumentation. The teeth were analysed using digital radiography at 1mm and 3mm of the apical third of the root canal system. Statistical analysis was done using the One wayanova test. Group 3 showed the maximum radiopacity of 0.28 mm and 0.52 mm at 1mm and 3mm respectively followed by Group 2 with 0.11mm and 0.31 mm. Group 1 showed the least radiopacity of 0.04 mm and 0.24 mm at 1mm and 3mm respectively. A statistically significant difference in the radiopacity was observed between the study groups at both the levels. In the present study, the reverse rotary technique proved to be a superior system of delivery of calcium hydroxide as compared to the other techniques.

Keywords: Calcium Hydroxide, Metapex, Apical Third, Hand Plugger, Lentulospiral, Reverse Rotary.

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INTRODUCTION

By virtue of the pathological modulations in the pulp, the root canal systemharbors voluminous irritants[1]. The formation and development of periradicaular lesions can be attributed to the ingress of the irritants from the infected root canal system into the surrounding periapicalregion[1, 2]. Literature advocates the microorganisms to be the fundamental cause for perpetuation of pulp and periapical diseases.[3,4]

Despite the availability of numerous instrumentation systems and irrigation techniques, a thoroughdisinfection of the root canal system is hampered, owing toits circuitous anatomy and the subsequent constraints. Thus the use of an antimicrobialintracanal medication is a must for disinfection the root canal system [5, 6].

Calcium hydroxide is a strong alkaline substance with a pH of approximately 12.5[7]. Most of the endopathogens are unable to survive in this high alkaline environment [8]. Their lethal effects on the bacterial cells are probably due to the damage to the cytoplasmic membrane, protein denaturation and damage to the DNA [7,8,9]. Calcium hydroxide is used extensively as an intracanal medicament in endodontics for many years. It is used in various clinical situations such as to promote apexification, to repair perforation, to enhance healing of periapical lesions, to control root resorption, and to control exudation in teeth with persistent periapicalinflammation[10, 11].

According to Gutmann, "a rotary NiTi instrument that fits loosely in the canal can be used ***in reverse***to place the material apically; the file is placed only to the middle third, and the rotary action will carry the material apically"[12]. This hypothesis can be utilized to deliver intracanal medicaments into the apical third of the root canal, where effective cleansing has not been demonstrated. The purpose of the present study was to evaluate the efficiency of reverse rotary instrumentation in delivering intracanal medicament at the apical third of the root canals.

MATERIALS AND METHODS

Thirty patients with indicated pulp space therapy on mandibular teeth was selected for the study. Ethical clearance was obtained from the institutional ethical committee. Informed consent was obtained from the patient.

In each teeth, access opening was done with the help of Endoaccess bur no.2 and Endo Z bur following which the working length was determined with the help of the Digital radiography (Intra SkanDigi, SKANRAY Technologies, Mysore, India). The roots were prepared by serial preparation to #25 K-file. Sodium hypochlorite and saline were used as an irrigants between each step of the preparation for removal of debris. The preparation was stopped at the apical constriction.Rotary NiTi files were used to instrument the canals with crown down technique to a size F2 at 300 rpm. The apical portion was tapered with 0.02 tapered NiTi hand files to an ISO #30 to ensure the removal of debris at the apical third.

The intracanal medicaments were placed in the teeth randomly according to the following groups:

Group 1: Placement of Metapex using a hand plugger.

The Metapexpaste was placed to the entire length of the hand plugger and applied uptil the working length in clockwise motion. The paste was applied until it was visible at the orifice of the canal.

Group 2: Placement of Metapex using lentulospirals

Depending upon the size of the canal, alentulospiralof preferred size was coated with the metapex paste, followed by the instrument being introduced into the root canal with subsequent placement of the paste into the canal. This procedure was continued until the metapexpaste was visible at the orifice of the canal.

Group 3: Placement of Metapex using reverse rotary instrumentation

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Using .06 rotary NiTi files; the orifice opener Sx (Protaper) preparation, the metapexpaste was coated onto the entire length of the file and placed uptilthe middle third of the root canal, followed by reverse rotary instrumentation at 150 rpm. The procedure continued until the paste was visible at the canal orifice.

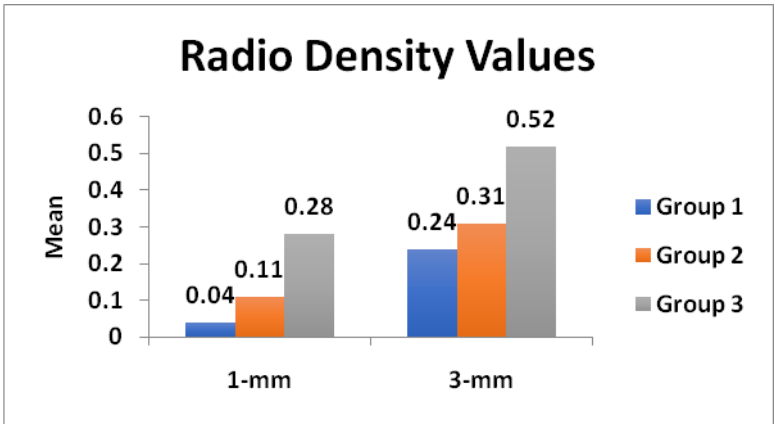
After placement of the calcium hydroxide paste in each sample, a radiograph angulated from a buccolingual direction was taken to mimic the clinical situation.

The teeth were analysed using digital radiography to evaluate the placement of intracanal medicament in the apical third. The radiodentisty of the teeth were measured using the digital scale on the Intra SkanDigi software at 1mm and 3mm levels from the apex. Two independent examiners evaluated the measurements of radiopacity at 1mm and 3mm levels from the apex.

The data obtained was statistically analysed by the One wayAnova and Tukeys Post Hoc test.

RESULTS

Graph 1: Comparison of the radio density values between placement of calcium hydroxide by the three groups; hand plugger ,lentulospirals and reverse rotary instrumentation.



Group 3: Reverse rotary instrumentation showed the maximum radiopacity of 0.28 mm and 0.52 mm at 1mm and 3mm respectively followed by group 2: Lentulospirals with 0.11mm and 0.31 mm. Group 1: Hand pluggers showed the least radiopacity of 0.04 mm and 0.24 mm at 1mm and 3mm respectively. A statistically significant difference in the radiopacity was observed between the study groups at both the levels. (p<0.001)

Table 1: Comparison of the radio density values between placement of calcium hydroxide by the three groups; hand plugger ,lentulospirals and reverse rotary instrumentation by one way anova test.

		N	Mean	SD	Min	Max	ANOVA	
							F	p-value
1 mm	Group 1	10	0.04	0.05	0.00	0.10	31.88	<0.001*
	Group 2	10	0.11	0.09	0.00	0.20		
	Group 3	10	0.28	0.06	0.20	0.40		
3 mm	Group 1	10	0.24	0.05	0.20	0.30	21.31	<0.001*
	Group 2	10	0.31	0.14	0.10	0.50		
	Group 3	10	0.52	0.08	0.40	0.60		

The samples in group 3 showed the maximum radiopacity of 0.28 mm and 0.52 mm at 1mm and 3mm respectively followed by group 2 with 0.11 units and 0.31 units. Group 1 showed the least radio opacity of 0.04 m and 0.24 units at 1mm and 3mm respectively. A statistically significant difference in the radio opacity was observed between the study groups at both the levels. (p<0.001)

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Table 2: Comparision of the radiodensity values between placement of calcium hydroxide by the three groups; hand plugger ,lentulospirals and reverse rotary instrumentation by Tukey Post Hoc test.

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval	
						Lower Bound	Upper Bound
1mm	Group 1	Group 2	-0.07	0.03	0.08(NS)	-0.15	0.01
		Group 3	-0.24	0.03	<0.001*	-0.32	-0.16
	Group 2	Group 3	-0.17	0.03	<0.001*	-0.25	-0.09
3mm	Group 1	Group 2	-0.07	0.04	0.28(NS)	-0.18	0.04
		Group 3	-0.28	0.04	<0.001*	-0.39	-0.17
	Group 2	Group 3	-0.21	0.04	<0.001*	-0.32	-0.10

On pairwise comparison, the difference in the radio opacity between group 1 and group 3 and between group 2 and group 3 was observed to be statistically significant at both 1mm and 3 mm. However the difference between group 1 and group 2 was not statistically significant (p>0.05)

DISCUSSION

A dense and homogenous filling at the apex of the root is imperative in order to intensify the antibacterial properties of calcium hydroxide [13]. Although literature documents various studies investigating the quality of calcium hydroxideplacement in blunderbuss canals, most cases typically describe apexificationprocedures[14,15,16]. However, the best placement technique for mature canals still remains ambiguous.

Multiple methods of calcium hydroxide delivery have been advocated,such as the use of rotary instruments such as the lentulospirals and hand instruments such as spreaders and pluggers[17,18]. In the present study, the reverse rotary technique was compared with two traditional techniques; the placement of Metapex with lentulospiral and the hand plugger. In the present study, each tooth was prepared by Protaper rotary files upto size F2 for standardization of the samples, as the degree of biomechanical preparation of the root canal system has been known to influence the optimal placement of calcium hydroxide in previous studies.[19, 20]

In the present study, reverse rotary instrumentation demonstrated better results as compared to the other methods. This can be attributed to Guttmann's hypothesis stating that "a rotary NiTi instrument that fits loosely in the canal can be used ***in reverse***to place the material apically; the file is placed only to the middle third, and the rotary action will carry the material apically"[12]. This enables the Metapex, which is paste of a dense and thicker consistency aiding in direct and more effective placement of the medicament into the canal. This technique helped minimize the surplus material at the canal orifices that may lead to obstruction, hence preventing further condensation of the paste into the canal. The use of length adjusted stoppers, allowed the Protaper file to be at the middle third of the canal, allowedfor judicious condensation of the Metapex to the working length, hence avoiding extrusion of the material. This novel method is cost effective and convenient as the placement of the intracanal medicament can be done following the cleaning and shaping of the canal with an endomotor.

Estrella et al postulated that a dense and homogeneous intracanal filling of the root canal system necessitates the placement of a calcium hydroxide paste with a consistency comparable to that of toothpaste, as ideal for placement with hand instruments but not for placement with lentulospirals[8]. Although Sigurdsson et al. reported that a lentulospiral achieved "adequate" fills in minimally prepared canals; the present study does not support those findings[20]. An explanation for this disparity could be in the differences in experimental technique. In their study, each experimental procedure was repeated three times before a radiographic assessment was made. In the present study, each experimental procedure was discontinued as soon as Metapex was noted at the canal orifices as it replicates the system followed in the clinical condition. The differences in the results could also be due to the fact that Sigurdsson used an aqueous mixture, which has higher flow.

A technique to deliver the maximum amount of material uptil the apical third of the root canal should be adapted when using Metapexas an interappointmentmedication[9]. According to the present study, reverse rotary instrmentation delivered close to optimal amounts of Metapex followed by the lentulospiral technique. However, the placement of calcium hydroxide with hand pluggers did not produce any desirable results.

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