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EFFICACY OF REMOVAL CALCIUM HYDROXIDE DRESSING FROM ROOT CANALS BY PASSIVE ULTRASONIC IRRIGATION AND HAND FILES (H FILE,K FILE)

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ABSTRACT:

Residual Calcium Hydroxide dressing on the root canal is considered one of the reasons of endodontic treatment failure. So ,the removal of this dressing completely before filling is required. The aim of the study was to evaluate the efficiencies of passive ultrasonic irrigation ,H file and increasing the instrumentation of the medicated canal to the file one size larger than MAF in removal of Calcium Hydroxide dressing. 30 single-root were prepared to size 40 with k-files and split longitudinally. Two standardized grooves were cut into the apical and coronal part of the root canal dentine. The roots were subsequently reassembled with wires and filled with calcium hydroxide. Then they were stored at 37 _C in 100% relative humidity for 1 week. Specimens were randomly divided into 3 experimental groups (n=10) according to removal technique. In group 1: ultrasonic system using a #15 Zippier file, was inserted to the canal and used passively for 8 to 10 seconds after the MAF with 5 ml of 5.25% NaOCl. Group 2: one size larger (k-file 45#) than MAF and were irrigated with 5 ml of 5.25% NaOCl. In group 3: hedstrom file size 40# was inserted at the WL with 5 ml of 5.25% NaOCl. The quantity of remaining of Calcium Hydroxide were observered under a steromicrescop with 30 magnification using a four-grade scoring system as described by van der Sluis *et al*. (2007). Statistical evaluation was performed using Mann-Whitney and Wilcoxon tests. Results showed that no statistically significant difference between Groups in the apical groove. However, there was a statistically significant difference between H file and increasing size in the coronal groove. there was a statistically significant difference between apical and coronal grooves, with the apical third associated with the largest amount of debris.

Key Words: Calcium hydroxide removal, passive ultrasonic irrigation, H file, Increasing file size, sodium hypochlorite, steromicrescop.

INTRODUCTION:

Overwhelming evidence indicates that microorganisms have a fundamental role in the pathogenesis of periradicular diseases (Provenzano et al.,2015). To eliminate the remaining microbes after root canal preparation and to prevent an interappointment reinfection of the root canal system, intracanal medications are recommended (Mohammadi et al.,2011). The most commonly used intracanal medicament is Ca(OH)2 because it is effective against the majority of endodontic pathogens and is a biocompatible material (Athanassiadis et al. 2007). It has been used in various clinical situations and is kept inside the canal for different time periods ranging from 7 days for intracanal medication to 6-24 months for apexification (Kleier et al.,1991). Before root filling, the Ca(OH)2 medicament that has been applied to the root canal should be removed. Any

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Ca(OH)2 residue on the canal walls negatively affects the quality of the root filling (Caliskan et al. 1998, Barbizam et al. 2008). It can hinder the penetration of sealers into the dentinal tubules, markedly increase the apical leakage of root canal-treated teeth, and potentially interact with zinc oxide eugenol sealers, rendering them brittle and granular (Calt et al.,1999).However, removing the Ca(OH)2 residues from irregular canal walls is difficult (Ricucci & Langeland 1997)

Various products and techniques were described Ca(OH)2 removal from the root canal. Using Master Apical File' (MAF) at working length combined with copious sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA) (Salgado et al,.2009), Using rotary NiTi-instruments (Kenee et al. 2006, Kuga et al. 2010), Passive ultrasonic irrigation(Wang et al.,2017), Sonic Activation(DabhiM *et al* ,2016), CanalBrush(Ljubisa *et al,*2015), Endo Vac(Yücel *et al*., 2013), RinsEndo(Emel U *et al*,2015), SelfAdjustingFile(FARIAet al, 2013),Laser(Gokturk et al.,2017) . Yet, none of these techniques have successfully removed the CH medicament completely (Van der Sluis et al.,2007).

The use of an additional file one size above the MAF is one of the strategies used for Ca(OH)2 removal, whose effectiveness has been rarely investigated. The purpose of this study was to evaluate the efficacy of removal of Ca(OH)2 from an artificial standardized grooves using Passive ultrasonic irrigation, hedstrom file and additional instrument size.

MATERIALS AND METHODS:

30 single-rooted central and lateral maxillary incisors were selected ,The criteria for tooth selection included: a single root canal, no visible root caries, fractures, or cracks, no signs of internal or external resorption or calcification, and a completely formed apex. Roots with _15° of curvature were considered to be straight and were included in this study. The teeth were stored in tap water throughout the study. The teeth were decoronated to. standardize the root length to 15 mm, and the working length was established by inserting a #15 k file (TG,Germany#110168) through the apical foramina.Working length (WL) was established 1mm short of the length where the file exited the apical foramen. Canals were prepared by preflaring using Gates Glidden burs #2-3 (MANI ,INC,Japan) .Teeth were prepared with traditional technique to size 40 with k-files(TG,Germany#110168) and canals were irrigated with 5 ml of 5.25% NaOCl between each instrument. A final rinse with 5 mL 2% NaOCl, 5 mL 17% EDTA, and 10 mL distilled water was performed. The roots were split longitudinally into two halves allowing subsequent reassembling. As suggested by Lee et al. (2004), two longitudinal grooves of 4.0 mm length, 0.2 mm width and 0.5 mm depth were cut into the root dentine of each root. The locations of the grooves

were 2–6 mm from the apical foramen in one half of the tooth (apical section) and 10–14 mm from the apex in the opposite part (coronal section). Following careful removal of debris from the sections using a toothbrush, The roots were subsequently reassembled with wires (Figure 1) . Root canals were dried with paper points(SHINHUNG,Korea#160725). The canals were filled with Ca(OH)2 paste(made in EU.130730) using a lentulo spiral (RADIX,Medin,a s.098001), The access cavities were sealed with glass ionomer (Medicem,made in Germany,1521321).. Then they were stored at 37 _C in 100% relative humidity for 1 week. Specimens were randomly divided into 3 experimental groups (n=10) according to removal technique. In group 1: ultrasonic system using a #15 Zippier file, was inserted to the canal and used passively for 8 to 10 seconds after the MAF with 5 ml of 5.25% NaOCl. (Figure 2) Group 2: one size larger than MAF (k-file 45#) (Radix,madin,a.s.10908594) and were irrigated with 5 ml of 5.25% NaOCl. Group 3:Hedstrom file size 40#(Radix ,madin,a.s.12931903) was introduced into the root canal up to working length and fifteen up-anddown strokes were performed to loosen the medication. The quantity of remaining of Calcium Hydroxide were observered under a steromicrescop with 30 magnification using a four-grade scoring system as described by van der Sluis *et al*. (2007). Score 0: Cavity is empty; (Figure 3) Score 1: Less than half of the cavity is filled with calcium hydroxide, (Figure 4) Score 2: More than half of the cavity is filled with calcium hydroxide, (Figure 5) Score 3: Cavity is completely filled with calcium hydroxide. (Figure 6)

Fig.1. reassemble The roots with wires

Fig.2.pui irragation

Fig.3. Score 0.

Fig 4. Score 1

Fig.6. Score 3

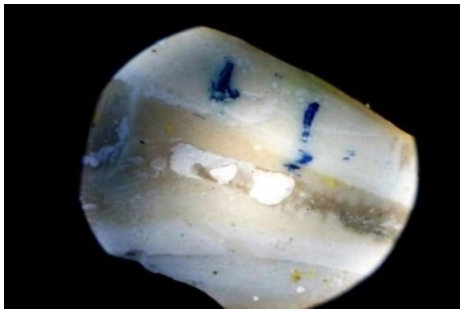

Fig.5. Score 2

Data were analyzed statistically by Kruska-Wallis and Mann-Whitney

Technique	Mean	Kruska-Wallis	p-value	Result
Size larger 45 K file	18.90	4.109	0.128	Non sig.
H 40	12.50			
PUI	15.10			

Technique	Mean	Kruska-Wallis	p-value	Result
Size larger 45 K file	20.50	7.08	0.029	Sig.
H 40	11.85			
PUI	14.15			

	Technique	مجموع الرتب	Mean	Mann-Whitney	p-value	Result
1	**Size larger 45 K file**	132.5	13.25	22.5	*0.035	Sig.
	H 40	77.5	7.75			
2	**Size larger 45 K file**	127.5	12.75	27.5	0.089	Non sig.
	PUI	82.5	8.25			
3	**H 40**	96	9.6	41	0.53	Non sig.

RESULTS:

The results showed that there were no statistically significant difference (p>0.05) for calcium hydroxide removal by passive ultrasonic irrigation and hand instruments (H file and K file), however PUI and H file improve the removing. (Table 1 and 2). No statistically significant difference (p>0.05) for calcium hydroxide removal by passive ultrasonic irrigation and H file in coronal and apical groove but there was a statistically significant difference between H file and K file when

compared at coronal and apical groove, more residues in the apical groove than in the coronal groove (Table 1 and 2)

DISCUSSION:

Root canal systems have a complex anatomy with irregularities, fins, isthmuses and lateral canals that may contain bacteria and necrotic tissue (Vertucci et al.,1984). Calcium hydroxide Ca(OH)2 has been shown to be an effective intracanal medicament due to its antimicrobial and tissue repair properties. It can be placed easily into the root canal system and pushed towards canal irregularities for further disinfection of infected root canal walls(Haapasalo et al. 2010). If Ca(OH)2 is not removed from the root canal walls completely, it can negatively influence the sealing quality of a root canal filling(Kim SK and Kim,2002), reduced the bond strengths of a resin-based sealer to root canal dentine (Barbizam et al. 2008) and interfered with the sealing ability of a silicon-based sealer (Contardo et al. 2007). It was demonstrated that intracanal medication with calcium hydroxide increased apical leakage of gutta-percha root fillings when a zinc oxide–eugenol sealer was used (Kim & Kim 2002), which can be explained by an accelerated setting of the sealer (Margelos et al. 1997).

Many factors may affect on removal calcium hydroxide from root canals : apical preparation size (Maalouf L *et al,*.2013), the size of the needle used for irrigant delivery, (Yücel AÇ *et al*.,2013), the length of time devoted to irrigation, (Nainan *et al,*.2013) ,and the system that is used for canal irrigation (Lambrianidis,*et al*.,1999).

Effective removal of Ca(OH)2 requires a system that delivers irrigant effectively to the WL of the apical root canal, especially the oval extensions. Syringe irrigation with needles is the standard procedure but, unfortunately, it is not effective in the apical root canal or in isthmuses or oval extensions (Shin SJ *et al*.,2010 ( )Nielsen *et al*.,2007) .

Ultrasonic instrumentation of the root canals has been widely advocated as an effective modality for cleaning pulpal remnants and dentinal debris from canals and isthmuses. The mechanical agitation provided by ultrasonic instrumentation or a rotary file in conjunction with irrigation may also enhance removal of calcium hydroxide(Margelos et al., 1997). The basis for the passive ultrasonic irrigation is the transmission of energy from an ultrasonically oscillating instrument to the irrigant inside the root canal. It showed that an irrigating solution in addition with ultrasonic vibration is directly associated with the removal of organic or inorganic debris from the root canal wall (Teixeira et al,2005). Webber et al,and Ghobadi et al suggested that all the calcium hydroxide remnants should be removed by increasing the instrumentation of the medicated canal to the files one or two sizes larger than the one used at the working length (Webber et al.,1981). (Ghobadi *et al,*.2012).

In previous studies, the amount of Ca(OH)2 in the canal was calculated by digital photographs (Maalouf *et al* 2013), steromicrescop (Michelon *et al*. ,2014), scanning electron microscopy (Dabhi *et al*,.2016), spiral computed tomography(Nandini S *et al*,. 2006), CBCT (Vineeta *et al* ,.2014), micro-computed tomography micro-CT (Wiseman *et al*,.2011).

The design of this study is comparable to that described by Lee et al. (2004) and seems well suited to evaluate the removal of substances from the root canal. A similar design also has been used by van der Sluis et al. (2005a,b) to investigate the removal of debris from artificial grooves as well as the removal of calcium hydroxide (van der Sluis et al. 2007, Kuga *et al*,.2010, Jiang *et al*. 2010, Ro¨dig *et al*. 2010b, Salgado *et al*,.2009). Other studies investigated the cleanliness of the complete root canal wall (Lambrianidis et al. 1999, 2006, Kenee et al. 2006). The advantage of the groove model is the standardized size and location of the grooves allowing a standardized evaluation with a high intraobserver reproducibility and a good interobserver agreement. In addition, this model allows good discrimination between mechanical removal of the medicament and influence of the irrigant alone.

The data for the present study shows that, though none of the methods completely removed all of the material from the walls ,Similar results were obtained by other authors(Caper et al.2014, Hoffmann et al.2015, Dabhi *et al* .2016, VLASA et al.2017, Wang et al.2017).this result contradicated with the result of C¸ alt & Serper (1999) reported complete removal of Ca(OH)2 from the root canal after irrigation with EDTA and NaOCl in comparison with NaOCl alone.this is may because no irrigation with EDTA was used in this study. EDTA may neutralize Ca(OH)2 residues to prevent chemical influence on the sealer (C¸ alt & Serper ,1999). The data for the present study shows that no significant difference was seen between PUI and hand files in the removal of Ca(OH)2, These data are in agreement with several previous studies (VLASA *et al*.,2017, Maalouf *et al*., 2013 , Michelon *et al*,.2014, Balvedi *et al*. 2010). However, these results diverge from results obtained by (Wang *et al*.,2017) ,In the study of , Wang significant differences appeared between the 30 K file and sonic and ultrasonic irrigation groups when using 2.5% NaOCl. The findings might be explained by the differences in the experimental models and the curvature and morphology of the root canal. Van der Sluis et al. (2007), which showed that the PUI with 2% NaOCl was more effective in removing Ca(OH)2 paste from artificial root canal grooves than either syringe delivery of NaOCl or water as irrigant. The methodological difference between the studies may explain the discrepancy in results, van der Sluis et al. did not use a file concomitantly with manual irrigation, which differs from this research.

This study also showed that removal of calcium hydroxide was better at the coronal area when compared to apical area in all the three experimental groups. This may be related to the volume of the irrigation which

may help in influencing the clean canals that is if large amount of irrigating solutions are used it will lead to cleaner canal walls compared to that of smaller amount(Yamada 1983).this result agreement with recent studies((Kourti *et al*.,2016)) (Emel *et al*.,2015) (Türker *et al*.,2013) ,this result was in contrast to Rödig, et al. (2010) when they demonstrate a superior cleaning efficacy of the irrigation solutions in the apical root canal third in comparison to the coronal third,also Masudi *et al*. shown that removal of calcium hydroxide was better at the apical area when compared to coronal area, Masudi used 17% EDTA and SmearClear as an irrigation solution foe removing the dressing.(Masudi *et al*.,2014).

CONCLUSION:

None of the investigated protocols were able to completely remove the CH from the grooves.There was no significant difference between PUI and hand files in the removal of Ca(OH)2, however PUI and H file enhanced CH removal from apical and coronal grooves, the apical third associated with the largest amount of debris.

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