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The Effect of Chloroquick on Fracture Resistance of Root Filled Teeth- An In-Vitro Study

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ABSTRACT

Aim: To evaluate and compare the fracture resistance of endodontically treated teeth irrigated with different irrigating solutions under instron testing machine.

Materials and Methodology: Hundred extracted, human, single rooted mandibular premolars, recently extracted from patients for orthodontic purpose were selected. All the teeth were decoronated upto a standardised length of 12 mm. All the teeth were then biomechanically prepared upto size F4 and chemomechanically irrigated with different combinations of irrigants : Group 1: Chloroquick, Group 2: 5% EDTA(ethylenediamine tetra acetic acid) and 2.5% NaOCl(so, Group 3: 17% EDTA and 2.5% NaOCl, Group 4: 5% EDTA, Chloroquick and 2% Chlorhexidine and Group 5: 17% EDTA, Chloroquick and 2% Chlorhexidine followed by insertion of F4 gutta percha cones and application of AH Plus 26 sealer. All teeth irrespective of the groups were stored at 37^0C and 100% relative humidity for 14 days to allow sealer to set and each group was subjected to instron testing machine to evaluate their fracture resistance. The force required to fracture each specimen was recorded in Newtons and data were analysed statistically using analysis of variance (ANOVA) test and Post- Hoc Tukey test.

Results: The mean fracture resistance of Group 5 was highest followed by Group 3, Group 1, Group 4 and Group 2. (Group 2<Group 4<Group 1<Group 3<Group 5).

The mean fracture resistance of Group 5 was significantly higher than rest of the groups (P<0.001) and also of Group 3 was significantly higher than other groups.

Conclusion: In context to all the irrigating solutions used for chemomehanical preparation, Chloroquick and it's combination with 17% EDTA and 2% Chlorhexidine showed higher fracture resistance.

ARTICLE DETAILS

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KEYWORDS: Endodontic irrigant, Protaper Gold rotary files, Chloroquick, 5% EDTA, 17% EDTA, 2% Chlorhexidine, Ni-Ti spreader, F4 paper point, F4 gutta-percha cones, AH Plus sealer, Instron universal testing machine

INTRODUCTION

Irrigation plays an important role in chemo-mechanical preparation of the root canal system.[1] Mechanical failures of endodontic ally treated teeth are likely to occur from excessive stresses or fatigue, which is a cumulative process of crack initiation and its propagation.[2,3]

Chlorhexidine gluconate, a less malodorous and toxic agent has been suggested as an irrigant which acts as an Antibacterial substantivity and lower cytotoxicity than NaOCl.[4,5]

Irrigation is complementary to instrumentation in facilitating the removal of pulp tissue and/or microorganisms.[6] Irrigation Dynamics plays an important role ;[7,8] the effectiveness of irrigation depends on the working mechanism of the irrigant And the ability to bring the irrigant in contact with the microorganisms and tissue debris in the root canal.[9,10]

Mechanical enlargement of canals must be accomplished by copious irrigation in order to facilitate maximum removal of microorganisms so that the prepared canal becomes as bacteria free as possible.[11,12]In addition, root canal irrigants should be biocompatible with oral tissues such as acids(citric and phosphoric acids), chelating agents; EDTA (ethylenediaminetetracetic acid), proteolytic enzymes, alkaline solutions (NaOCl, KOH, urea), oxidative agents (H_20_2 and glyoxide).[13]

It is observed that antibacterial and tissue dissolution capacity of aqueous hypochlorite is a function of it's concentration and so is it's toxicity and therefore, ultrasonic activation of sodium hypochlorite would accelerate chemical reactions and therefore, creating cavitational effects and to achieve a superior cleansing action.[14]

Triphala is a formulation of dried and powdered fruits of Terminalia bellerica, Terminalia chebula, Emblica officinalis and green tea polyphenols.[15-18]Dimethyl sulfoxide is a combination of herbal solutions which found to be effective.[19,20]

Herbal solutions proved to be safe which found to have multifunctional properties and advantageous over the traditional root canal irrigants.[21-24]

Chlorhexidine is used in endodontics as both irrigant and intra-canal medicament.[25-28]High surface tension could affect the ability of irrigants to penetrate the dentin and thus reduce antibacterial effectiveness within the dentinal tubules which is dependant on their wettability.[29,30] The wettability of certain solutions relies on the surface tension of ideal surfaces of dentin (chemically homogeneous, flat, non-reactive, undeformable and not swollen by the irrigants).[31,32] The efficiency of irrigant could thus be improved by reducing its surface tension, consequently increasing its diffusion into the root canal.[33-35] The improvement of the wettability of an irrigant may contribute to its capacity to dissolve organic tissues and increase antimicrobial activity.[36,37]The association of NaOCl with a specific substances aiming at these characteristics and proper

Several studies proved that Chlorhexidine products with surface active agents (CHX-Plus) showed excellent antibacterial properties mostly in all forms of microorganisms.[44]Available literature lacks sufficient reports regarding the flexural strength of irrigating solutions in which 2% Chlorhexidine, Sodium hypochlorite, 5% EDTA, 17% EDTA and Chloroquick is involved. Therefore, this study is done to evaluate the effects of irrigants on the dentinal walls.

MATERIALS AND METHODOLOGY

Sources used

This in-vitro study "Effect of final irrigation procedures on fracture resistance of root filled teeth-An in-vitro study was undertaken in department of Conservative Dentistry and Endodontics", Babu Banarsi Das College of Dental Sciences, Lucknow, using the following materials and methods. The facility of Universal testing Machine was available at Central Institute of Plastic Engineering and Technology, Lucknow.

Study Subject:

Freshly extracted human single rooted mandibular premolar teeth.

STUDY SAMPLE AND SIZE

Hundred single rooted mandibular premolar teeth.

Group 1: 20 teeth irrigated with Chloroquick irrigating solution.

Group 2: 20 teeth irrigated with 5% EDTA and 2.5% NaOCl

Group 3: 20 teeth irrigated with 17% EDTA and 2.5% NaOCl

Group 4: 20 teeth irrigated with 5% EDTA and Chloroquick

Group 5: 20 teeth irrigated with 17% EDTA, Chloroquick and 2%Chlorhexidine

ARMAMENTARIU

1. Micromotor and straight hand piece (NSK, Japan)
2. Diamond disc(S.S.White)
3. Biosonic S1 Ultrasonic scaler and tips (Coltene)
4. 4.Airotor (NSK, Japan)rotaper Gold rotary files (Dentsply, India)
5. K-files ISO no. 10,15 (Dentsply)
6. Finger spreader (Dentsply)
7. Endomotor (X-Smart Plus, India)
8. GP cutter (GDC)
9. Cement spatula (GDC)
10. Instron Universal testing machine(PTC/083/ME),U.S.A.

MATERIALS

1. Sodium hypochlorite solution 5.25%(Septodont)
2. Self-cure acrylic resin(DPI, India)
3. Airotor (NSK, Japan)
4. EDTA Solution(5 and 17% SDFL)
5. Paper points (Diadent)
6. AH Plus sealer(Dentsply)
7. Gutta percha cones; F4 (Dentsply Maillefer, India)

EVALUATION OF FRACTURE RESISTANCE

A universal testing machine (Instron, Corp, Canton, U.S.A.) was used for the fracture resistance test.

Each of the acrylic blocks were then placed on lower plate of Instron Universal testing machine.

The upper plate with spherical tip (diameter 3mm) was centered over the canal orifice and slowly increasing vertical force was exerted (1mm/min) until fracture occurred .

The maximum force required to fracture each specimen was recorded in Newtons with the help of the software Instron Bluehill.

Fig 1: PROTAPER GOLD ROTARY FILES

Fig 2: CHLOROQUICK

Fig 3: 2% CHLORHEXIDINE

Fig 4: AH PLUS SEALER

Fig 5: EDTA SOLUTION

Fig 6: 2.5% SODIUM HYPOCHLORITE

Fig 7: NI- TI SPREADER

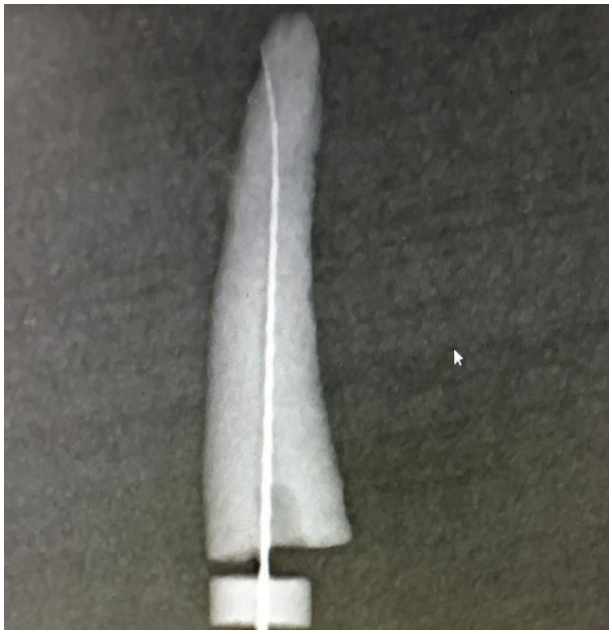


Fig 8: Working length determination

Fig 9 : MASTER CONE DETERMINATION

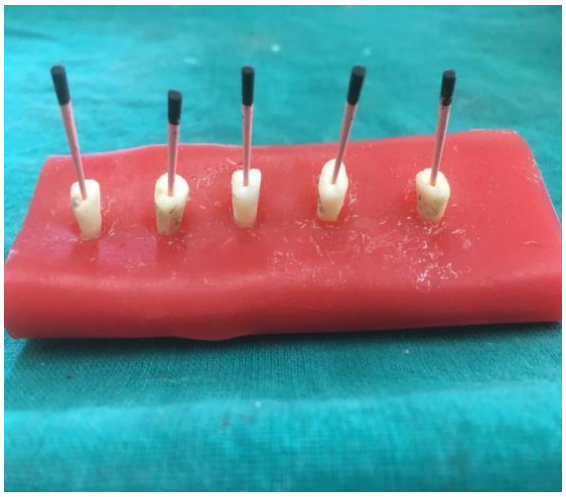


Fig 10: MASTER CONE PLACEMENT

Fig 11: OBTURATION

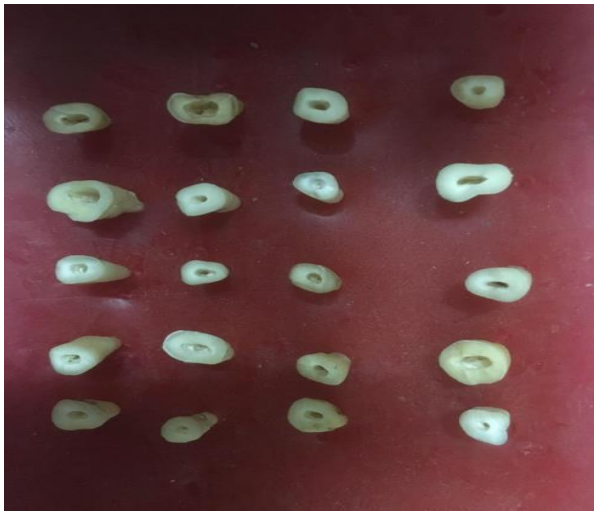


Fig.13: SECTIONED SPECIMENS WITH OBTURATION

Fig 14: MOUNTED SPECIMEN

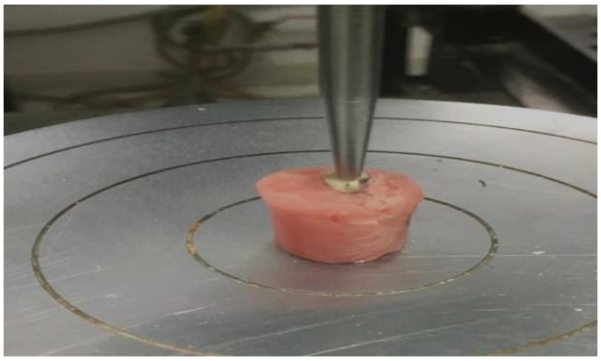


Fig 15: MOUNTED SPECIMEN UNDER UNIVERSAL TESTING

MACHINE

Sample Selection:

A)Inclusion Criteria:

Non-carious, sound and intact human single rooted premolars confirmed radiographically.

B)Exclusion criteria:

1.Teeth with any crack or caries.

2.Teeth with developmental anomaly.

3.Teeth with any restoration.

4.Teeth with resorption, calcification.

OBSERVATIONS AND RESULTS

A) Statistical analysis:

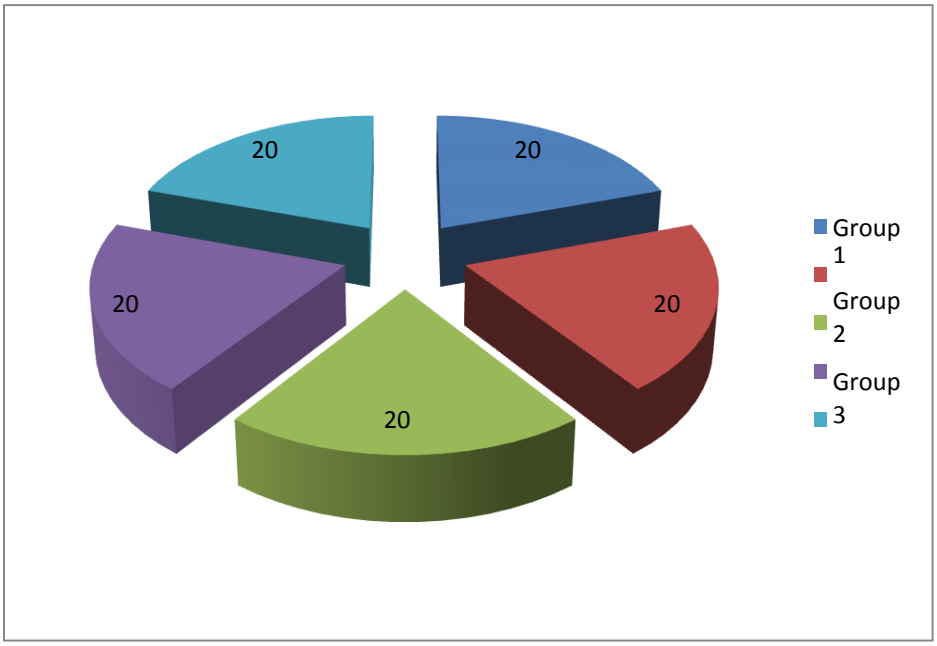
Data were summarised as Mean ± SD (standard deviation). Groups were compared by one factor analysis of variance (ANOVA) and the significance of mean difference between (inter) the groups was done by Tukey's HSD (honestly significant difference) post hoc test after ascertaining normality. A two-tailed (a=2) $P<0.05$ was considered statistically significant. Analysis was performed on SPSS software (Windows version 17.0).

The present an in-vitro study compared fracture resistance of teeth irrigated with different irrigating solutions under universal instron testing machine. Hundred freshly extracted, human, single rooted mandibular premolars were selected. The teeth were randomly divided into five groups (n=20) and irrigated with (Group 1) : Chloroquick, (Group 2): 5%EDTA and 2.5%NaOCl, (Group3): 17%EDTA and 2.5%NaOCl, (Group 4): 5% EDTA and Chloroquick, (Group 5): 17%EDTA, Chloroquick and 2% Chlorhexidine and obturated withProtaper F4 gutta percha and epoxy resin based root canal sealer (AH Plus) using a single cone technique. The specimens were decoronated and standardised upto a working length of 12 mm. The outcome of the study was fracture resistance measured in Newtons. The objective of the study is to measure fracture resistance among five groups:

Table 1. Group allocation and distribution of samples

Irrigating solution	Group name	Total sample (n=100)(%)
Chloroquick	Group 1	20 (20)
5% EDTAand 2.5% NaOCl	Group 2	20 (20)
17% EDTA and 2.5% NaOCl	Group 3	20 (20)
5% EDTA and Chloroquick	Group 4	20 (20)
17% EDTA, Chloroquick and 2% Chlorhexidine	Group 5	20 (20)

DISTRIBUTION OF SAMPLES



Graph 1: Pie chart showing distribution of samples in five groups

FRACTURE RESISTANCE

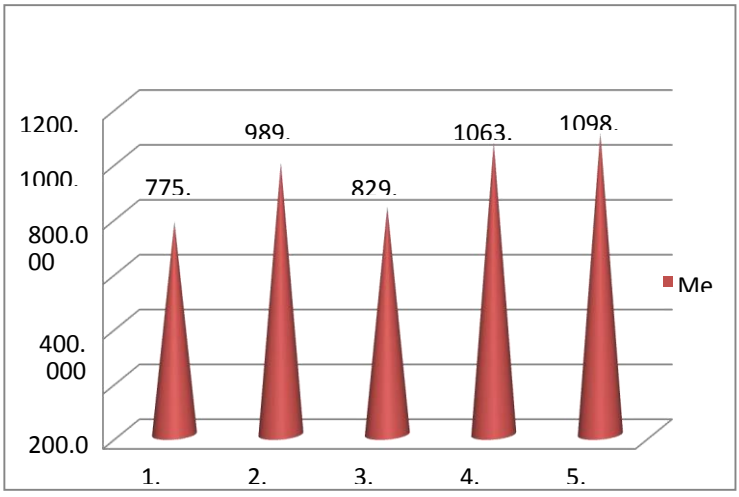
The fracture resistance (Newton) of five groups is summarised in table 2 and also depicted in figure 2.The mean fracture resistance of Group 5 was the highest followed by Group 3, Group 1 , Group 4 and Group 2 (Group 2<Group 4<Group 1<Group 3<Group 5).

Comparing the mean fracture resistance of five groups, ANOVA showed significantly different fracture resistance among the five groups (F=4.863, P<0.001).

Table 2. Comparison of Mean Maximum compressive Load of different Groups

Group	N	Mean	Std. Deviation	F Value	P Value
1.00	20	775.130	271.924	4.863	0.001* Significant
2.00	20	989.475	175.409		
3.00	20	829.300	302.485		
4.00	20	1063.140	251.369		
5.00	20	1098.695	400.191		
Total	100	951.148	311.458		

One Way ANOVA Applied P<0.05 *Significant



Graph 2: Mean Maximum compressive load Comparison

The above table shows the mean comparison of maximum compressive loadof different groups. The lowest mean value (775.130) was of group 1 whereasthe highest mean value (1098.695) was of group 5.

The difference between all groups together was compared using one way ANOVA which found to be statistically significant (P value <0.05).

Post Hoc Tukey test was applied to perform the pair wise comparison of individual groups. The comparison was shown in below table.

Table 3. Post Hoc Tukey Test

Pair wise Comparison		Mean Difference	Std. Error	P Value	Result
1.00	2.00	-214.345	91.602	0.141	Non Significant
	3.00	-54.170	91.602	0.976	Non Significant
	4.00	-288.010	91.602	0.018*	Significant
	5.00	-323.565	91.602	0.006*	Significant
2.00	3.00	160.175	91.602	0.410	Non Significant
	4.00	-73.665	91.602	0.929	Non Significant
	5.00	-109.220	91.602	0.756	Non Significant
3.00	4.00	-233.840	91.602	0.088	Non Significant
	5.00	-269.395	91.602	0.033*	Significant
4.00	5.00	-35.555	91.602	0.995	Non Significant

P Value < 0.05, * Significant

The above comparison shows that there was statistical significant difference between Group1&4 and Group1&5. The mean value of Group 1 was significantly lower than that of Group 4 and Group 5, but there was no significant difference between Group1&2 and Group1&3.

Also the mean value of Group 5 was found to be significantly higher than that of Group1, Group2 and Group3, but not significantly higher than that of Group 4.Whereas there was no significant difference between Group 2 & 3, Group 2 &4, Group 2 & 5, Group 3 & 4

DISCUSSION

This in-vitro study "Effect of final irrigation procedures on fracture resistance of root filled teeth" was undertaken in the department of Conservative dentistry and Endodontics, Babu Banarsi Das College of Dental Sciences, Lucknow. The facility of Instron universal testing machine was availed at Central Institute of Plastic Engineering and Technology, Lucknow.

The present study was done in vitro as the clinical performance and characteristics of endodontically treated teeth are difficult to evaluate under in vivo conditions. In vitro test give possibility to evaluate fracture resistance of endodontically treated teeth and are considered as a predictor of the possible clinical performance of irrigating solutions. As the purpose of the study was to compare the fracture resistance of endodontically treated teeth irrigated with different irrigating solutions followed by application of sealer and obturated with F4 gutta percha cones as per requirement used in same working motions and was only possible in vitro study condition.

The present study was conducted in natural teeth (n=100) due to the obvious reasons of difference in the temperature and humidity of the root canal, morphological variations, pooling of irrigation media at the apical level and direction of force applied during instrumentation. The parameters cannot be achieved in artificial root or any other commercially available acrylic resin blocks that cannot mimic the natural tooth structure like dentin and cementum.

The objectives of irrigation are to flush out dentinal debris and reduces the number of canal bacteria, disinfects and penetrates into dentin and its tubules, antimicrobial substantivity and be nonantigenic, nontoxic and noncarcinogenic. None of the irrigants follow all of these properties more or less.[45,46]Therefore, at least two irrigants are usually used to reduce organic and inorganic matter and dentinal debris. The two most widely used irrigants are sodium hypochlorite(NaOCl) and ethylenediaminetetracetic acid (EDTA). There are other irrigants in the market such as Chlorhexidine, Biopure MTAD(mixture of tetracyclin isomer, citric acid and detergent; Tween 80) , Q mix, Tubuliclean, Largal Ultra, Tetraclean, Tetraclean NA, Saline solution, Electrochemically activated solutions, ozonated water, photon-activated disinfection, herbal irrigants; Morinda citrifolia, Green tea, Triphala,Aloe barbadensis miller (Aloe vera) solution, Azadirachta indica (Neem) solution, basic irrigants; KOH, NaOH, 17% EGTA (ethyleneglycoltetracetic acid) and 10% citric acid, 0.10% Octenidine (OCT), 2% Silver Zeolite (SZ), Chloroquick, REDTA (EDTA with surfactant), HEBP(Hydroxyethylidene biphosphonate), Smear Clear.[47]

Since, literature related to flexural strength regarding certain irrigating solutions such as 2% Chlorhexidine, 3% NaOCl, Chloroquick, 5% EDTA solution, 17% EDTA solution were not available sufficiently, therefore, present study conducted

to analyse the effects of these irrigating solutions on the root canal dentin walls. This study is by using Chloroquick solution(Vial A consists of 2.5% NaOCl and Vial B consists of 1-Hydroxyethane1,1 Diphosphonic acid (HEDP) acts an activator) as new irrigating solution so as to determine it's multifunctional properties such as removal of smear layer, antimicrobial activity, proteolysis, chelation (EDTA), lubrication, emulsion and buffer (NaOCl).[48]

The importance of this study is to analyse the effects of irrigation solutions on the coronal and radicular parts of teeth during mastication and other purposeful functions which has been performed and to conclude the fracture resistance of teeth measured in Newtons. This is observed on the basis of shear, tensile and compressive stresses which has a direct effect on the root canal system.

The combinations of different irrigating solutions is used in different groups followed by application of AH Plus 26 sealer and obturated with F4 gutta percha cones and analysed the flexural strength of teeth under Instron universal testing machine. Group I consists of Chloroquick solution, goup II consist of 5% EDTA and 2.5% NaOCl, group III consist of 17% EDTA and 2.5% NaOCl, group IV consist of 5% EDTA, 2.5% NaOCl and Chloroquick and group V consist of 17% EDTA, 2.5% NaOCl, 2% Chlorhexidine and Chloroquick and group V proved to exhibit higher fracture resistance as compare to other groups because of the presence of Chlorhexidine and mulitifunctional properties of Chloroquick. This is because it maintains the integrity of collagen fibrillar network, inhibiting the action of dentinal matrix metalloproteinases(MMP's). Moreover, Chlorhexidine has immediate antimicrobial properties, high substantivity and relatively low toxicity.

Due to the interaction of endodontic irrigants with dentin would aid in maintaining a stable hard tissue environment in endodontically treated teeth for long term function. Previous studies have highlighted deleterious effects caused by different irrigants on root dentin.[49]Several studies confirmed that mineral loss, changes in dentin hardness and cleanliness of the root canal walls depends on the working time of the chelating agents. NaOCl is most commonly used endodontic antimicrobial irrigant which has the ability to dissolve organic materials.[50] EDTA is a chelating agent that is used to remove inorganic fractions of smear layer from the dentin.

It is observed that EDTA and NaOCl solutions applied alternatively to determine their effects on the root canal dentin walls and therefore, proved to show eroded dentin surfaces and enlarged tubular dentinal orifices.[51] NaOCl has tendency to chlorinate protein terminal groups and therefore, results in the formation of N-chloramines which further broken down into smaller species (Stoward,1975). Consequently, hypochlorite solutions may affect the mechanical properties of dentin by the degradation of organic dentin components (Marending et al, 2007).[52] When hypochlorite is used before EDTA, the hydroxyapatite coating protects the dentinal walls from erosive action. In case of hypochlorite follows EDTA, EGTA or Citric acid, hypochlorite directly erodes the root canal dentinal walls.

Chlorhexidine tends to bind with anionic molecules such as phosphate groups; a molecular factor of hydroxyapatite. Phosphate exists in calcium carbonate molecular structure in dentin. Chlorhexidine can bind phosphate, which tends to release small amounts of calcium from the molecular complex structure of dentin.[53]Chlorhexidine proved to be used as final irrigating solution and therefore, has affinity for dental hard tissues and once bound to a surface proved to show prolonged antimicrobial activity which is known as substantivity. [54]

Chloroquick; a combination solution of stabilised Sodium hypochlorite solution with buffer and Hydroxyethane diphosphonic acid with detergent and system activator along with other excipients remove endodontic smear layers, eliminating microbes that are resistant to conventional endodontic irrigants and provide sustained antimicrobial activity.[55]

The combination of various irrigating solutions affect the structure of dentin in microscopic as well as in chemical forms. Therefore, it has been proved that various concentrations and duration of time till when it will be in contact with the root canal dentin wall greatly affects the flexural strength of teeth proved by various studies.

So according to statistical analysis it is proved that combination of 2% Chlorhexidine, 17%EDTA, Chloroquick and 2.5% NaOCl solutions greatly affects the fracture resistance of teeth. Hence, according to Kandaswamy et al (2010) proved that NaOCl is an efficient solvent which leads to degeneration of dentin due to it's known property by dissolving collagen structures as it directly acts on it and leads to cleavage of the bonds between the carbon atoms and primary structure of protein compound. NaOCl has tendency to directly acts on the collagen molecules and thereby, impeding the formation of hybrid layer which reduces the bond strength seen between the adhesive systems and monobloc .

Chlorhexidine illustrated it's use as a final rinse after the application of EDTA which does not tends to erode the walls of dentin as NaOCl proved to show; therefore, 2% Chlorhexidine recommended for irrigation after the removal of smear layer.

The long term exposure of dentin to NaOCl reduces dentin elasticity and flexural strength.

The low effectiveness of Chlorhexidine in eliminating the E.faecalis from root canals might be related to its limited ability in removing the smear layer formed during the biomechanical preparation which can obliterate the dentinal tubules and root canal system.

By increasing the temperature of solutions, it alters the properties of dentin. The effect of EDTA depends on the concentration of EDTA solution and length of time is in contact with dentin. EDTA has self-limiting action, forms a stable complex with Ca^{+2} and Fe^{+3} dissolves dentin thus, shows mineralolytic effects. The recommended concentrations of EDTA is 15-17% at a pH of 7-8. Several studies explained the use of 5 ml 17% EDTA for 3 minutes proved to be effective in removal of the smear layer. Thus, 17% EDTA is effective to help in the complete removal of smear layer, whereas when

EDTA is used in lower concentrations i.e., (15%,10%, 5%, 1%) after initial rinse with NaOCl, also proved to be effective in removal of the smear layer.

As concentration increases, pH levels and the time of exposure to dentin to EDTA, the degree of dentin demineralisation also increases simultaneously. Several studies evaluated that the application of 10 ml of 17% EDTA exposed for 1 minute effectively removes the smear layer. On the other hand if it exceeds upto 10 minutes, results in a severe erosion of the peritubular and intertubular dentin. One of the study examined the effects of EDTA and on the other hand the combination of EDTA and NaOCl on the root canal dentinal walls in elderly and young patients evaluated that it is must to neglect too long exposure of matured dentin to be used in the combination of those irrigants which reduces the probability of being eroded excessively and therefore, demineralised to the same extent. It is concluded that such combination of irrigants tends to be more prone to fracture in case of sclerotic root dentin, and subsequently leads to crack propagation during the functional loading of the root.

Several chelators drastically minimises the physical properties of root canal dentinal walls such as microhardness and pressure resistance of dentin, and such effects is significantly observed when EDTA is used as an irrigant, either alone or in combination with 2.5% NaOCl. It also proved to reduce the resistance of root to fracture and the use of 17% EDTA for 10 minutes and 1% NaOCl for 1 minute has shown the same result calculatively approximately 1.5 times and on the other hand, during the use of lower concentration of EDTA (5%) and shorter exposure times (1 minute) proved to show reduced fracture resistance. Therefore, it leads to the formation of certain precipitates by removing the smear layer and causes demineralisation of dentin.

Different irrigating systems may alter the chemical and structural composition of dentin, thereby altering its solubility and permeability characteristics. Hence, affecting the adhesion of obturating materials to the dentin surface.[56]. The incapability for Chlorhexidine and NaOCl to remove smear layer hinders sealer adhesion to dentin and hence, inability to reinforce the tooth.

Relying on EDTA alone with activity against the inorganic matter only, however, results in incomplete removal of the smear layer.[57] EDTA can effectively dissolve inorganic material, including hydroxyapatite to remove the dentinal chips and remenants of tooth substructure entirely.[58]Therefore, the teeth irrigated with 17% EDTA, 5.25% NaOCl+17% EDTA showed greater resistance to fracture than teeth irrigated with other irrigating solutions.

Siquiera reported that irrigating the root canal with 5% NaOCl for 40 minutes is effective, bearing in mind that its deleterious effect on dentin depends on concentration time and exposure time and these factors resulted in degradation of organic components which necessitates the stabilisation of the root dentin.[59]

Two of the identified dentinal changes are the water loss and structural integrity loss, highlighted by Faria et al as the main causes of tooth fracture.[60] Consequently, the tooth suffers substantial changes in terms of the analysed mechanical properties; microhardness, modulus of elasticity, compressive and tensile strength due to collagen degradation (peptides breakdown and chlorination of its terminal group) and to the loss of mineral phase.

Saleh et al reported that irrigating the root canal with 5% NaOCl and 17% EDTA for 60 seconds significantly reduces the dentin's Knoop microhardness. The authors also found a reduction of Knoop microhardness in superficial dentin and observed by various studies that use of NaOCl with EDTA leads results in dissolution of inorganic components.[61] In solvent form , it appears to show it's "sparse ghost mineral layer" and thereby exposing the underlying dentin, completely dissolutes by NaOCl. Conclusively, H^+ ions gradually dissolves the remenants of apatite crystals which is visible. As a result, NaOCl has no role on flexural strength on the root surface.[62]

Regarding the changes in modulus of elasticity of the treated dentin, according to Mountouris et al all the results were controversial, since they reported that the modulus of elasticity in coronal dentin did not suffer changes, unlike the modulus of elasticity in root dentin, which decreased depending on the type of irrigants and the origin of samples. These differences can be explained because the coronal dentin has higher content of calcium and a higher Ca/P ratio, and its properties are dependent of the tubules density rather than the intertubular dentin, as Kinney stated.[63]

The use of 15% EDTA at pH=7.3 with an added detergent there was 20-30 micrometre penetration by EDTA in which zone of demineralisation can be seen under polarised light microscopy just after 5 minutes. Therefore, it was proved that use of EDTA solution along with NaOCl, Chlorhexidine affects structure of dentin but Chloroquick does not affect the structure of dentin but helps in smear layer removal, antimicrobial activity.

Calt and Serper (2002) evaluated that if 10 ml of irrigants used in combination with 17% EDTA for 1 minute proved to be effective in removal of smear layer, whereas on the other hand if it is used for 10 minute caused drastically intermolecular and intramolecular wear of dentin.[64] Prolonged exposure and variations in concentrations of EDTA from 10% to 17% as well as pH of 7.5 versus pH 9 has been shown to enhance demineralisation of dentin.

Irrigation with different solutions such as NaOCl, EDTA and Chlorhexidine is essential for chemomechanical debridement of the root canal system, although they can reduce the vertical root fracture resistance by altering the physical properties of root canal dentin such as reduced flexural strength, elastic modulus and microhardness.[65] In addition, it has been shown that NaOCl decreases the bond strengths of root canal sealers to root canal dentin, particularly used as a final rinse. Several studies shown that NaOCl reduced vertical root fracture resistance more than Chlorhexidine did. This may be due to the negative effects of NaOCl on bond strengths between resin based root canal filling

materials and the positive effects of Chlorhexidine on resin-dentin bond stability.[66-70]

CONCLUSION

Within the limitations of the present in-vitro study (i.e., sample size, difficult to obtainsymmetrical canal geometry in natural tooth) titled "Effect of final irrigation procedures on fracture resistance of root filled teeth and the observations and analysis were made from the same, the following conclusion were drawn: The combination of Chloroquick , 2% Chlorhexidine, 2.5% NaOCl and 17% EDTA have shown to reinforce the strength of the root canal after biomechanical and chemomechanical preparation as compared to the combination of other irrigating solutions and thus, increasing the fracture resistance of the root to the stress encountered.

Further studies are suggested to clinically correlate the findings of the present study.

FINANCIAL SUPPORT AND SPONSORSHIP:

Nil

CONFLICTS OF INTEREST:

There are no conflicts of interest.

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