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Comparative Radiological Evaluation of Penetrating Ability of Various Herbal Irrigants With 5.25%Sodium Hypochlorite - An Invitro Study

[1]Dr.L.Karthik, Reader, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

[2]Dr.P.Samba Shiva Rao, Professor, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

[3]Dr.M.Pratap Kumar, Professor, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

[4]Dr.K.Sowmya, PG Student, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

[5]Dr.V.Gayathri Devi, PG Student, Department of Conservative Dentistry And Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

[6]Dr.M.Vasantha, PG Student, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

Corresponding Author: Dr.K. Sowmya, PG Student, Department of Conservative Dentistry and Endodontics, Meghna Institute of Dental Sciences, Nizamabad, Telangana, India.

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Abstract

Introduction : This experimental study was conducted to study the comparison of the depth of penetration of herbal irrigants with 5.25% Sodium hypochlorite

Aim : This experimental study compared and evaluated three herbal irrigants penetration depth with sodium hypochlorite.

Materials And Methodology : Fifty single rooted teeth samples were collected . Samples that were excluded from this study were teeth affected by the extraction, short roots, roots with open apex, extraction of more than three months and samples unpreserved as soon as the extraction was made. All the teeth were divided randomly into 5 groups. Working length was determined by direct visualization. Using

stainless steel K- files chemo-mechanical preparation was performed. Samples were irrigated with GROUP A: Green tea extract (n = 10), GROUP B : Propolis (n = 10), GROUP C : Chitosan (n = 10), GROUP D : Sodium hypochlorite (n = 10), GROUP E : Control group (n = 10). After irrigation all the canals were dried using paper points. Radiopaque contrast was applied allowing visualization of the infiltration of the contrast. Radiographs were performed to measure the length of penetration of irrigant after each irrigant using a fixation system. Infiltration length of radiographic contrast was measured and results were statistically analyzed.

Results: There was higher degree of penetration for 5.25% Sodium hypochlorite.

Conclusion : On comparing the radiological penetration of irrigants , it is shown in this study as Sodium hypochlorite penetrates more better than Chitosan followed by Propolis and then Green tea. Least penetration is seen in control group (normal saline).

Keywords: Herbal irrigants, Green tea, Propolis, Chitosan , Radiological penetration.

Introduction

The success rate in endodontics has increased much these days with various advancements in techniques and instrumentation. Success in endodontics depends on complete removal of infected and necrosed pulp tissue from the root canal . The use of various root canal instruments helps in creation of sufficient space for the ingress of irrigants which results in the success of root canal treatment1. Accessory canals, lateral canals, apical deltas , anastomosis make complete mechanical cleaning of the root canal difficult2. Irrespective of any instrumentation technique, almost 35% or more remains uninstrumented and hence the ability of irrigant solution becomes critical in penetration into areas not instrumented by mechanical method for debridement and disinfection of root canal system3.

In response to chemical disinfection, several irrigant solutions have been developed among which sodium hypoclorite(5.25%) is always most widely accepted and used4,5,6. Sodium hypochlorite has antibacterial effect and has the ability to dissolve both organis and necrotic tissues within the smear layers7, but sodium hypochlorite has many side effects such as tissue toxicity, bad taste, odour, and staining of clothes. The Scientific Committee Concenses recommended concentration of 2.5%-5.25% of sodium hypochlorite to provide a balance between disinfection and toxicity5,7,8,9.

So, the irrigant solutions which shows more compatibility with the periapical tissues, less toxicity, antibacterial activity and also which has anti-inflammatory action in order to reduce the inflammation in the periapical region are being used. Many researches have led that plant extracts can be successfully used as endodontic irrigants with more biocompatibility and less toxicity than synthetic irrigants10.

New trend of using herbal extracts as endodontic irrigants began when propolis was compared with saline and sodium hypochlorite in 200311. Due to easy availability, low toxicity, cost effectiveness, lack of microbial resistance and increased shelf life of herbs they are gaining more popularity in dentistry12. In this invitro study the herbal extracts explored are propolis, chitosan, green tea.

Green Tea Extract : Green tea has very useful physiological effects because of the active materials in it. The useful characteristics of green tea which makes it an appropriate intra canal medicament are

its antioxidant activity, anti-inflammatory and radical scavenging properties. It also has chelating action13.

Chitosan : Chitin, second most abundant natural polysaccharide, is composed of β-(1,4)-linked N-acetyl glucosamine units. Chitosan is produced by the partial deacetylation of chitin. It is a naturally occurring polysaccharide which comprises of copolymers of glucosamine and N-accetyl glucosamine14. It is widely used for its biological properties such as hypocholestromic15, antibacterial, antifungal14 and wound healing properties16.

Propolis : Propolis contains organic compounds such as phennolic compounds and esters, flavonoids in all their forms(flavonols, flavones, flavonones, dihydroflavonols, and chalcones), terpenes, beta-steroids, aromatic aldehydes and alcohols, sesquiterpenes, and stilbene terpenes. Propolis possess antibacterial, anti-inflammatory, antiviral, antioxidant, hepatoprotective, antitumor and immunomodulatory effects17.

This experimental study compared and evaluated the depth of penetration of these herbal products by using radiopaque solution in conjunction with radiography .

Materials and Methodology

Fifty single rooted teeth which were freshly extracted and stored in physiological saline solution were used in this study(Figure 1). Samples that were excluded from this study are tooth which are affected by the extraction, roots which have open apex, short roots, teeth which were extracted more than three months back and teeth which were not preserved after extraction.

Figure 1 : Fifty extracted teeth

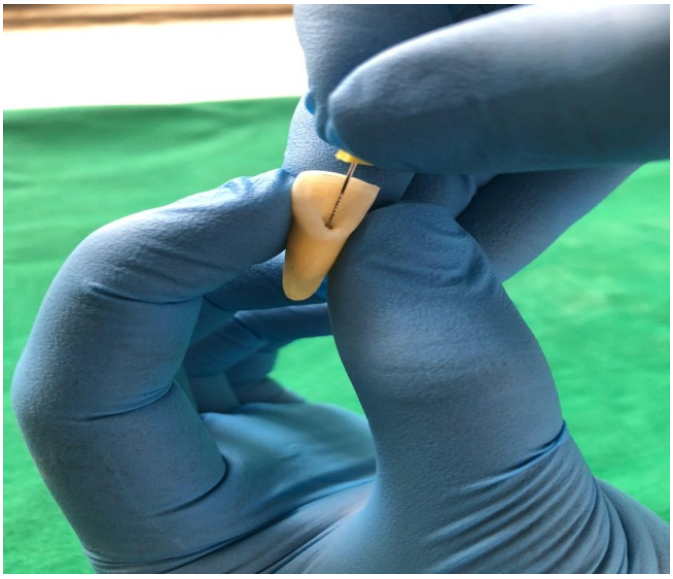

Figure 2: Determining the working length of each sample directly

The chemo- mechanical preparation was performed by using stainless steel K-files. The working lengths of each sample was determined by direct vision, using 10 K-file until the tip of the instrument appears from the apical foramen of the canal(Figure 2). All the teeth were randomly divided into five groups, GROUP A (n=10), this group was irrigated with GREEN TEA EXTRACT, Group B(n=10), this group was irrigated with PROPOLIS, Group C (n=10), this group was irrigated with CHITOSAN, Group D

(n=10) irrigation with 5.25% SODIUM HYPOCHLORITE, Group E (n=10), CONTROL GROUP, this group was irrigated with NORMAL SALINE.

Preparation of Gree Tea Extract : For preparing green tea extract , green tea powder was weighed (15gms) , it is mixed with distilled water (150ml), and boiled at 100^0 C for 15 mins to get 15 ml of green tea extract[18].

Preparation of Propolis Extract : Propolis extract was prepared by using 11% alcoholic extract by diluting 33% commercially available extract of propolis by using warm saline in the ratio of 2:1[19].

The final file which was used in every sample was 25K file. To each sample, a layer of varnish is applied to the apex of the root, in order to prevent contamination with plaster. Each sample was sunk into the plaster and is placed into individual supporting structure(FIGURE 2). A fixation system was developed in order to standardize the radiological standards. This system is divided into three parts. A. The first part is used to fix the x-ray cone, B The second part is to place the sample, C. and the third part is to fix the radiographic sensor (Figure 3)

Figure 3: Fixation system. (A) Fixation place of the radiological cone. (B) Fixation place for the tooth sample (C) Fixation place for the radiological sensor

Radiopaque contrast solution (OMNIPAQUE) (Figure 4) was used, allowing visualization of the infiltration. Digital radiography with intra oral sensors was used along with Kodak Dental Imaging Software 6.12.10.0 in order to get immediate results

Figure 4 : Contrast solution

After irrigating all the samples with respective irrigant solutions, all the canals were cleaned with saline and dried with paper points. Contrast solution was then injected into the canal using syringe. Radiographs were taken immediately and were recorded. Measure of the infiltration of the contrast solution into the root canals were recorded on Kodak Software.

Index of infiltration was calculated in each group by dividing infiltration length by working length.

Results

All the results were statistically analysed with ONE-WAY ANOVA of variance to compare the means of the groups. The TURKY POST HOC test was performed for comparisons of mean between the groups. There was a significant difference among all the groups.

There was more penetration seen in 5.25% Sodium hypochlorite(Figure 5) group followed by chitosan(Figure 6). Propolis penetrated less than chitosan(Figure 7). Among irrigants least penetration was seen in green tea(Figure 8) followed by control group(Figure 9). Table 1 shows the values of the index of infiltration of all the groups. Table 2 shows the mean values of the index of infiltration. Figure 10 shows the graphic representation of mean of the index of infiltration.

Figure 5 : Infiltration of Contrast Solution In NaOCl Irrigated Tooth

Figure 6: infiltration of contrast Solution In Chitosan Irrigated Tooth

Figure 7: Infiltration of Contrast Solution In Propolis Irrigated Tooth

Figure 8: Infiltration of Contrast Solution In Green Tea Irrigated Tooth

Figure 9: Infiltration of Contrast Solution in Saline Irrigated Tooth

SAMPLE										
GROUP A	0.11	0.13	0.12	0.11	0.10	0.09	0.12	0.11	0.13	0.10
GROUP B	0.33	0.33	0.32	0.34	0.35	0.32	0.33	0.32	0.34	0.34
GROUP C	0.52	0.55	0.53	0.54	0.52	0.54	0.53	0.52	0.55	0.54
GROUP D	0.89	0.88	0.87	0.86	0.87	0.88	0.86	0.90	0.88	0.89
GROUP E	0.09	0.07	0.08	0.09	0.10	0.08	0.09	0.10	0.08	0.09

Table 1 : All The Values of Index of Infiltrations In All The Groups

GROUPS	MEAN VALUES OF ALL THE SAMPLES
GROUP A	0.11
GROUP B	0.33
GROUP C	0.53
GROUP D	0.87
GROUP E	0.08

Table 2: Mean Values of All the Samples

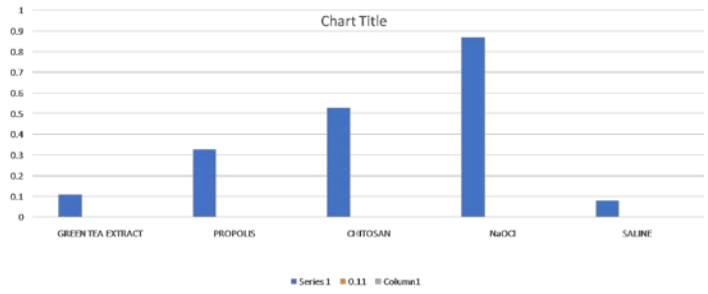

Figure 10: Means of Index of Infiltrations

Discussion

Any limits of instrument maneuvers due to complexity of the canal anatomy especially in the apical area will require chemomechanical preparation[20]. According to K. Jhajharia (2015) root canal irrigants promotes the removal of 30 – 50% of bacterial biofilm from canal walls without mechanical preparation[21]. For mechanical preparation we used hand k- files as all the dentists are familiar with the hand instruments and they can have better control over those instruments[22].

This experimental study evaluated the infiltration length of the irrigant which is directly correlated with the optimal and thorough disinfection of the root canals. Omnipaque contrast solution was the final irrigant used to view its penetration into the canal using X-rays. Omnipaque is a high molecular weight solution and with its decreased fluidity will penetrate slow and shallow into the root canal. Omnipaque also has a Radiopaque character enabling the observation of infiltration directly on the radiographs[23].

The fixation system i.e, radiological tube, sensor and samples were kept at standardized position during whole process in order to avoid any bias during RVG exposure so that all the images of X- rays can be obtained without any distortion.

This study compared the penetrating ability of 5.25% sodium hypochlorite, green tea extract, propolis, chitosan and normal saline and showed that Sodium hypochlorite(5.25%) has maximum penetrating ability into the dentinal tubules when compared to others. Factors affecting the depth of penetration of endodontic irrigants could be surface tension, viscosity and molecular size[24].

Surface tension can be defined as " the force acting between molecules that produce a tendency for the

surface area of the liquid to decrease[25].” This force limits the ability of a liquid to penetrate a capillary tube. The increased penetration of 5.25% Sodium hypochlorite is due to its low surface tension (48.90 Mn/m) [26] when compared to chitosan whose surface tension is more (2027 mN/m)[24], hence in this study Sodium hypochlorite(5.25%) penetrated more deeper than chitosan.

Propolis extract contains saponins with similar characteristics as detergent which are often regarded as natural detergents. These saponins are characterized as surfactants. Surfactants can be used to lower the energy barrier that is limiting two liquids to soluble. Surfactants will lower the cohesive forces and improve the adhesion forces so they can reduce the surface tension. But as the viscosity of the propolis is very high its penetration into the dentinal tubules is very limited[27].

If the pH value is less, then there is more penetration of the irrigant into the dentinal tubules. This is due to the fact that when Ph increases then the availability of calcium ions from hyydroxyapaatite for chelation decreases. Greater dissociation of the acidic irrigant showcased more penetration[28,29]. As green tea is having more pH of about 7-10, possibly the reason for its least penetration[30].

Conclusion

Penetrating ability of endodontic irrigants enhances the efficiency of irrigants, properly remove the smear layer and also increases the penetrating ability of sealers during obturation.

Within the limitations of this study, it is concluded that better penetrating ability is seen in Sodium hypochlorite(5.25%) , followed by chitosan, propolis, green tea and finally by saline.

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