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Comparative Evaluation of Three Different Herbal Extracts in Smear Layer Removal Efficacy Used as Endodontic Irrigants-An Invitro Study

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Abstract

Aim : Aim of the present study is to compare the effect of four different irrigant solutions: German chamomile, Morinda citrifolia, Orange oil and Sodium hypochlorite on removal of smear layer efficacy when used as Endodontic irrigants.

MATERIALS AND METHODOLOGY: Forty freshly extracted single rooted maxillary central incisors were collected. Access opening was done. A size 15K file was used to ensure apical patency. All the samples were randomly divided into four groups GROUP 1(n=10)- samples were irrigated with 5ml of German chamomile extract, GROUP 2(n=10) - samples were irrigated with 5ml of Morinda citrifolia extract, GROUP 3(n=10)- samples were irrigated with 5ml of orange oil extract, GROUP 4(n=10) - samples were irrigated with 5ml of Sodium hypochlorite. Root canals were instrumented and enlarged with protaper rotary file system up to F2 file using e-connect pro endomotor (orikam). Final irrigation was done with 5ml of sterile distilled water for the specimens. Decoronation of each tooth was done at cemento enamel junction. One longitudinal groove was placed on buccal and lingual surfaces, then the roots were split into two halves. The specimens were viewed under scanning electron microscope (SEM) at coronal, middle and apical thirds of root canal for evaluation of smear layer removal. Smear layer removal was then evaluated using Rome.et al scoring system. (1985). **Results:** Results obtained were statistically analysed. Conclusion**:** Morinda citrifolia showed greater amount of smear layer removal followed by German chamomile, Orange peel extract and NaOCl **.**

Keywords: German chamomile, Morinda citrifolia, Orange oil , Sodium hypochlorite and smear layer.

INTRODUCTION

Success of root canal treatment completely depends on eradicating the microbes by chemo- mechanical instrumentation and by three dimensional obturation of the endodontic system[1]. The major objective of biomechanical preparation is cleaning and shaping which depends on both instrumentation and irrigation. This can be achieved by mechanical, physical and chemical adjuncts which act on organic material, neutralizing and dissolving the toxic products and microorganisms along with their byproducts[2]. The major causes of the pulpal and periradicular pathosis are micro-organisms and their by-products. Hence to achieve complete eradication of micro-organisms, mechanical instrumentation and chemical irrigation should be accomplished with placement of intracanal medicaments between treatment sessions[3].

Smear layer, which is formed due to cutting of dentin using hand or rotary instruments, consists

of small mineralized collagen proteins, microorganisms, saliva, dentine chips, etc . Smear layer harbors bacteria, preventing the canal from being disinfected. In addition, removal of smear layer promotes dentin permeability, enhancing diffusion and the action of intracanal medication, allowing greater penetration of filling materials into lateral canals and dentinal tubules. Smear layer should be removed or not to be removed remains controversial[4].

Irrigating solutions play an important role in eradication of smear layer to ensure bacterial minimization and elimination of organic tissue elements. Irrigation fulfils several mechanical, chemical and biological functions. A root canal irrigant is considered ideal if it has maximum tissue dissolving properties and antibacterial effect and minimum or no inflammatory response on tissues[5].

Sodium hypochlorite, the most commonly used synthetic irrigant that can be used from concentration range of 0.5% - 6% , has stronger tissue dissolution properties and affectivity on biofilms. But they are even associated with many adverse effects such as toxicity, chemical burns, tissue necrosis, damage to oral mucosa and may also cause parastesia and anesthesia of trigeminal nerves if extruded from the apex[6]. So in order to overcome these adverse effects, researches are being done for more biocompatible natural ingredients.

Recently, herbal products are gaining popularity for their biocompatibility, ease of availability, low toxicity, increased shelf life and also cost effective. Morinda citrifolia juice, commonly known as Noni, is known for its wide range of therapeutic effects suggesting that it is potential to be used as endodontic irrigant. German chamomile, commonly known as Blue chamomile, was found to be effective when used as mouth wash to treat the irritation and minor infections in the mouth and gingival tissues. Orange oil, which is an essential oil produced from the rind of oranges.

For mechanical debridement of root canal space, the field of endodontics has led to the use of nickel titanium files with more recent advances in past few decades, one among them is Protaper Universal, which has unique properties like progressive taper which allows increased flexibility, cutting efficiency and faster shaping ability.

Hence this study aims to compare the effect of four different irrigant solutions: German chamomile, Noni (Morinda citrifolia), Orange oil and Sodium hypochlorite on removal of smear layer efficacy when used as Endodontic irrigants.

MATERIALS AND METHODOLOGY:

Forty freshly extracted single rooted human maxillary central incisors were collected for the study. The inclusion criteria included were single rooted teeth with single canal, with intact apex, patent root canals, without abnormal anatomy, the exclusion criteria for teeth selection was teeth with cracks, teeth with calcified canals, teeth with root caries, teeth with fractured roots and resorptive roots. The teeth were cleaned using ultrasonic scalar to render them free from calculus and tissue tags followed by sterilization with autoclave. The teeth were then stored in distilled water until use.

PREPARATION OF THE HERBAL IRRIGANTS

1. GERMAN CHAMOMILE: - For preparation of German chamomile extract German chamomile powder which is weighed 15grams was mixed with 150ml of distilled water and boiled at 100^0 centigrade to get 15 ml of German chamomile extract.

2. MORINDA CITRIFOLIA: - For preparation of Morinda citrifolia extract Morinda citrifolia powder which is weighed 15 grams was mixed with 150 ml of distilled water and boiled to 100^0 centigrade to get 15 ml of Morinda citrifolia extract.

3. ORANGE OIL: - For preparation of orange oil extract orange peel powder was weighed 15 grams and is mixed with 150 ml of distilled water and boiled at 100^0 centigrade to get 15 ml of Orange oil extract.

All the prepared samples were filtered using Dr.Watts filter paper and the final irrigating solutions were obtained and stored in opaque bottles.

Access opening was done. Glide path was established by 15K file (Mani Inc.,Japan) until it was visible at the apical foramen to ensure apical patency. All the samples are then randomly divided into four groups with each group having ten samples.

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1. GROUP 1(n=10):- In this the samples were irrigated with 5ml of German chamomile extract.

2. GROUP 2(n=10):- In this the samples were irrigated with 5ml of Morinda citrifolia extract.

3. GROUP 3(n=10):- In this the samples were irrigated with 5ml of Orange oil extract.

4. GROUP 4(n=10); - In this the samples were irrigated with 5ml of Sodium hypochlorite.

Root canals were instrumented and enlarged with Protaper rotary file system up to F2 file using e-connect pro endomotor (orikam).The root canals were irrigated with 5ml of prepared irrigating solutions during instrumentation corresponding to the respective group and final irrigation was done with 5ml of sterile distilled water for the specimens. Decoronation of each tooth was done at cement-enamel junction with a diamond disc to obtain standardized root length of 10mm. One longitudinal groove was placed on buccal and lingual surfaces of each root using diamond disc (Figure 1), then the roots were split into two halves using chisel and mallet. The specimens were then mounted onto metallic stub (Figure 2)with carbon strip backing.

Figure 1 : Placing longitudinal grooves on buccal and lingual surfaces.

Figure 2 : Placement of sample on metal stud

The specimens were viewed under Scanning Electron Microscope (SEM) at coronal, middle and apical thirds of root canal. SEM photomicrographs were taken at a magnification of X1000 for evaluation of smear layer removal of each specimen. Smear layer removal was then evaluated using the scoring system given by Rome.et al. (1985)[6] Table - I. Mean and standard deviation were calculated for each sample.

Table – I: Smear Layer Removal Scores (Rome et .al.-1985)[6].

Score	Interpretation
0	No smear layer
1	Smear layer present only in aperture of dentinal tubules
2	Thin smear layer covering the root canal surfaces and dentinal tubule apertures
3	Heavy smear layer masking dentinal tubule apertures

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RESULTS:

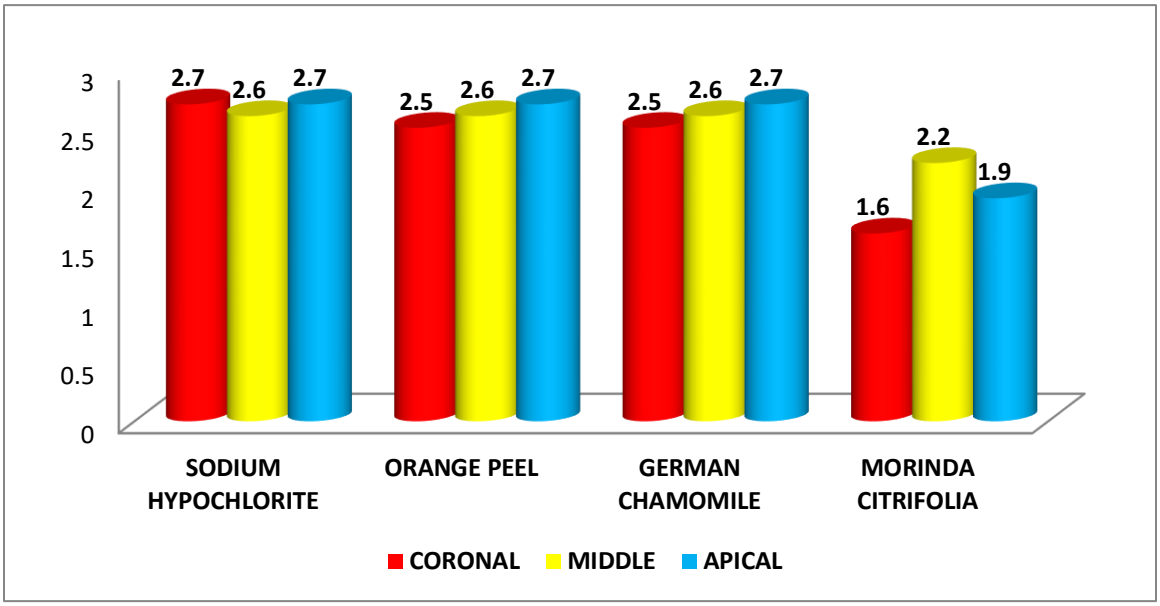
Results obtained were statistically analysed using computer software statistical package for social sciences (SPSS) version 23, One –way Analysis of variance (ANOVA) to compare the means of the groups. The Tukey's post hoc test was performed for the inter group mean comparison between the groups. The data were considered to be statistically significant when $p< 0.05$.

The result showed that Group 2(Morinda citrifolia) showed greater amount of smear layer removal of all the groups and Group 4 (NaOCl) exhibited the least amount of smear layer removal of all the groups.

Regarding different regions in the root, coronal third showed the greater amount of smear layer removal followed by middle third and apical third. No statistical significant difference was found in relation to coronal, middle and apical thirds of the teeth within the same group, statistically significant difference was found when comparison of means smear layer removal at coronal, middle and apical third of teeth with four different irrigating solutions.

TABLE 2 : Comparison of mean descriptive statistics of smear layer removal between four different irrigating solutions:

Irrigating sol.	N	Mean	Std. Deviation	Minimum	Maximum
NAOCL	30	**2.67**	**.479**	2	3
ORANGE PEEL	30	**2.60**	**.498**	2	3
GERMAN CHAMOMILE	30	**2.60**	**.498**	2	3
MORINDA CITRIFOLIA	30	**1.90**	**.607**	1	3



GRAPH 1: Graphical representation of scoring index

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DISCUSSION:

Endodontic infections are poly microbial in origin and root canal therapy is aimed to completely eradicate microbes and to achieve three dimensional hermetic seal[6]. Chemo – mechanical debridement is considered as most acceptable method to achieve complete disinfection. Irrigation which is most important aspect in irrigation aids in cleaning the pulp chamber, root canals, lubricate files, flush out debris, antimicrobial and tissue dissolution properties[7]. However, owing to potential side effects of synthetic irrigants, constant increase in antibacterial resistance, safety concerns, usage of herbal irrigants has been increased in last few decades and researches are going on for herbal root canal irrigant which can match gold standard. Various herbal preparations which are derived from various sources such as roots, leaves, seeds, stem and flowers are being used in dentistry for various purposes such as anti- inflammatory, antibiotic, analgesic, sedative and as endodontic irrigant[8].

Sodium hypochlorite, first recorded as endodontic irrigant in 1920, has low viscosity which allows easily in intracanal architecture, an acceptable shelf life, easily available and inexpensive. Sodium hypochlorite on reaction with dental pulp results in liquefaction of organic tissues by reaction with fatty acids and amino acids in dental pulp. Its toxicity and corrosion of metals are the main disadvantages of NaOCl in dental use[9].

After irrigating with respective irrigants mentioned above, the final irrigation was done with 5 ml of distilled water in every group. The irrigated canals were then dried with absorbent paper points.

The sample size was standardized to 10mm, by sectioning the teeth at cemento enamel junction, to maintain similar lengths of all the samples.

In the present study more amount of smear layer removal is seen in Group 2 (Morinda citrifolia) when compared to Group 4 (NaOCl). This study was in agreement with the study done by Suparna Ganguly Saha. et. al(2017)[10], reported that Morinda citrifolia juice found to be more effective in smear layer removal. This is attributed due to Morinda citrifolia juice comprises of milder acids such as caproic acids,Ursolic acid and caprylic acid present in Morinda citrifolia. which may be responsible for smear layer removal action. Morinda citrifolia has a pH 3.5. Less surface tension property of Morinda citrifolia juice might have attributed for smear layer removal. Morinda citrifolia juice may potentially be advantageous as an endodontic irrigant because it is a biocompatible antioxidant and has no adverse effects[10].

In the present study Group 1 (German chamomile) showed more amount of smear layer removal when compared to Group 4 (NaOCl). This study was in agreement with the study done by M.S.Sadr Lahijani (2016)[11] and V.Venkatram et al (2013)[12]**.** This is due to the presence of its compounds to chamazolene, α - Bisabolol and acids such as capric acid,caprylic acid, chlorogenicacid, O-caumaric acid , P –caumaric acid, dihydroxybenzoic acid .The cleaning effect of chamomile may be due to presence of these acid compounds[11,12].

In this present study Group 3 (Orange peel) showed more amount of smear layer removal when compared to Group 4(NaOCl),less amount of smear layer removal than Group 1 (German chamomile) and Group 2 (Morinda citrifolia)This study was in agreement with the study done by Sebatni MA (2017)[6] . This may be due to the presence of the acid metabolites, flavonoids, exhibited the high amount of smear layer removal in Orange oil[6].

In the present study Group 4 (NaOCl) showed less amount of smear layer removal when compared to all the other Groups. This study was in agreement with the study done by Sadr Lahijani et al (2006)[11], Mahmoud Torabinejad (2002)[13], Riccardo Garberoglio (1994)[14], and Hariharan VS (2010)[15]. Morgan and Baumgartner showed that the quantity of the smear layer removed by the material is directly related to its pH and the time of exposure. Irrigation with NaOCl was comparatively ineffective in achieving thorough smear layer removal because of the physio-chemical action of NaOCl is important only in removal of organic residue[11].

The cleaning effect of all the irrigants was more pronounced in the coronal third when compared to middle and apical thirds of the root canal. This finding concurs with Mc Comb and Smith 1975, Yamada et al 1983, Torobinejad et al 2003.This attributed to the smaller diameter of the root canal in the apical third

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and the consequent decrease in the flow of the irrigants is the most probable explanation.

Limitations Of The Study

- As this was an in vitro study, direct extrapolation of these results to clinical application requires further in vitro and in vivo studies.
- There was no standardization for irrigation time of the root canals with the prepared herbal irrigants.

CONCLUSION:

Within the limitations of this study, it is concluded that, Morinda citrifolia showed greater amount of smear layer removal when compared to the other three groups. German chamomile, Orange peel extract and NaOCl showed less amount of smear layer removal than Morinda citrifolia. Sodium hypochlorite showed the least amount of smear layer removal when compared to other groups. Coronal thirds of the root canal showed greater amount of smear layer removal when compared to the middle and apical thirds. Apical thirds showed least amount of smear layer removal when compared to the middle and coronal thirds of the tooth.. However, the preparation of fresh irrigating solutions, standardization and toxicity should be further evaluated before they are recommended for clinical use. Researchers are still underway on to scientifically validate an irrigation solution with ideal characteristics.

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