

Cleaning Efficacy of Triphala (An Indian Herbal Medicine) and Green Tea Polyphenol Used as Irrigants on Removal of Smear Layer: A Sem Study

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ABSTRACT

The aim of this study is to compare the cleaning effectiveness of Triphala and Green Tea Polyphenol to 2.5% sodium hypochlorite (NaOCl) solution as an intracanal irrigant for the removal of the smear layer. Forty extracted, single-rooted, mature, permanent, human teeth were allocated at random into one of three experimental groups of ten teeth and two control groups of five teeth. For each tooth, the pulp chamber was accessed and the canal prepared using K-type files and Gates-Glidden burs, using a step-back technique; the apical stop was prepared to a size 40. Each canal was subsequently irrigated with one of the following solutions: distilled water (as a negative control), 2.5% NaOCl + 17% ethylenediamine tetraacetic acid (EDTA) (as a positive control), Triphala or GTP or 2.5% NaOCl. Each tooth was split longitudinally and prepared for examination by scanning electron microscopy (SEM). The quantity of smear layer remaining on the three levels of each canal (coronal, middle and apical) was examined using magnifications of 1000 and 2000. The data were analysed using nonparametric Kruskal–Wallis and Mann–Whitney U-tests. The most effective removal of smear layer occurred with the use of NaOCl with a final rinse of 17% EDTA (negative control) followed by the use of a Triphala. Triphala was found to be significantly more effective than distilled water and GTP ($P < 0.008$). The use of a 2.5% NaOCl solution alone, without EDTA and that of GTP, was found to have only minor effects. There was no statistical difference between distilled water, 2.5% NaOCl and GTP. The efficacy of Triphala to remove smear layer was superior to NaOCl alone but less than NaOCl combined with EDTA.

Key words: Smear layer, Triphala, GTP, Irrigants.

INTRODUCTION

Successful root canal treatment is dependent on the removal of microorganisms through chemo-mechanical instrumentation in which the shaping phase enhances the action of intra-canal medicaments and permits better adaptation of filling materials¹. Bacteria present in obturated root canals may be denied access to nutrients and die, or they may survive and ultimately proliferate. It may be prudent to create the cleanest

dentinal surface possible and removal of smear layer is an essential step in the process of successful root canal treatment².

McComb & Smith (1975) were the first to describe the smear layer in instrumented root canals through the use of scanning electron microscopy (SEM). The smear layer consists of organic and inorganic substances³. While root canal shaping can be predictably and efficiently performed with instrumentation, effective cleaning of the entire root

canal system with a suitable irrigant remains a challenge⁴. Numerous irrigants have been recommended for clinical use. Sodium hypochlorite (NaOCl) is widely recommended and is now the preferred irrigant in root canal treatment because of its microbicidal and organic tissue-dissolving ability. However, NaOCl does not effectively remove the smear layer⁵. Ethylene-diaminetetra-acetic acid (EDTA) is used in root canal treatment and it is highly effective in smear layer removal. It is not a powerful bactericide, and generally has no effect on Gram-positive species⁶.

Healing potential in plants is an ancient idea, but in recent times it has gained renewed interest and importance. Herbal products have been proven to be safe, containing active constituents that have beneficial physiological effect apart from its curative property. Prabhakar *et al.* (2010) evaluated the antibacterial efficacy of Triphala and Green Tea Polyphenol against 3 week and 6 week old *E. faecalis* biofilm (7). They reported a statistically significant antibacterial activity by herbal alternatives. Triphala is an Indian ayurvedic herbal formulation consisting of dried and powdered fruits of three medicinal plants *Terminalia bellerica*, *Terminalia chebula* and *Emblica officinalis*⁸ and Green tea polyphenols, the traditional drink of Japan and China is prepared from the young shoots of tea plant *Camellia sinensis*⁹.

The purpose of this study was to compare the In Vitro capacity of Triphala and Green Tea Polyphenol (GTP) to 2.5% NaOCl, on the removal of the smear layer using SEM.

MATERIALS AND METHODS

A total of 40 maxillary and mandibular, single-rooted, noncarious, extracted human teeth with fully developed apices were included in this study. The teeth were randomly divided into three experimental groups of 10 teeth each and two control groups of five teeth each. After access preparation for each tooth, the root canals were mechanically prepared using a stepback technique with a K-type file and Gates-Glidden burs (Dentsply Maillefer, Ballaigues, Switzerland) to size 40 at the working length. During instrumentation 5 mL of the selected irrigant was used for at least 10 s after

each file using a 30-gauge endodontic tipped needle. Each of the five groups (I -V) were treated with one of the following solutions: group I, sterile distilled water (negative control); group II, 2.5% NaOCl + 17% ethylenediamine tetraacetic acid (EDTA) (positive control); group III, Triphala powder (IMPCOPS Ltd., Chennai, India) ;group IV, GTP (Essence and Flavours, Mysore, India.) ; group V: 2.5% NaOCl (Prime Dental , India). Both the Triphala and GTP prepared by dissolving 60mg/ml in distilled water

Longitudinal grooves were made on the buccal and palatal surfaces of the root segments without penetrating into the canal. The roots were then split into two halves with a chisel. The specimens were examined using a SEM JEOL 6400 (JEOL, Tokyo, Japan) and Cambridge S360 (Cambridge,UK) SEM at magnifications of 1000 and 2000-. The specimens were blind coded. Analysis of the SEM images was performed by two investigators who scored the presence of smear layer on the surface of the root canal in the coronal, middle and apical portion of each canal based on the criteria described by Hu¹⁰lsmann *et al.* (2002) outlined below (10):

- 1) Score 1: dentinal tubules completely opened;
- 2) Score 2: more than 50% of dentinal tubules opened;
- 3) Score 3: less than 50% of dentinal tubules opened;and
- 4) Score 4: nearly all of the dentinal tubules covered with smear layer.

The data were further analysed using statistically based, nonparametric Kruskal–Wallis and Mann–Whitney U-tests.

RESULTS

A moderate to thin smear layer was seen in specimens treated with Triphala (group III), especially in the middle and coronal sections (Fig.1) but in the apical section there was more smear layer (moderate to heavy). Group IV, which was treated with GTP, had substantial smear layer in all sections (Fig. 2). No smear layer was noted on the surface of the samples irrigated with 2.5% NaOCl and a final rinse of EDTA (positive control; group II) (Fig. 3). The specimens irrigated with 2.5% NaOCl (group

Table 1: Comparison of different irrigation regimens using Mann-Whitney U-test

Irrigant	Apical third	Middle third	Coronal third
Sterile distilled water (A)			
Triphala (C)	0.004	0.001	0
GTP (D)	0.584	0.824	1
NaOCl (E) 2.5%	0.073	0.033	0.029
NaOCl + EDTA (B) 2.5%	0	0	
NaOCl (E) 2.5%			
Triphala (C)	0.036	0.001	0.001
GTP (D)	0.006	0.035	0.01
NaOCl + EDTA (B) 2.5%	0.001	0.001	0.001
GTP (D)			
Triphala (C)	0	0	0
NaOCl + EDTA (B) 2.5%	0	0.001	0.001
NAOCl + EDTA (B)			
Triphala (C)	0.001	0.004	0

After Bonferroni correction, $P < 0.008$ was considered statistically significant

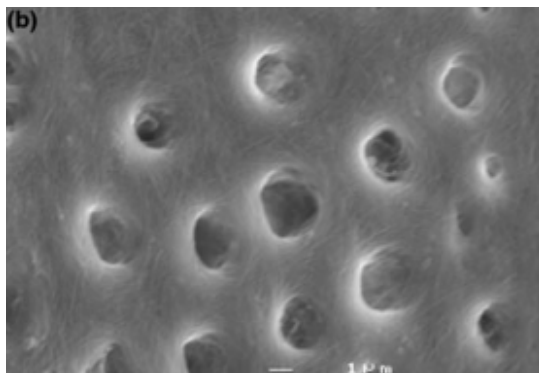


Fig. 1:

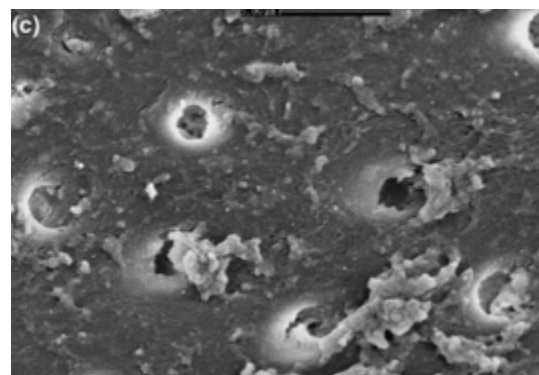


Fig. 2:

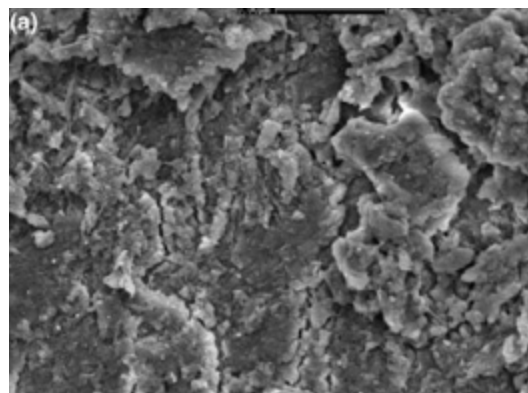


Fig. 3:

V) had moderate to heavy smear layer. In Group I, in which distilled water (negative control) was used as the irrigant, the dentinal walls were completely covered by smear layer (Fig. 3).

Triphala was found to be significantly more effective at smear layer removal than distilled water and GTP ($P < 0.008$). Only in the apical section of the root canal, there was no statistical difference between Triphala and 2.5% NaOCl (Table 1). Statistical analysis revealed that distilled water and GTP were not effective in removing the smear layer and the difference between them was not statistically significant. There was a significant difference between the NaOCl + EDTA group (negative control) and all other groups at different levels of the root ($P < 0.0008$).

DISCUSSION

Theoretically all this debris and bacteria should be removed from the root canal system, if long-term success is to be achieved. Bacteria could be shielded by the smear layer from the actions of antibacterial agents, can survive and multiply. This may offer some explanation for some long- or medium-term failures of root canal treatments¹⁰. Because of its potential contamination and adverse effects on the outcome of root canal treatment, smear layer removal is recommended.

In this study, Triphala showed better cleaning in the coronal and middle thirds compared with 2.5% NaOCl. The results showed no significant difference in the ability of distilled water, GTP and 2.5% NaOCl to remove the smear layer. The results from Group II indicated that irrigation with 2.5% NaOCl during instrumentation with final flush of 17% EDTA for 2 min was significantly more effective in

removing the smear layer compared with distilled water. Small areas of erosion were noted in the coronal and middle third of the root canal walls. The results of the present study also demonstrated that conventional irrigation with 2.5% NaOCl alone (Group V) was comparatively ineffective in achieving thorough removal of the smear layer.

As an alternative to the undesirable effects of NaOCl, two herbal alternatives which might disinfect the root canal system with less toxicity were selected for the study. Triphala demonstrated better cleaning in the coronal and middle thirds. Triphala (TPL) is a traditional ayurvedic herbal formulation consisting of the dried and powdered fruits of three medicinal plants, Terminalia chebula, Phyllanthus emblica and Terminalia bellerica in equal proportions. Phyllanthus emblica contains a range of tannins and other phenolic compounds. It also contains ascorbic acid and flavanoids⁹. It would appear that the cleaning effect of Triphala in this study may be related to these acid components. In contrast to Triphala, GTP did not clean the canal walls effectively.

CONCLUSION

Within the limitations of this study, it could be concluded that Triphala showed good cleaning efficacy than other irrigants used in this study. The most effective removal of smear layer occurred with the use of NaOCl with a final rinse of 17% EDTA (positive control) followed by the use of Triphala. A 2.5% solution of NaOCl alone did not produce satisfactory results. A less effective cleaning effect was found in groups in which either distilled water or GTP was used as irrigants. Further investigations are recommended to evaluate the potential use of Triphala as a root canal irrigant.

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