Effect of Different Irrigation Solutions on Coronal Microleakage in Endodontically Treated Teeth (An In Vitro Study)

ABSTRACT

Background: The coronal microleakage in the endodontically treated teeth causes recurrent caries and can be associated with the restoration and the root canal treatment failures. Intra orifice barrier is an efficient alternative method to decrease coronal leakage in endodotically treated teeth and one of the best barriers is glass ionomer. The current studie propose that using different irrigation solutions in root canals effect on coronal microleakage.
Purpose: this study aimed to compare the coronal microleakage in glass ionomer obturated root canals in endodontically treated teeth using different irrigation solutions.
Methods: sixty extracted human single-rooted teeth with single canals were collected and disinfected with 0.5 choloro amin. After root canal therapy and evacuation of 2mm coronal gutta percha, the teeth were divided into 3 groups of each 20, based on irrigation solutions. Glass ionomer was used as the coronal barrier and the teeth were stored in distilled water. The irrigation solutions used were: 17% EDTA, Alcohol and normal saline. Then all the specimen were submerged in 2% methylene blue dye for 24 hours at room temperature and sectioned sagittally and the dye penetration was assessed by stereomicroscope.
Results: There were not dye penetration only in 3.3% of teeth and all of the teeth that irrigated with saline showed dye penetration. Dye penetration was seen in 0 %, 5% and 15% of EDTA, Alcohol and Saline group, respectively. Dye penetration was higher in Saline group than other two groups but coronal microleakage has not shown statistically significant differences in different groups.
Conclusion: The results of current study indicated that using different irrigation solutions may be associated with decrease in coronal microleakage. Although, based on our findings there are not any significant differences among different irrigation solutions but more studies may be needed to confirm this results.

Keywords: Coronal microleakage, Coronal barrier, Glass ionomer, Irrigation solution

1. INTRODUCTION

Salivary microorganism and their products have an important role in progression of pulpal and periradicular diseases. One of the fundamental challenges in dentistry is keeping the pulpal space out of the microorganisms, becuase they have the ability to penetrate through the minutest pore of spaces. So,The major aim of endodontic treatment is to keep the pulpal space out of bacteria and hence to prevent infection [1]. While, the coronal microleakage at the crown of endodontically treated teeth cause recurrent caries, It can be associated with restoration and the root canal treatment failure[2].High rates of success in treatment of endodontics are related to the root canal preparation and coronal sealing[3]. The studies showed that endodontically treated teeth without coronal sealing had more failure rate [4]. The most widely used sealers include: Cavit, amalgam, intermediate restorative material, super-EBA, composite resin, glass ionomer cement and mineral trioxide aggregate (MTA)[5]. Glass ionomer cements (GIC) are restorative materials with many uses

in dentistry and contain calcium, strontium aluminosilicate glass powder (base) and water-soluble polymer (acid) [6].

Irrigation solutions are used in variety of purposes such as antibacterial action, tissue dissolution, cleaning and chelating and They are one of the fundamental steps in root canal treatment [7]. The most commonly used Irrigation solutions are Sodium hypochlorite (NaOCl) and chlorhexidine (CHX). They are usually used along with ethylenediaminetetraacetic acid (EDTA) or other chelating agents [8]. Irrigation is the most important step in endodontic treatment.It is doing special for the elimination of root canal microorganisms .In other words, irrigating solutions are used to kill and remove necrotic tissue and debris of dentine[9].The recent studies showed that different irrigation solutions may be associated with varies stage of coronal microleakage[10,11]. Shinohara et al showed that the amount of microleakage in using of NaOCI is dependent on the adhesive system[12].While, Sung et al reported that effect of different irrigation solutions on microleakage is not significantly different[13].So, we aimed to compare coronal microleakage in glass ionomer obturated root canals in endodontically treated teeth using different irrigation solutions.

2. MATERIAL AND METHODS

A sample of 60 single-rooted human teeth with single canals was used for the study. Teeth that were extracted for orthodontic or periodontal reasons were used.The surfaces of each root were cleaned with a Gracey curette. After extraction, the teeth were stored in 0.5% choloro amin solution at 4C until required.

Roor canals were prepared by crown down technique up to 40 master apical file. Then latral cpmpactopn obturation was performed by using Zinc oxide sealer (Golchi,Iran), eugenol(Gordab chime Gmbh ,Germany) and gutta percha(Gapadent, Germany). The teeth were sectioned coronally 2mm above the cementoenamel junction. After that, Gates Glidden Drills (Size 2) was used to remov 2mm of coronal gutta.

The samples were divided into three groups based on different irrigation solutions.

Group1: The root canals were irrigated with 5 ml of EDTA 17% for 10 seconds and 2mm of glass ionomer was used as coronal barrier.

Group2: The root canals were irrigated with Alcohol and for 10 seconds and 2mm of glass ionomer was used as coronal barrier.

Group3: The root canals were irrigated with 5 ml of normal saline for 10 seconds and 2mm of glass ionomer was used as coronal barrier.

In this study we used Light-cure glass ionomer (GG Fuji,Japan) . Light curing was done for 20 seconds.

The samples were stored in normal saline solution for 24 hours. Then root apex were coated with sticky wax.After that, except apex, all part of the teeth to CEJ were coated with two layer of nail varnish. All teeth were treated in 2% methylene blue dye solution for 24 hours.The samples were sagittally sectioned with automatic cutter (Sruers,Denmark). At the end,the dye penetration was assessed by stereomicroscope. Two independent observers evaluated the teeth and dye penetration was recorded.

The scoring was done as below:
0: Dye penetration was not seen

1: Dye penetration is less than 1:2 Light-cure glass ionomer thickness
2: Dye penetration is higher than 1:2 Light-cure glass ionomer thickness but did not received to gutta.
3: Dye penetration received to the gutta.

2.1 Statistical Analysis

To compare the mean of microleakage in different groups,in the cases with normal distribution , If variance was equal we used ANOVA and if not Weltch test was performed .But in which that normal distribution was not seen Kruskal wallis test was done. The significance level was set at p = 0.05.

3. RESULTS

Each group needed at least 20 teeth (totally 60) to give a 5% error level (a) and 80% power.The frequency distribution of dye penetration in different groups was showed in table 1. There were not dye penetration only in 3.3% of teeth and all of the teeth that irrigated with saline showed dye penetration. Dye penetration was seen in 0 %, 5% and 15% of EDTA, Alcohol and Saline group,respectively. Dye penetration was higher in Saline group than other two groups but coronal microleakage has not shown statistically significant differences in different groups.

Table1. Frequency distribution of dye penetration in different groups

Dye penetration	Study Groups			Total
	EDTA	Alcohol	Normal Saline	
Not seen	1(5%)	1(5%)	0	2(3.3%)
Less than 1:2 GI	8(40%)	9(45%)	4(20%)	21(35%)
higher than 1:2 GI	9(45%)	8(40%)	11(55%)	28(46.66%)
Between GI and Gutta	2(10%)	1(5%)	2(10%)	5(8.3%)
Received to Gutta	0	1(5%)	3(15%)	4(6.6%)

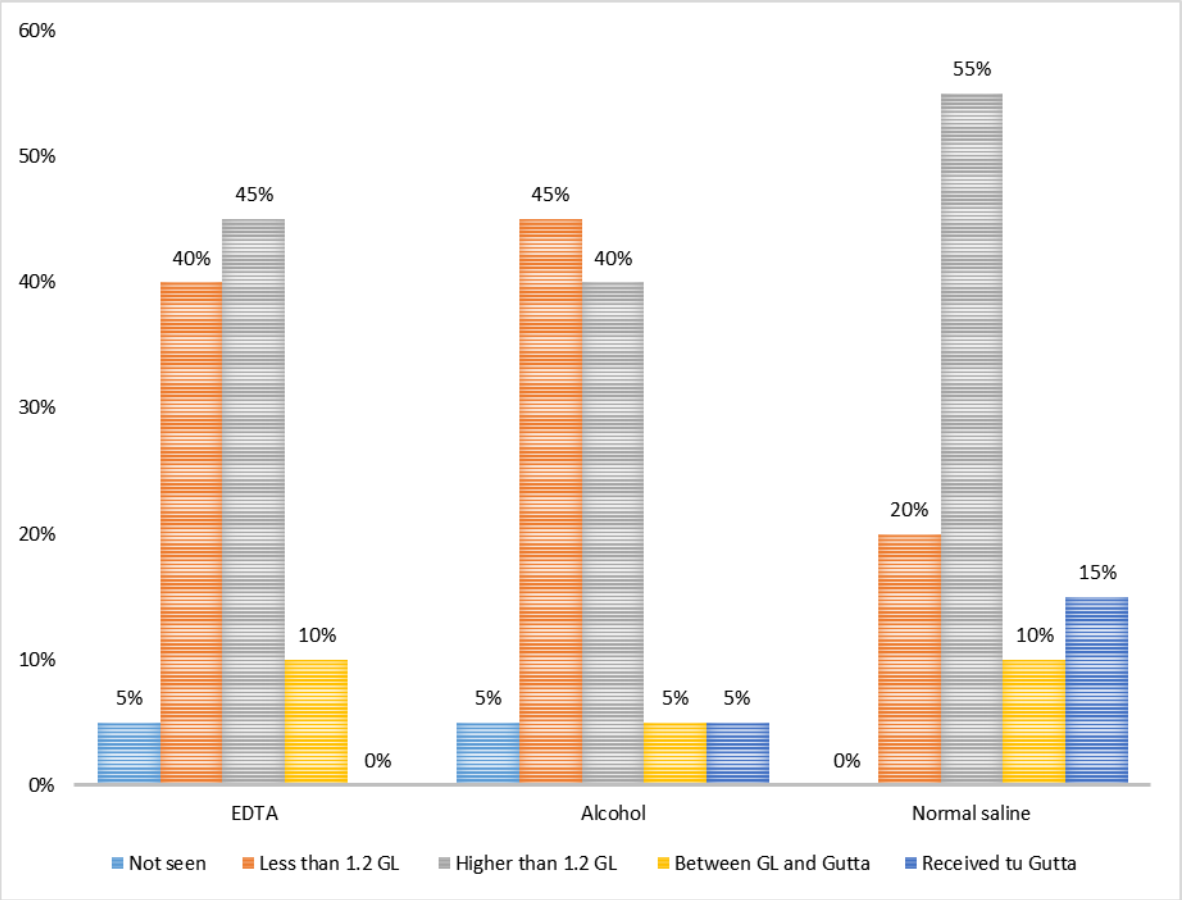

Fig.1. Comparison of coronal microleakage between the groups

4. DISCUSSION

Finding clinical properties of different irrigation solution is very important to choose the best one. Previous studies have contravesy in respect to irrigation solutions association and coronal microleakage. But, to the best of our knowledge, there is not any study that specifically focus on the impact of irrigation solutions on coronal microleakage in endodontically treated teeth with glass ionomer obturated root canals [10-12].

The results of the current study indicated that dye penetration was higher in Saline group than other two groups but it doesn't show statistically significant difference between different groups. This results are in line with previous studies. Sung et al compared microleakage of Class V composite restorations after using different irrigation solutions include: (1) tap water, (2) sterile water, (3) sodium chloride solution, (4) filtered water, (5) chlorhexidine, (6) sodium hypochlorite, and (7) distilled water .They reported that microleakage in ranging 10% to 30% was seen in all groups.Also they reported the effect of different irrigation solutions was not significant.[13]. Zare Jahromi et al in another study that was carried out on 55 single rooted teeth comparing the effect of different irrigation solutions on the coronal microleakage.They used three irrigation protocol; MTAD , citric acid, and EDTA/NaOCl. Microleakage was less in MTAD, citric acid and EDTA/NaOCl compared with normal saline. But, the differences was not significant. But some studies are in controversy with our results;Vivacque et al studied on fifty single root canal teeth evaluated the effect of different irrigation solutions on coronal microleakage after root canal treatment. They used 1% NaOCl, 1% NaOCl + 17% EDTA,

2% chlorhexidine gel, 2% chlorhexidine gel + 1% NaOCl, and V--distilled water as irrigation solutions and reported that the least leakage occurred when 1% NaOCl + 17% EDTA (2.62 mm) and 2% chlorhexidine gel (2.78 mm) were used,the differences were statistically significant(14).Moreover,Prado et al in another study compared coronal microleakage in 18 different irrigation protocols and filling material.The irrigation protocols were used as below: distilled water; sodium hypochlorite (NaOCl)+eDTA; NaOCl+H3PO4; NaOCl+eDTA+chlorhexidine (CHX); NaOCl+H3PO4+CHX; CHX+eDTA; CHX+ H3PO4; CHX+eDTA+CHX and CHX+H3PO4+CHX.At the end micro leakage against Enterococcus faecalis was assessed for 90 days. They found that irrigation with 2% chlorhexidine is associated with significantly reduced coronal microleakage [15].

5. CONCLUSION

According to this study using different irrigaton solutions may be decrease the coronal microleakage.Althogh,there are not any significant difference between irrigation solution.But more studies are needed to confirm this results.

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COMPLIANCE WITH ETHICS GUIDELINES

CONFLICT OF INTEREST

The Authors declare that they have no conflict of interest.

HUMAN AND ANIMAL RIGHTS, INFORMED CONSENT

This paper does not involve any studies with human or animal subjects performed by the any of the authors.

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