

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 endodontically treated teeth and one of the best barriers is glass ionomer. The current study 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 chloro 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 penetration of dye only in 3.3% of teeth and all of the teeth that irrigated with saline showed dye penetration. the dye penetration was seen in 95%, 95% and 100% of the EDTA, alcohol and saline groups, 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

Microorganism of Salivary 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 microorganisms, because they have the ability to penetrate through the minutest pore of spaces. Therefore a 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

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

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

43 2. MATERIAL AND METHODS

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

49 Root canals were prepared by crown down technique up to 40 master apical file. Then Side
50 congestion obturation was performed by using Zinc oxide sealer (Golchi,Iran),
51 eugenol(Gordab chime GmbH ,Germany) and gutta percha(Gapadent, Germany). The teeth
52 were sectioned coronally 2mm above the cemento enamel junction. After that, Gates Glidden
53 Drills (size 2) were used to remove 2 mm of gutta coronal.

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

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

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

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

61 In this study we used Light-cure glass ionomer (GG Fuji,Japan) . Light curing was done for
62 20 seconds.

63 The samples were stored in normal saline solution for 24 hours. Then root apex were coated
64 with sticky wax. After that, except apex, all part of the teeth to CEJ were coated with two
65 layer of nail varnish. All teeth were treated in 2% methylene blue dye solution for
66 24 hours.The samples were sagittally sectioned with automatic cutter (Sruers,Denmark). At the
67 end,the dye penetration was assessed by stereomicroscope. Two independent observers
68 evaluated the teeth and dye penetration was recorded.

69 The scoring was done as below:

70 0: Dye penetration was not seen

- 71 1: Dye penetration is less than 1:2 Light-cure glass ionomer thickness
 72 2: Dye penetration is higher than 1:2 Light-cure glass ionomer thickness but did not received
 73 to gutta.
 74 3: Dye penetration received to the gutta.

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76 2.1 Statistical Analysis

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

81 3. RESULTS

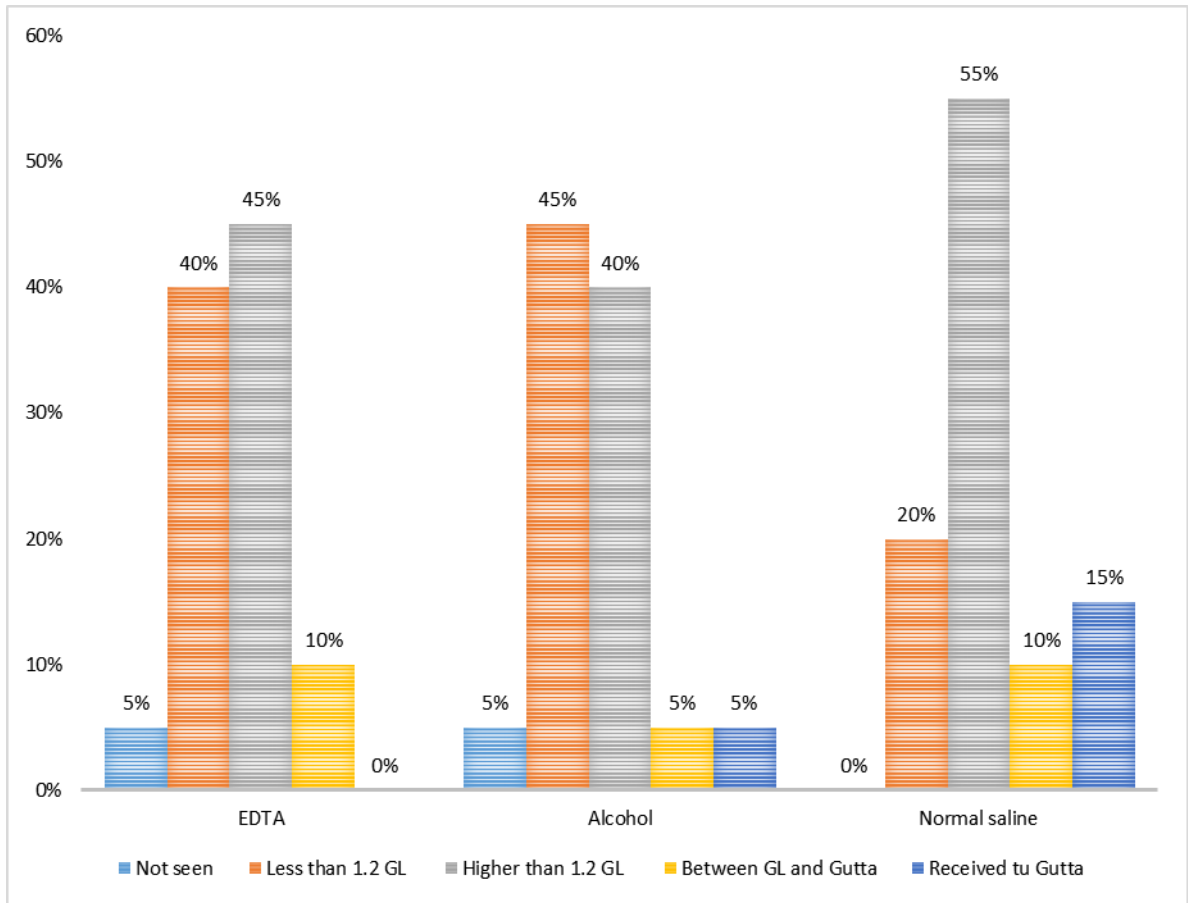
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83 Each group needed at least 20 teeth (totally 60) to give a 5% error level (α) and 80% power.
 84 The frequency distribution of dye penetration in different groups was showed in table 1.
 85 There were not penetration of dye only in 3.3% of teeth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

90 **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 Gutta	to 0	1(5%)	3(15%)	4(6.6%)

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Fig.1. Comparison of coronal microleakage between the groups

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4. DISCUSSION

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Considering the importance of crown flood in the success of rooting, the application of a barrier of over-the-material gutta-percha reduces microleakage and results in the success of root cure [2]. Because of the chemical bond to the dentin, the thermal coefficient is similar to the ivory And fluoride release properties can be used as a coronal dam [5].

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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].

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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. **These 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

113 teeth comparing the effect of different irrigation solutions on the coronal **microleakage**. They
114 used three irrigation protocol; MTAD , citric acid, and EDTA/NaOCl. Microleakage was less
115 in MTAD, citric acid and EDTA/NaOCl compared with normal saline. But, the differences was
116 not significant. But some studies are in controversy with our results; Vivacqua et al studied on
117 fifty single root canal teeth evaluated the effect of different irrigation solutions on coronal
118 microleakage after root canal treatment. They used 1% NaOCl, 1% NaOCl + 17% EDTA,
119 2% chlorhexidine gel, 2% chlorhexidine gel + 1% NaOCl, and V--distilled water as irrigation
120 solutions and reported that the least leakage occurred when 1% NaOCl + 17% EDTA (2.62
121 mm) and 2% chlorhexidine gel (2.78 mm) were used, the differences were statistically
122 significant [14]. Moreover, Prado et al in another study compared coronal microleakage in 18
123 different irrigation protocols and filling **material**. The irrigation protocols were used as below:
124 distilled water; sodium hypochlorite (NaOCl)+eDTA; NaOCl+H3PO4;
125 NaOCl+eDTA+chlorhexidine (CHX); NaOCl+H3PO4+CHX; CHX+eDTA; CHX+ H3PO4;
126 CHX+eDTA+CHX and CHX+H3PO4+CHX. At the end micro leakage against Enterococcus
127 faecalis was assessed for 90 days. They found that irrigation with 2% chlorhexidine is
128 associated with significantly reduced coronal microleakage [15].

129 **5. CONCLUSION**

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

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138 **COMPLIANCE WITH ETHICS GUIDELINES**

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140 **CONFLICT OF INTEREST**

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142 The Authors declare that they have no conflict of interest.

143 **HUMAN AND ANIMAL RIGHTS, INFORMED CONSENT**

144

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

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