Original Article

Effect of Enamel Bonding Agents on Pit and Fissure Sealant Retention in An Isolated Situation

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Abstract:

Objective: The aim of this study was to evaluate the efficacy of enamel bonding agents on pit and fissure sealant retention in a well-isolated situation.
Materials and Methods: Thirty-two patients (6-9 years old, all males) with four fully erupted permanent first molars were selected. Their occlusal, buccal, and lingual fissures were sealed according to a split-mouth design using concise light curing white sealant (3M) for the control group and Heliobond (Vivadent) plus sealant for the study group. The retention of sealants was carefully inspected after one year and the data were analyzed by chi-square test.
Results: The percentages of complete retention in the study and control groups were 73.2, and 71.4, respectively. Chi-square test revealed no significant difference between these groups (P>0.05)
Conclusion: In a dry and isolated situation, application of enamel bonding agent has no significant effect on fissure sealant retention.

Key Words: Pit and Fissure Sealants; heliobond; white sealant; Dental Enamel

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INTRODUCTION

Dental caries is the most common chronic human disease [1]. Although only 12.5 percent of all tooth surfaces are occlusal, these surfaces are shown to develop more than two-thirds of total caries experienced by children [2]. A recent paper suggests that approximately 90% of caries in children occurs in pit and fissures [3]. Several methods have been recommended for caries prevention so far, including the introduction of pit and fissure sealants, which has provided a preventive method for minimizing occlusal caries [4-8].

Fissure sealants were first introduced in 1967 by Cueto and Buonocore [9] and their effectiveness was recognized by the American Dental Association in 1971 [10]. The ability of fissure sealants to prevent fissure caries is related to sealant retention. Intact sealants protect the surfaces they cover from caries and their successful application is dependent upon good clinical technique. The most important criteria mentioned, as the key point for a successful result is complete isolation of the teeth from saliva contamination [11].

Enhancing the penetration of the sealant into the fissures, should improve sealant retention. It can be assumed that due to lower viscosity and higher penetration rate of an unfilled bonding agent, its penetration into the fissures and enamel tags is more than sealants; as a result, the sealant will be more retentive. Some papers have reported an increase in fissure sealant retention following bonding agent ap-

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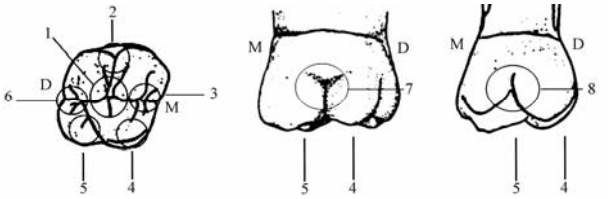

Fig 1. Maxillary permanent first molar: Occlusal view (left), Buccal view (middle), palatal view (right).
1. Central Fissure; 2. From Central Fissure toward buccal; 3. Mesial Fissure; 4. Fissure of Carabelli Cusp; 5. Distolingual Fissure on Occlusal Surface; 6. Distal Fissure; 7. Buccal Fissure; 8. Palatal Fissure.

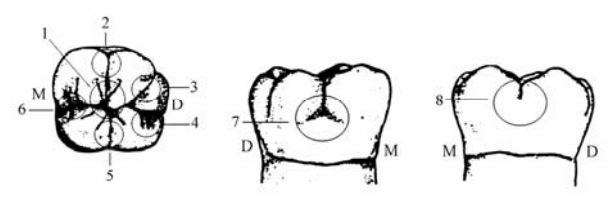

Fig 2. Mandibular permanent first molar: Occlusal view (left), Buccal view (middle), palatal view (right).
1. Central Fissure; 2. From Central Fissure toward buccal; 3. Mesial Fissure; 4. Fissure of Carabelli Cusp; 5. Distolingual Fissure on Occlusal Surface; 6. Distal Fissure; 7. Buccal Fissure; 8. Palatal Fissure.

plication [12,13], while others have shown no such difference [11,14]. The aim of this study was to determine the effect of enamel bonding, in a well-isolated dry situation, as a pre-treating agent on sealant retention.

MATERIALS AND METHODS

This clinical trial was carried out in Nikan School (Tehran, Iran). Thirty-two boys (6-9 years old) with no malocclusion or parafunctional habit and four fully erupted permanent first molars were involved. The study scored 128 occlusal and 512 buccal/lingual permanent first molar sealants, with use of a split-mouth design, half of which received sealant alone (control group) and the other half enamel bonding agent plus sealant (experimental group). The control and experimental teeth were chosen randomly in each patient (complete matching of the two groups). One control and one study tooth were treated in the same visit. To evaluate the sealant retention, fissures of each tooth were coded 1 to 8 (Fig 1 and 2).

They were cleaned by means of a low speed handpiece (4000 rpm) and a brush followed by spray of air and water. Before and after etching with 37% phosphoric acid (Kimia, Tehran, Iran) for 30 seconds, the teeth were dried and isolated with cotton rolls. In the experimental group, enamel bonding agent (Heliobond, Ivoclar Vivadent, Ag. Bendererstrasse 2, FL-9494, Schaan-Lichtenstein) was applied, thinned with air spray and cured (Heliolux, Vivadent) for 20 seconds prior to fissure sealant application.

The teeth were treated as follows:

Fissure sealant (Concise light curing white sealant, 3M Co. St. Paul, MN, USA) was applied for all the teeth and cured for 60 seconds. In cases where air bubbles were produced, sealant insertion was repeated. Occlusion was evaluated and adjusted before the patients were dismissed. Retention of sealant in the fissures was carefully inspected by explorer (Da 468, Aesculap, Tuttlingen, Germany) and a mouth mirror (No. 4, Ausculap, Tuttlingen, Germany) under adequate light after insertion and one year later. The results were recorded and chi-square test was used to analyze the data.

RESULTS

Sealant retention rates in the maxillary and mandibular permanent first molars, their fissures, and the retention percentage for the fissures in each jaw were evaluated in the experimental and control groups (Fig 3-6). The enamel bonding agent slightly increased the sealant retention of the maxillary teeth; however, Chi-square revealed no significant difference between the groups (P=0.15).

In addition, no significant difference was observed between sealant retention rates in the maxillary and mandibular fissures (P=0.15) and the fissures in each jaw (P=0.15).

The distopalatal fissure (code 5) was least, and palatal fissures (code 8) were most retentive in both groups.

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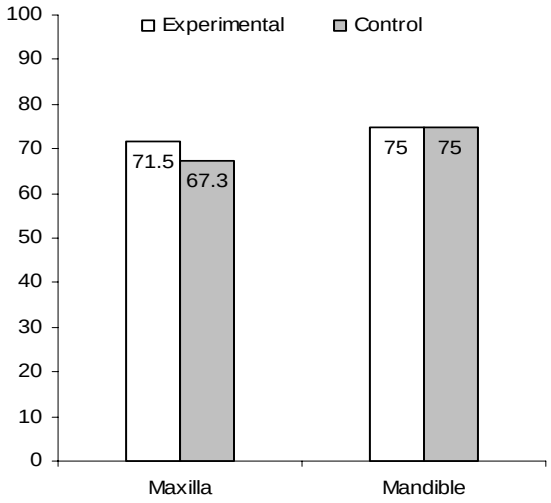

Fig 3. Sealant retention rates in the maxillary and mandibular permanent first molars.

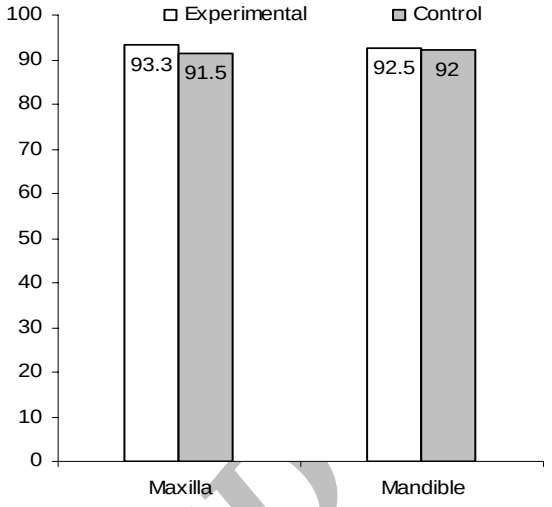

Fig 4. Sealant retention percentage in the maxiallary and mandibular permanent first molar fissures.

In the mandibular teeth, fissures from central fossa toward buccal (fissure code 2) and from central fossa toward lingual (fissure code 5) in the study group had the highest retention rates.

DISCUSSION

The results of this study indicated that, although, application of enamel bonding agents prior to fissure sealant caused more retention in the experimental group, this increase was not statistically significant (P=0.15).

As mentioned earlier, concise light cured white sealant resin (3M/ESPE) was used in this study. The manufacturer's manual reveals that it contains Bis-GMA and TEGDMA, the density of which is 9.9 and its penetration rate is 0.008 cm/s. The enamel bonding agent used in the study was Heliobond (Vivadent), which is an unfilled enamel bonding agent and contains Bis-GMA and TEGDMA. Its penetration rate as stated by the manufacturer is 0.046-0.048 cm/s. Thus, it can be assumed that because of the lower viscosity and the higher penetration rate of Heliobond, its penetration into the fissures and enamel tags is more than concise white sealant and, as a result, more sealant retention will occur.

However, as previously stated, in our study application of enamel bonding agent prior to fissure sealant did not increase the retention rate of the sealant. Similar results have been reported from other studies. Boksman et al [14] compared the retention rate of a filled (concise light cured) and an unfilled sealant (prisma shield light cured) with and without the use of two bonding agents (Scotch bond 2 and prisma universal bond) under *in vivo* settings. After two years, they concluded that using bonding agents did not increase the retention of either types of sealant. It is worth noting that different materials were used in the previous studies, for example, in Boksman's study, dentin-bonding agents were used as the pre-treatment materials. Controversial results have been obtained when dentin bonding agents were used as so.

In other *in vivo* studies which were carried out for two and five years, dentin bonding agents increased the retention rate of sealants [2,15]. It has been suggested that if it is impossible to avoid saliva/water contamination, application of a hydrophilic bonding agent prior to sealant application may improve the retention rate of the sealant [16]. The author believed that priming the etched enamel with a dentin-bonding agent prior to placement of a sealant could in-

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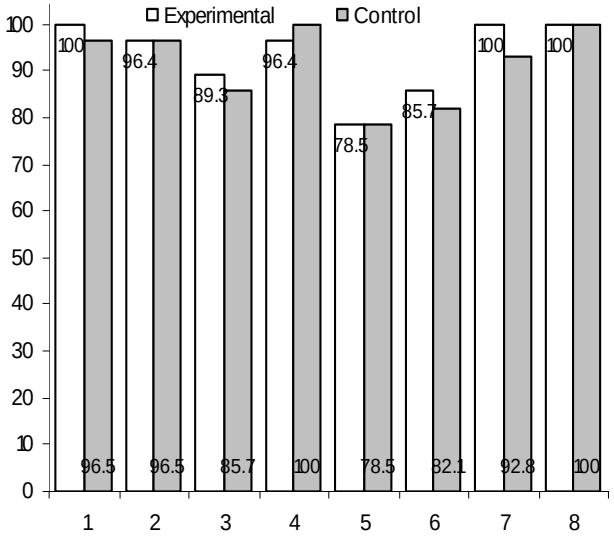

Fig 5. Fissure sealant retention rates in each fissure of the maxillary permanent first molars.

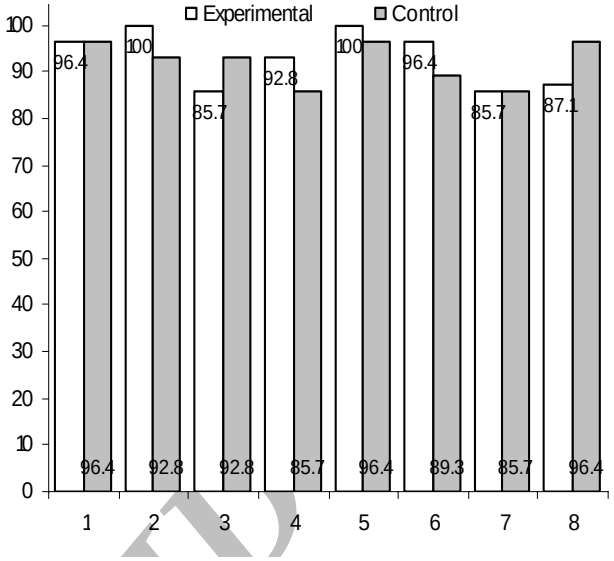

Fig 6. Fissure sealant retention rates in each fissure of the mandibular permamanent first molars.

crease the surface wettability and the approximation between the sealant and the substrate by removing contaminants. However, recently, Locker, after an evidence-based study, recommended that placing a bonding agent prior to the sealant on the surface does not appear to enhance retention rates [11]. Though not contraindicated, considering the extra time and cost needed and the inconclusive importance in retention, routine use of a bonding agent as part of the sealant application technique is not recommended.

Other studies have been carried out to investigate the penetration rate of sealants and its effect on retention. Courson et al [17] reported that penetration and sealing are two different phenomena. The authors believed that sealing ability of a sealant is the main criteria for good retention. They have also mentioned that ideally, an efficient sealant must have a good sealing ability and a high rate of infiltration as well; but these two properties probably do not have the same clinical relevance. The enduring and stable seal remains the most important requirement. Although the materials used in our study had different penetration rates, similar results were obtained with both the materials. This seems to emphasize the significance of sealing ability of the sealant material.

In our study, failure rate of fissure sealant (after one year) in the experimental and control groups were 6.7% and 8.5% in the maxillary, and 7.5% and 8.0% in the mandibular fissures, respectively. This is similar to the 5 to 10 percent reported by others [12], but lower than the 15 to 29 percent obtained by Feigal [15]. Most failures in the maxillary first molar were in distal (fissure code 6) and distopalatal fissures (code 5) while in the mandible, they were in lingual (code 8), buccal (fissure code 7) and distal fissures (code 3,4). This confirms the findings of Waggoner and Siegal [2] and Futatsuki et al [18]. The distopalatal fissure on the occlusal surface of the maxillary first molar (code 5) was the least retentive fissure in the two groups. Feigal et al [15] reported that maxillary sealants were more likely to fail than mandibular sealants. However, an Australian clinical survey showed equal losses between both the maxillary and mandibular molars [19].

CONCLUSION

In a dry and isolated situation, application of enamel bonding agent has no statistically significant effect on fissure sealant retention.

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