The Efficacy Of Glass Ionomer Hybrid As Orthodontic Brackets Adhesives To Inhibit Calsium Released Of The Enamel

Rina Sutjiati[1]

[1]Department of Orthodontic Dentistry Faculty Jember University

Abstract

Background : Composite resins are predominantly used to bond orthodontic brackets onto teeth. These can lead to calcium released of the enamel surrounding the brackets. **Purpose** : To observe calcium release during the use of adhesives which release fluoride **Method** : This experimental study was design to determine the calcium released after soaking in the acid solution. This in vitro study used forty extracted human premolars (20 teeth were bonded with glass ionomer, and 20 teeth were bonded with glass ionomer hybrid). Half of the teeth in each group were treated with fluoride application and the other half were not treated fluoride application topically. Calcium released of the enamel was evaluated using Spectrofotometer. **Result :**The results showed that there was a significant difference between glass ionomer group without and with fluoride application ($p<0,005$), and there was not significant difference ($p>0,005$) in the group of glass ionomer hybrid without and with fluoride application topically. **Conclusion :**The adhesive glass ionomer hybrid could prevent calcium released with or without the usage of sodium fluoride.

Key words :topical application, adhesive bracket, calcium released.

Efektifitas Bahan Perekat Breket Ortodonti Gelas Ionomer Hibrid Dalam Mencegah Pelepasan Kalsium Pada Enamel

Abstract

Bahan perekat resin komposit banyak digunakan untuk melekatkan breket pada enamel. Pelepasan kalsium dapat terjadi pada enamel di sekitar breket.Tujuan penelitian ini adalah untuk menguji pelepasan kalsium pada bahan perekat breket yang dapat melepaskan fluor. Metode penelitian laboratoris ini dilakukan untuk menentukan pelepasan kalsium setelah dilakukan perendaman pada larutan asam. Penelitian ini menggunakan 40 gigi premolar pertama permanen yang dicabut untuk perawatan ortodonsi (20 gigi dilekatkan dengan gelas ionomer, dan 20 gigi dilekatkan dengan semen gelas ionomer hibrid). Separuh dari 40 gigi tersebut diberi topikal aplikasi fluor dan separuh berikutnya tidak diberi topikal aplikasi fluor.Pelepasan kalsium diukur dengan menggunakan Spektrofotometer. Hasil penelitian ini menunjukkan perbedaan yang bermakna pada kelompok gelas

Correspondence: Rina Sutjiati, Department of Orthodontic Dentistry Faculty Jember University, e-mail: rinasutjiati@yahoo.co.id

ionomer tanpa dan dengan topikal aplikasi fluor (p<0,005), serta tidak terdapat perbedaan yang bermakna antara kelompok gelas ionomer hibrid tanpa dan dengan topikal aplikasi fluor (p>0,005). Penelitian ini dapat disimpulkan bahwa penggunaan bahan perekat breket gelas ionomer hibrid tanpa dan dengan aplikasi fluor dapat menghambat pelepasan kalsium.

Kata kunci : pelepasan kalsium, topikal aplikasi fluor, bahan perekat breket.

Introduction

Composite resin is widely used to attach orthodontic brackets on teeth, plaque is more easily accumulated on adhesive resin material on enamel[1]. It may occur since composite resin used releases fluoride. Plaque accumulation on adhesive composite resin material may lead to demineralisation including calcium release on enamel in the edges of brackets that results in white lesion around the resin. The increase of calcium release on enamel mostly caused by the increase of removing plaque as well as the increase of bacterial attachment in the composite resin. The presence of carbohydrate in subsequent process may emerge fermentation by bacteria and results acid. It plays role in dissolving inorganic matrix in enamel [2].

Adhesive material used in this study was material releasing fluoride i.e. glass ionomer and hybrid glass ionomer. Fluoride application possesses essential role to prevent mineral release during orthodontic treatment. Hybrid glass ionomer cement has adhesive force the same as composite resin by releasing fluoride nearly the same as glass ionomer cement. Several studies show that this glass ionomer cement demonstrates adhesive force required in vivo[3, 4], or in vitro[5] and capable to release fluoride[6].

Studies on caries show the advantageous affects of topical fluoride application in decreasing lesion size as well as lesion formation. Therefore, it is necessary to conduct a further study on the how the difference of topical fluoride application on the edges of orthodontic brackets attached using hybrid glass ionomer adhesives towards calcium release. The purpose of the study was to observe the difference of calcium release of hybrid glass ionomer adhesive material and glass ionomer after topical application. The benefit of this study may become the basis to use adhesive material containing fluoride in the use of fixed orthodontic appliance.

Materials and Methods

The study was an experimental laboratory conducted using the method of the post test only control group design. The sample consisted of 40 first premolar teeth of upper jaw extracted for orthodontic treatment, 20 teeth attached using hybrid glass ionomer (Fuji Orto), and the rest were attached using glass ionomer (GC Fuji I). Half of the 40 samples were provided with fluoride topical

application (NaF 0,2%). Subsequently, all of the samples were immersed in acid solution, and after thirty days all of the samples were observed for their calcium release using Spectrophotometer Atomic Absorption.

Results

The result of the study on the mean of calcium release in each group is figured as follows:

Table. The mean of calcium release from teeth after one month immersion (% Ca)

ADHESIVE MATERIAL	MEAN OF CALCIUM RELEASE
FO without application	0,2562
FO with application	0,2461
GO without application	0,3917
GO with application	0,3090

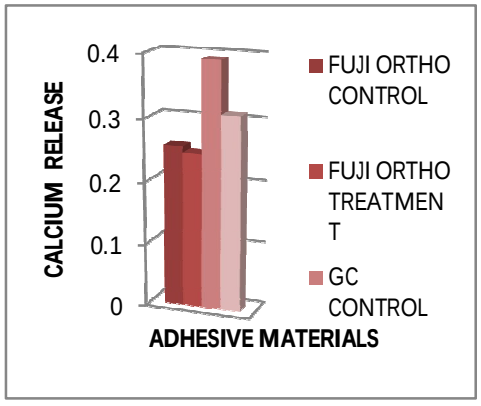

Figure: The mean of calcium release from teeth after one month immersion (% Ca).

The result of Kolmogrov-smirnov normality test showed that the data were distributed normally (p>0,05), and subsequently followed by Levene homogeny test demonstrating that the three groups were homogeny (p>0,05). The t-test was subsequently conducted to observe the differences among the three groups.

The difference of calcium release on enamel of the teeth in the hybrid glass ionomer between those with application and without fluoride applicationvalued p=0,3204(p>0,05) that statistically was not significant. In the other hand, the calcium release on the enamel of the teeth in the glass ionomer group between those with application and without application valued p=0,0044 (p<0,05) that was statistically significant. While the difference of calcium release on the enamel of the teeth between hybrid glass ionomer with fluoride application and glass ionomer with fluoride application valued p=0,0008 (p<0,05) that was statistically significant. The calcium release between hybrid glass ionomer cement without fluoride application and glass ionomer without application valued p=0,0033 (p<0,005) that was significantly significant.

Discussion

Based on the statistic t-test, there is no significant difference between hybrid glass ionomer cement with and without fluoride application, it occurs due to fluoride release of hybrid glass ionomer cement as the main factor. It is the same as Vorhies'[1] study although

using different method that the depth of mineral released in Fuji Orto adhesive material shows no significant difference between those with and without fluoride application. Silverman reports that hybrid glass ionomer cement, Fuji Orto, releases fluoride increasingly on the first day up to the 400^{th} day[8], therefore, the fluoride release from the material becomes the main factor so that not affect its mineral release. Calcium release between hybrid glass ionomer and glass ionomer cement shows significant difference between both groups with and without topical application material. It is due to fluoride release in hybrid glass ionomer cement is more than glass ionomer cement. Ogaard[9], reveals that enamel crystal, after fluoride application, will partly absorbed by enamel surface by forming fluoride depot. During the subsequent remineralisation, some of the fluoride will be released in line with the increase of fluoride level in the solution, fluoride is capable to stimulate fluorapatite or fluorhydroxiapapite formation. This change occurs when the fluoride is on the enamel surface (CaF2) and functions to decrease the amount of mineral losing during demineralisation process, and in the same time it also stimulates mineral residual on the enamel surface that subsequently binds to structure of apatite crystal and causes it endurable to dissolvability.

Conclusion

The level of calcium release on hybrid glass ionomer cement between those with and without fluoride application is nearly the same. In the other hand, the calcium release in glass ionomer is greater than hybrid glass ionomer both with and without fluoride application.

Reference:

1. Gorelick L, Geiger AM, Gwinnet AJ, (1992) : `Dynamics of caries lesion formation, fluoride in dentistry`,2^{nd} edition, (Boisen Print, Munksgaard), pp : 187-201.
2. O`relly MM, Featherstone JDB, (1987) : `Demineralization around orthodontic appliance` : an in vivo study, *Am J Orthod Dentofac Orthop*, 92: 33-40.
3. Silverman E, Cohen M, Demke RS, Silverman M, (1995) : ` A new light-cured glass ionomer cement that bonds brackets to teeth without etching in the presence of saliva, *Am J Orthod* Dentofac *Orthop*, 108 : 231-6.
4. Wright AB, Lee RT, Lynch E, Young KA, (1996) : ` Clinical and microbiologic evaluation of a resin modified glass ionomer cement for orthodontic bonding, *Am J Orthod* Dentofac *Orthop*, 110 : 469-75.
5. Chung CH, Cuoso PT, Mante FK, (1999) : `Shear bond strength of a resin-reinforced glass ionomer cement; an in vitro study, *Am J Orthod Dentofac Orthop*, 115 : 52-54.
6. Hallgren A, Oliveby A, Twetman S, (1994) : ` Fluoride concentration in plaque adjacent to orthodontic brackets retained with glass ionomer cements, *Br J Orthod*, 21: 33-40.

7. Vorhies AB, Donly KJ, Stanley RM, Wefel JS, (1998) : ` Enamel demineralization adjacent to orthodontic brackets bonded with hybrid glass ionomer cement; in vitro study, *Am J Orthod Dentofac orthop*, 114 : 668-74.
8. Silverman E, Cohen M, Demke RS, Silverman M, (1988) : ` Restorative materials containing fluoride, *JADA*, 116 : 80-86.
9. Ogaard B, Rolla G, Helgeland K, (1983) : ` The efficacy of toothpastes with different fluoride contents, a ph Cycling, in Factors relating to demineralization and remineralzation of teeth, IRL Press Ltd, Oxford, pp : 43.