CLINICAL EVALUATION OF GLASS IONOMER FOR PIT AND FISSURE SEALING OF FULLY ERUPTED MOLARS

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ABSTRACT

The aim of this study was to evaluate the clinical behavior of two conventional glass ionomers used for pit and fissure sealing in terms of retention, marginal adaptation, caries recurrence and cracking. Eighty-three fully erupted first permanent molars were sealed, in a group of children aged 5 to 8 years. A double-blind, single operator, paired design was used. Materials applied were Fuji IX and VII. Retention (R), presence of caries (PC), marginal discoloration (MD), marginal adaptation (MA) and cracking (C) were evaluated at 6 and 12 months using Ryge's criteria. Data registered 6 months after treatment were: Fuji IX: R: Alpha 37, Bravo 2, Charlie: 4; PC: Alpha 43, Bravo: 0; MA: Alpha 38, Bravo: 1; MD: Alpha 39, Bravo: 0, Charlie: 0; C: Alpha 39, Bravo: 0. Fuji VII: R: Alpha 29, Bravo 4, Charlie: 7; PC: Alpha 40, Bravo: 0; MA: Alpha: 34, Bravo: 0; MD: Alpha: 34, Bravo: 0; Charlie: 0; C: Alpha 33, Bravo: 0. Results after one year were: Fuji IX: R: Alpha 33, Bravo: 3, Charlie: 9; PC: Alpha 44, Bravo: 1; MA: Alpha 33, Bravo: 1; MD: Alpha: 34, Bravo: 0, Charlie: 0; C: Alpha: 34, Bravo: 0. Fuji VII: R: Alpha 22, Bravo 4, Charlie: 13, PC: Alpha 40, Bravo: 0; MA: Alpha 23, Bravo: 1; MD: Alpha 23, Bravo: 1, Charlie: 0; C: Alpha 23, Bravo: 1. Statistical analysis using Fisher test showed no significant difference ($p>0.05$) for R, and MA. For PC, MD and C, values are not reported because both materials showed the same results. The second control showed no significant difference ($p>0.05$) for R, MA, PC, MD and C. Results suggest no difference between Fuji IX and Fuji VII as sealants in fully erupted permanent molars.

Key words: glass ionomer, pit and fissure sealants.

EVALUACIÓN CLÍNICA DE CEMENTOS DE IONÓMERO VÍTREO APLICADOS COMO SELLADORES DE FOSAS Y FISURAS

RESUMEN

El objetivo de este trabajo fue evaluar el comportamiento clínico de dos ionómeros vítreos convencionales aplicados como selladores de fosas y fisuras. Se evaluó la retención, decoloración y adaptación marginal, incidencia de caries y agrietamiento. Se sellaron ochenta y tres primeros molares totalmente erupcionados en un grupo de niños de 5 a 8 años. Se llevó a cabo un diseño de doble ciego, único operador y apareado. Los materiales aplicados fueron Fuji IX y VII. Luego de 6 y 12 meses se recitaron los niños y se evaluó: Retención (R), presencia de caries (PC), decoloración marginal (MD) y agrietamiento (C). La evaluación se realizó utilizando los criterios de Ryge. Los datos registrados al cabo de 6 meses fueron: Fuji IX: R: Alpha 37, Bravo 2, Charlie: 4; PC: Alpha 43, Bravo: 0; MA: Alpha 38, Bravo: 1; MD: Alpha 39, Bravo: 0, Charlie: 0; C: Alpha 39, Bravo: 0. Fuji VII: R: Alpha 29, Bravo 4, Charlie: 7; PC: Alpha 40, Bravo: 0; MA: Alpha: 34, Bravo: 0; MD: Alpha: 34, Bravo: 0; Charlie: 0; C: Alpha 33, Bravo: 0. A los 12 meses: Fuji IX: R: Alpha 33, Bravo: 3, Charlie: 9; PC: Alpha 44, Bravo: 1; MA: Alpha 33, Bravo: 1; MD: Alpha: 34, Bravo: 0, Charlie: 0; C: Alpha: 34, Bravo: 0. Fuji VII: R: Alpha 22, Bravo 4, Charlie: 13, PC: Alpha 40, Bravo: 0; MA: Alpha 23, Bravo: 1; MD: Alpha 23, Bravo: 1, Charlie: 0; C: Alpha 23, Bravo: 1. La evaluación estadística por medio de la prueba de Fisher no mostró diferencias significativas entre los materiales ($p>0.05$) para R y MA. En PC, MD y C, el valor de p no se indica ya que los resultados fueron idénticos. El segundo control no mostró diferencias significativas ($p>0.05$) para R, MA, PC, MD y C. Los resultados sugieren que no existiría diferencia en la aplicación de Fuji IX y Fuji VII como selladores de fosas y fisuras en molares totalmente erupcionados.

Palabras clave: Ionómero vítreo, sellador de fosas y fisuras.

INTRODUCTION

Pits and fissures of human molars have been recognized as caries susceptible dental sites. Absence of post-eruptive maturation and contact with the other arch favor the development of carious lesions[1]; therefore the extreme vulnerability of pits and fissures has prompted researchers to find ways to prevent this situation[2]. Glass ionomers were developed in the late 60s and their application has significantly increased since then[3]. They have lately been used as intermediate restorative materials by means of atraumatic restorative technique (ART) and as sealants of pits and fissures of erupted permanent molars[4-5]. This technique can be effective in newly erupted molars or when the use of resin sealant is not indicated, mainly because of the very difficult moisture control

and accessibility. Based on this situation, sealing the erupted first molars with conventional glass ionomer is a simpler alternative, mainly because of its low susceptibility to humidity, chemical adhesion to tooth structure and fluoride release.

A glass ionomer (Fuji VII – GC Corporation) has recently been developed as an alternative to resin sealants. It is biocompatible, has high fluoride release, can be set on command and is easily identifiable by its color, among other properties. It is prepared using a low powder/liquid ratio[6-8], which produces a fluid consistency, and although it is a conventional glass ionomer, it can be set on command by means of light activation. However, there is no information about the advantage of this material compared to a conventional, high powder/liquid ratio glass ionomer used as a pit and fissure sealer.

The aim of this study was to compare the clinical efficacy of two glass ionomers (Fuji IX and FujiVII) in sealing pits and fissures of first permanent molars in terms of retention, marginal adaptation, caries recurrence and cracking.

MATERIALS AND METHODS

Eighty-three fully erupted first permanent molars, with healthy or healthy deep occlusal grooves, were selected in children aged 5 to 8 years. An informed consent was received from each adult in charge and training in basic hygiene techniques and dietary advice was given to every child. The protocol was submitted to the Ethics Committee of the School of Dentistry, University of Buenos Aires. Before the treatment, an O'Leary index was determined and recorded for each child. Every site was brushed with pumice and water and thoroughly rinsed in order to improve the diagnosis. Only children with two sites were selected for this study.

The following clinical maneuvers were conducted: each tooth was brushed with pumice and water, rinsed and dried, and relative isolation was achieved by means of cotton rolls and aspiration. The surface was then prepared with Conditioner (Fuji, GC Corporation, Japan) for 30 seconds, rinsed and gently air-dried, taking care not to over-dry the site. Sites were sealed with glass ionomer cement (Fuji VII – batch 0609271and Fuji IX – batch 0610101– GC Corporation, Tokyo, Japan), one on each side of the arch, applied using a split mouth, double-blind design with a single operator. Each molar was identified with a number (odd or even), which was related to the material used in each case: odds were sealed with Fuji VII and evens with Fuji IX. Materials were prepared following manufacturer's instructions. Since both are encapsulated glass ionomers, the powder/liquid ratio informed by manufacturer was: Fuji IX 0.35 g / 0,08 ml and Fuji VII: 0.30 g / 0.12 ml and mixed for 10 seconds. Disclosure of any relationship between authors and manufacturer was applied.

After sealing, occlusion was checked using articulating film and adjustments were made in order to avoid overload. All surfaces were protected by means of a protective resin (Finishing Gloss, 3M ESPE, St. Paul, USA) and light cured for 10 seconds. Six and twelve months after treatment patients returned in groups of five. In each case, an O'Leary test was performed to determine presence of bacterial biofilm, and teeth were brushed with pumice and water, rinsed and dried. The sealers were evaluated using Ryge's criteria[9] in terms of retention, presence of caries, marginal discoloration, marginal adaptation and cracking. Table 1 shows the Ryge criteria applied in this study. Results were analyzed using Fisher's exact test.

Table 1: Ryge's Criteria for clinical evaluation.

Retention	ALPHA	Full Retention
	BRAVO	Partial Retention
	CHARLIE	Complete loss of the restoration
Presence of caries	ALPHA	No clinical diagnosis of caries
	BRAVO	Clinical diagnosis of caries
Marginal adaptation	ALPHA	No retention of an interface browser Complete marginal adaptation
	BRAVO	There is a gap
Cracking	ALPHA	No cracking
	BRAVO	Cracking
Marginal discoloration	ALPHA	No discoloration between restoration and tooth
	BRAVO	Marginal discoloration is less than half of the circumferential margin
	CHARLIE	Exists in more than half of the circumferential margin

RESULTS

Data obtained for 6 and 12 months are presented in Tables 2 and 3. Blinded observers clinically assessed every sealed molar using the Ryge criteria selected for this study, and recorded the results of the observation. Table 2 and Table 3 show the results after 6 and 12 months, respectively. In Table 2, it can be seen that data for retention showed 37 over 43 (86.1%) and 29 over 40 (72.5%) cases of the highest quality (full retention) for Fuji IX and Fuji VII, respectively. Regarding presence of caries, marginal discoloration and cracking, all sealers were 100% successful and qualified as Alpha. For marginal adaptation, there was only one sealer that qualified as Bravo for Fuji IX. As to the results for 12 months, data for presence of caries showed one case qualified as Bravo for Fuji IX, one case as Bravo for each glass ionomer for marginal adaptation (97 and 95.8% success for Fuji IX and VII respectively) and one case for marginal discoloration and cracking, i.e. 95.8% success for Fuji VII and 100% for Fuji IX. Retention was 73.3% and 56.4% (33 cases over 45 and 22 over 39) for Fuji IX and VII respectively. Based on data obtained using the Fisher exact test, we analyzed whether there was significant difference between the materials for these variables. The first control showed the following results: retention ($p = 0.359$), marginal adaptation ($p = 0.347$). For presence of caries, marginal discoloration and cracking, no p value is reported because the results for both materials were the same. Results after 12 months were: retention ($p = 0.256$), marginal adaptation ($p = 0.999$), caries ($p = 0.999$), marginal discoloration ($p = 0.414$) and cracking ($p = 0.414$).

DISCUSSION

The objective of this study was to determine the clinical effectiveness of two conventional glass ionomers used as pit and fissure sealants in first fully erupted or recently erupted permanent molars, in order to make a standardized comparison of their application in pediatric dentistry. Statistical analysis of results showed no significant difference between the two materials in this specific clinical application.

In the literature there is some research evaluating Fuji VII and different resin sealants in order to compare the marginal seal, and it concludes that resin-based sealants proved to have better performance [1]. Regarding retention, Skrinjaric et al. carried out a one-year follow-up research, comparing a resin-based sealant to heat-treated glass ionomer sealant and found lower retention for the cement[10]. Kervanto-Seppälä et al. stated that resin sealants are more effective than glass ionomer cement in terms of preventing recurrent caries[11]. A systematic review carried out by the University of Toronto established that permanent molars should be sealed as soon as they fully erupt; they should not be sealed if they are partially erupted, cav-

Table 2: Values obtained after 6 months evaluation for each material and variable evaluated.

	Retention			Presence of caries		Marginal adaptation		Marginal discoloration			Cracking	
	A	B	C	A	B	A	B	A	B	C	A	B
FUJI IX	37	2	4	43	0	38	1	39	0	0	39	0
FUJI VII	29	4	7	40	0	34	0	34	0	0	33	0

A: Alpha, B: Bravo, C: Charlie. Numbers indicate registered cases for each category.

Table 3: Values obtained after 12 months evaluation for each material and variable evaluated.

	Retention			Presence of caries		Marginal adaptation		Marginal discoloration			Cracking	
	A	B	C	A	B	A	B	A	B	C	A	B
FUJI IX	33	3	9	44	1	33	1	34	0	0	34	0
FUJI VII	22	4	13	40	0	23	1	23	1	0	23	1

A: Alpha, B: Bravo, C: Charlie. Numbers indicate registered cases for each category.

itated or have dentinal caries. Furthermore, in primary molars, sealants should be applied when children are susceptible to caries, in permanent molars within 4 years after eruption and resin-based sealers should be preferred until scientific evidence proves glass ionomer sealants to have better retention[11]. Our experience proved a high retention ratio with both materials tested. Moreover, some of the sealants were absent when children came to the next appointment, because they had been removed by some dentists through lack of knowledge. In our research we used pink Fuji VII and some dentists, who had no information on this material, considered it was pigmented or had marginal leakage.

On the other hand, Delmondes & Imparato considered glass ionomer as a lower-cost, easier to use alternative for sealing fully-erupted first molars in areas where it is not possible to achieve the total isolation that is essential for resin-based sealers[2]. An additional advantage is that glass ionomers do not require acid etching. They result in easier clinical maneuvers and, in case of failure, less damage to adjacent enamel. Adding fluoride release to its properties makes it easy to accept its application as a sealer. It has been previously reported that when resin-based sealers fail to bond to tooth structure, the adjacent enamel becomes weaker, mainly because it was acid etched, and the sealer often stays in place, but it helps biofilm retention. Glass ionomers release fluoride, which might mean that tooth structure, as well as the material, becomes reinforced. There are many studies of high-density glass ionomers demonstrating their fluoride release. Fluoride release and consistent bonding to tooth structure make glass ionomer a good choice for some patients. Ionomer sealants appear to exert a cariostatic effect, even when they are de-bonded, therefore long-term retention might not be necessary, mainly because the material´s anticariogenic properties increase resistance to fissure caries in newly erupted molars. This release from glass ionomer sealant can be maintained over time by prescribing toothpaste and mouthwashes with high fluoride content[12 -16] and it is a property that is necessary for post-eruptive maturation, since it is well known that contact with the antagonist favors the development of carious lesions in erupted molars. This makes glass ionomer sealants a conservative, economical, effective form of preventive care for children and teenagers[2,12]. This is consistent with the results of our investigation. We included 5- to 8-year-old children, achieving 86% permanence at 6 months and 73.3% at 12 months. Ercan et al.[17] found retention rates of 80.9% for atraumatic restorative technique restorations with high density glass ionomers for single surface, which proves that this material has a high survival ratio even under field conditions.

There is evidence that caries control through sealants using resin modified glass ionomer sealants can prevent 100% of cases[11]. Our study showed similar results, since none of the sealed molars presented caries after one year, even if the sealant was lost.

CONCLUSIONS

Under the experimental conditions of this study, it may be concluded that:

Both materials evaluated (Fuji VII and Fuji IX) proved to have similar behavior when applied as sealants in fully erupted permanent molars. No presence of caries was found for any of the patients included after 12 months of evaluation, even when de-bonding was registered.

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