Original Article

In Vivo Comparison of Conventional and Resin Reinforced Glass Ionomer Cement for Banding of Teeth

Iffat Batool, RaheelaYasmin, Hasnain Abbas

ABSTRACT

Objective: The present in-vivo study was performed to analyze the clinical efficacy of molar bands cemented with resin modified glass ionomer cement (RMGIC Gc Fuji Plus) with that of a conventional glass ionomer cement (GC 1 Gold Label) adhesive.

Methodology: Fifty-Nine orthodontic subjects were assigned into 2 groups randomly. Group 1 included 29 patients having all the maxillary and mandibular first permanent molar teeth banded with conventional non-resin glass ionomer cement (GC 1 Gold Label). Group 2 had 30 Orthodontic patients having all the maxillary and mandibular first permanent molar teeth banded with resin modified glass ionomer cement (GC Fuji Plus). This one year randomized clinical trial was conducted at Orthodontics Department, Sharif Medical and Dental College.

Results: The rate of band failure at first visit after banding with conventional glass ionomer cement (GIC) was 41% and with resin modified glass ionomer cement was 23%. At second visit the rate of band failure with conventional GIC was 24% and with resin modified glass ionomer was 18%.

Conclusion: The band failure rate of resin modified glass ionomer cement was significantly lower than conventional GIC in terms of bond strength and band stability.

Keywords: *Molar Bands. Resin Modified Glass Ionomer Cement. Conventional Glass Ionomer Cement.*

INTRODUCTION

Whenever anchorage requirements are a consideration factor, banding of teeth is a major treatment need in most orthodontics patients. In the present era, thanks to the availability of a variety of adhesive cement, many can be used as luting materials for banding of teeth. One of the pre-requisites of an ideal material is its ability to adhere to the teeth and prevent microleakage. The penetration of ions, molecules, fluids or bacteria between the tooth surface and the applied adhesive material is termed as microleakage.[1] It may lead to staining at the margins and development of white spot lesions on tooth surface.[2] Consequently, microleakage and failure of tooth surface adhesion have been a significant problem with current luting materials.[3]

As dental fluorides are regularly used in dentistry due to their beneficial enamel remineralization effects.[4] Glass ionomer cement have been frequently employed for cementation of bands due to their fluoride releasing properties. Therefore, these shortcomings can be effectively reduced if stannous fluoride or a glass ionomer adhesive is used.[4,5]

Decreased enamel demineralization can be the result of fluoride ions released into surrounding tooth structures and fluoride releasing cement might enhance caries protection during banding to the enamel surface.[6,7] Therefore, glass ionomer is considered a slow-release fluoride ions reservoir. The ease of glass ionomer removal makes cleanup after removal much quicker than with resin-based adhesive and it causes much reduced enamel surface damage as compared to the polyacid-modified resin cement group and non-fluoride releasing zinc phosphate cement.[8-10] GIC has the characteristic of being able to bond chemically to enamel and dentine in the absence of any etchant, and release fluoride ions to the surrounding areas.[11,12] These characteristics allow for the routine usage of GIC in orthodontic banding.[13,14] Conventional GIC have the benefits of fluoride ion leaking and absorption by enamel and dentin, and identical characteristics like biocompatibility, the formation of chemical bonds with enamel and dentin, same tooth coloring and co-efficient of thermal expansion almost alike to that of tooth structure. The disadvantages are prolonged setting duration, tendency to get dissolved while setting, poor wear resistance and low fracture strength upon setting.[15] This has compelled the researchers to develop newer hybrid versions of glass ionomer cement. These adhesives consist of a small amount of polymerizable resin component (4%-6%) added to glass ionomer cement.[16] To increase the bond strength, some resins, such as Hydroxyl dimethacrylate and BIS-GMA, are added to GIC.[17] The resin-reinforced GIC has proved to have a higher shear bond strength than conventional chemically cured GIC in vitro.[8,9,18-20] High viscosity glass ionomer cement have established themselves to be a valuable substitute for clinical application since it is reported that their properties are

Sharif Medical and Dental College
Sharif Medical City Road, Off Raiwind Road, Jati Umra, Lahore 54000, Pakistan.

Correspondence: Prof. Col. Iffat Batool
Prof. Department of orthodontics
Sharif Medical and Dental College
E-mail: assad14@hotmail.com

Received: Feb 15, 2016; Accepted: May 20, 2016.

improved. Recent studies of resin-modified glass ionomer (RMGI) cement have produced highly effective clinical results.[21-23]

The resin modified glass ionomer cement have benefits like improved physical properties, especially high tensile strength and improved abrasion and wear resistance, plus extended working time with rapid setting, command set, biocompatibility and fluoride release similar to that of conventional GIC, good adhesion to enamel and dentin and improved aesthetics.[24]

METHODOLOGY

This one year randomized clinical trial study was conducted at Orthodontic Department, Sharif Medical and Dental College after approval from the ethical committee. Informed consent was sought from all the participants. The total number of orthodontic patients was fifty nine which were assigned randomly into two groups. The first group (Group1) comprised of 29 Orthodontic patients having all the maxillary and mandibular first permanent molar teeth banded with a conventional non-resin glass ionomer cement (GC 1 Gold Label). The second group (Group2) included 30 Orthodontic patients having all the maxillary and mandibular first permanent molar teeth banded with resin reinforced glass ionomer cement (GC Fuji Plus).

Inclusion Criteria

Orthodontic patients requiring banding of maxillary and mandibular 1st molar teeth as part of their treatment were included in the study.

Exclusion Criteria

Orthodontic patients having grossly restored maxillary and mandibular 1st molar teeth as part of their treatment.Orthodontic patients having moderate to severe fluorosis, dentinogenesis imperfecta and amelogenesis imperfect.

A total of 236 molar teeth were banded. To eliminate inter-examiner variation, one single operator was employed. Care was taken to attain moisture control. The teeth were then dried and the adhesive was prepared as per instructions on the label before loading onto the molar bands. Adhesive was placed on teeth and was allowed to set in the presence of continuous suction and oil-free air spray. All 59 patients were evaluated throughout the one year study period. Patients were again examined after every one month for their band integrity and white spots were evaluated at end of treatment completion. Each banded tooth was examined to see loose or missing bands at each subsequent appointment, and failures were noted and recorded. Bands were then re-cemented with the same adhesive at each appointment visit after removal of adhesive. Tooth surface was examined for the development of any white spot lesions.

SPSS 20 software package was used for collecting the results and their statistical analysis. Wilcoxon signed rank test was used to compare the first-time failures per patient between the two cement. The Cox proportional hazards regression model was used to calculate the relative risk of failure. P-value of less than 0.050 was considered to be significant (Table 2).

RESULTS

The rate of band failure at first visit after banding with conventional non-resin glass ionomer cement was 41% and with resin modified glass ionomer cement was 23%. At second visit the rate of band failure with conventional GIC was 24% and with resin modified glass ionomer was 18%. The results showed a P value (P= 0.015).

Table 1: Patient characteristics

	Number (%) of patients	Age(years) Mean ± SD
Total No of Patients	59 (100%)	14.2 ±2.4
Females	43 (72.881%)	15.4 ± 3.7
Males	16 (27.1%)	13.8±1.7
Malocclusion Classification		
Class I	15 (25%)	
Class II Division 1	31(54%)	
Class II Division 2	7 (11%)	
Class III	6 (10%)	

Table 2: Distribution of band cementation failures per patient for two types of adhesive

Number of banding failures per patient	RMGIC	Conventional GIC
1	23%	41%
2	18%	24%
3	0%	4%

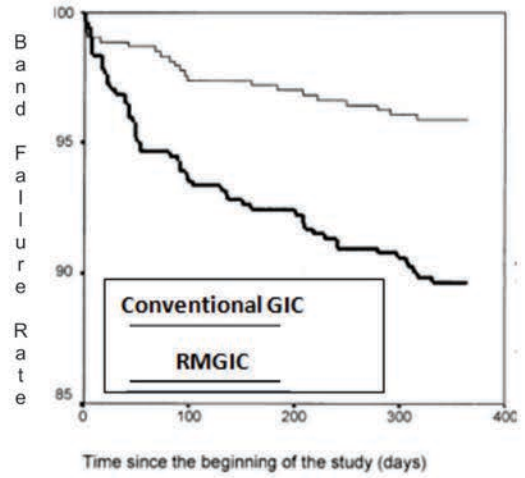

Figure 1: Survival analysis showing band failure rates of RMGI and conventional adhesives.

DISCUSSION

Loosening of molar bands is a major problem in clinical dentistry. Evaluation of microleakage is used as a measure by which clinician and researcher can predict the performance of an adhesive material.[25] So, the present in-vivo study was conducted for analysis of the comparison of leakage of conventional non-resin glass ionomer cement and resin-modified glass ionomer cement on permanent molars, which will act as a further tool for evidence based dentistry.

Castro et al. conducted a study and according to his results, the microleakage rate for the conventional GIC (Fuji II) was significantly greater than the values obtained for conventional GIC, Fuji IX GP, a resin modified glass ionomer (Vitremer) and TPH (composite resin).[26]

Another study was conducted by Eronat et al. to evaluate the microleakage of resin-modified glass ionomer (Ketac N100, 3M ESPE) at a high viscosity glass-ionomer restoration (Ketac N100, 3M ESPE). The results showed that high viscosity glass ionomer showed significantly reduced microleakage compared to the Nano-filled resin-modified glass ionomer (RMGIC) at the occlusal margin. No significant differences were found between the groups at the gingival margin.[21]

CONCLUSIONS

It was concluded that both the RMGI (GC Fuji Plus) and the conventional (GC Gold Label) adhesives produced clinically acceptable banding-failure rates in routine clinical usage.

The conventional adhesive (GC Gold Label) demonstrated a significantly higher banding-failure incidence than did the RMGI (GC Fuji Plus) product.

Teeth that contacted the molar bands had higher chances to show band failures than those without occlusion. The highest band failure incidence was observed for the conventional (GC Gold Label) with occlusion against opposing teeth. Within the limitations of this in vivo study.

Resin Modified Glass Ionomer cement performed significantly better than conventional glass ionomer in terms of bond strength and band stability which was, in turn, an indicator of decreased microleakages between the band and tooth surface.

The oral hygiene maintenance during treatment (being at least partially a patient dependent factor) might be an impact for the insignificantdifference in the development of white spot lesions between the two groups.

REFERENCES

1. Hoshi AT, Silva SM, Pavarini A. In vitro evaluation of the marginal microleakage of amalgam restorations associated with dentin adhesive, glass ionomer cement and cavity varnish by means of different evaluation methods. J Appl Oral Sci. 2005 Mar;13(1):10-4.

2. Hersek N, Canay S, Akca K, Ciftci Y. Comparison of microleakage properties of three different filling materials and auto radiographic study. J Oral Rehabil. 2002 Dec;29(12):1212-7.

3. Gupta I, Gupta S, Kothari A. Revisiting amalgam: a comparative study between bonded amalgam and amalgam retained with undercuts. J Contemp Dent Pract. 2011 May;12(3):164-70.

4. Koeser J, Carvalho TS, Pieles U, Lussi A. Preparation and optimization of calcium fluoride particles for dental applications. J Mater Sci Mater Med. 2014 Jul;25(7):1671-7.

5. Rakhmatullina E, Beyeler B, Lussi A. Inhibition of enamel erosion by stannous fluoride containing rinsing solutions. Schweiz Monatsschr Zahnmed. 2013;123(4):296-302.

6. Bahadure RN, Pandey RK, Kumar R, Gopal K, Singh RK. An estimation of fluoride release from various dental restorative materials at different pH: In vitro study. J Indian Soc Pedod Prev Dent. 2012 Apr-Jun;30(2):122-6.

7. Rohilla M, Pandit IK, Srivastava N. Why the carioprotective potential of luting cements crucial? J Indian Soc Pedod Prev Dent. 2009 Oct-Dec;27(4):219-23.

8. Ostman-Andersson E, Marcusson A, Horstedt P. Comparative SEM studies of the enamel surface appearance following the use of glass ionomer cement and a diacrylate resin for bracket bonding. Swed Dent J. 1993;17(4):139-46.

9. Komori A, Ishikawa H. Evaluation of a resin-modified glass ionomer cement for use as an orthodontic bonding agent. Angle Orthod. 1997;67(3):189-95.

10. VanMiller EJ, Donly KJ. Enamel demineralization inhibition by cements at orthodontic band margins. Am J Dent. 2003 Oct;16(5):356-8.

11. Forsten L. Fluoride release from glass ionomer cement. Scand J Dent Res. 1977 Sep;85(6):503-4.

12. Swartz ML, Phillips RW, Clark HE. Long-term F release from glass ionomer cement. J Dent Res. 1984 Feb;63(2):158-60.

13. Maijer R, Smith DC. A comparison between zinc phosphate and glass ionomer cement in orthodontics. Am J Orthod Dentofacial Orthop. 1988 Apr;93(4):273-9.

14. Mizrahi E. Glass ionomer cements in orthodontics: an update. Am J Orthod Dentofacial Orthop. 1988 Jun;93(6):505-7.

15. Croll TP, Bar-Zion Y, Segura A, Donly KJ. Clinical performance of resin-modified glass ionomer cements restorations in primary teeth. A retrospective evaluation. J Am Dent Assoc. 2001 Aug;132(8):1110-6.

16. Hegarty DJ, Macfarlane TV. In vivo bracket retention comparison of a resin-modified glass ionomer cement and a resin-based bracket adhesive system after a year. Am J Orthod DentofacialOrthop. 2002 May;121(5):496-501.

17. Chung CH, Cuozzo PT, Mante FK. Shear bond strength of a resin-reinforced glass ionomer cement: an in vitro comparative study. Am J Orthod Dentofacial Orthop. 1999 Jan;115(1):52-4.

18. Compton AM, Meyers CE, Hondrum SO, Lorton L. Comparison of the shear bond strength of a light-cured glass ionomer and a chemically cured glass ionomer for use as an orthodontic bonding agent. Am J Orthod Dentofacial Orthop. 1992 Feb;101(2):138-44.

19. McCarthy MF, Hondrum SO. Mechanical and bond strength properties of light-cured and chemically cured glass ionomer cements. Am J Orthod Dentofacial Orthop. 1994 Feb;105(2):135-41.

20. Blight SJ, Lynch E. Bond strengths of ceramic brackets using different bonding techniques. Br J Orthod. 1995 Feb;22(1):35-40.

21. Eronat N, Yilmaz E, Kara N, Topaloglu AA. Comparative evaluation of microleakage of nano-filled resins-modified glass ionomer: An in vitro study. Eur J Dent. 2014 Oct;8(4):450-5.

22. Fricker JP. A 12-month clinical evaluation of light-activated glass polyalkenoate (ionomer) cement for the direct bonding of orthodontic brackets. Am J Orthod Dentofacial Orthop. 1994 May;105(5):502-5.

23. Gaworski M, Weinstein M, Borislow AJ, Braitman LE. Decalcification and bond failure: A comparison of a glass ionomer and a composite resin bonding system in vivo. Am J Orthod Dentofacial Orthop. 1999 Nov;116(5):518-21.

24. Burke FJ, Fleming GJ, Owen FJ, Watson DJ. Materials for restoration of primary teeth. Glass-ionomer derivatives and compomers. Dent Update. 2002 Jan-Feb;29(1):10-4, 16-7.

25. Alani AH, Toh CG. Detection of microleakage around dental restoration: a review. Oper Dent. 1997 Jul-Aug;22(4):173-85.

26. Castro A, Feigal RE. Microleakage of new improved glass ionomer restorative material in primary and permanent teeth. Pediatr Dent. 2002 Jan-Feb;24(1):23-8.