Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 5 Issue 4 Oct-Dec 2019

Original Research

Assessment of microleakage using metal modified and conventional glass-ionomer cement in permanent teeth: A comparative study

Narendeep Ashutosh[1], Sanjeev Chauhan[2]

[1]*Medical Officer (Dental), Himachal Pradesh*
[2]*Senior Lecturer, Department of Conservative Dentistry and Endodontics, H.P.G.D.C, Shimla, Himachal Pradesh*

ARTICLE INFO

Keywords:
Glass ionomer cement, Metal modified

ABSTRACT

Background
For improving the physical characteristics of the original materials, additions of metal powders were introduced. The first such suggestion was a silver alloy and GIC admixture, with the subsequent emergence of materials incorporating fine metal particles sintered onto the cement-forming glass to form ceramic-metal materials. Hence; the present study was undertaken for assessing microleakage using metal modified and conventional glass-ionomer cement in permanent teeth.

Materials & methods
A total of 20 non-carious freshly extracted maxillary premolars were included in the present study. Mechanical debridement was done followed by preparing of all standard class I cavities. All the specimens were divided into two study groups with 10 specimens in each group as follows: Group 1: Conventional GIC; and Group 2: Metal modified GIC. The aqueous and non-aqueous pastes were mixed as per manufacturer's instructions and the mixture was placed into the cavity following two-step incremental techniques. This was followed by immersion of the specimens in 2% methylene blue dye for 24 hours. All the specimens were then analysed under stereomicroscope for assessment of microleakage followed by evaluation with SPSS software.

Results
While comparing statistically, it was observed that mean microleakage was significantly higher for metal modified GIC group in comparison to the conventional GIC group.

Conclusion
Conventional GIC is of superior quality in comparison to metal modified GIC in controlling microleakage in permanent dentition

INTRODUCTION

From the dawn of history the materials used in the human body, particularly those used in the oral cavity, should be stable, as well as passive, with no interactions with their surrounding environment. Amalgam, composite resins and cements generally have such characteristics. It is probable that the first sparks to produce active materials, with definite interactions with the human body, originated from the fact that materials capable of releasing fluoride can exert useful effects.[1-3] Glass-ionomer cements (GICs) are widely used in various branches of dentistry. Glass-ionomer cement (GIC) materials were invented four decades ago by Wilson and Kent in 1969 at the Laboratory of the

* Corresponding author: ***Sanjeev Chauhan,*** *Senior Lecturer, Department of Conservative Dentistry and Endodontics, H.P.G.D.C, Shimla, Himachal Pradesh.*

Government Chemist in London, United Kingdom. These materials form part of the contemporary armamentarium for restorative dentistry largely due to their adhesive, tooth-coloured and fluoride-leaching properties. One of the advantages of GI, compared to other restorative materials, is that they can be placed in cavities without any need for bonding agents; they also have good biocompatibility. In simple terms, glass-ionomers are derived from organic acids and a glass component, and are referred to as acid-base reaction cements.[4-6]

In an attempt to improve the physical characteristics of the original materials, additions of metal powders were introduced. The first such suggestion was a silver alloy and GIC admixture, with the subsequent emergence of materials incorporating fine metal particles sintered onto the cement-forming glass to form ceramic-metal materials or ‘cermets’. These cements with alloy additives, whether or not fused to the glass, collectively are better referred to as metal-modified glass-ionomer cements (MMGICs). [7-9] Hence; the present study was undertaken for assessing microleakage using metal modified and conventional glass-ionomer cement in permanent teeth.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the microleakage using two different variables of glass-ionomer cement in permanent teeth. A total of 20 non-carious freshly extracted maxillary premolars were included in the present study. Mechanical debridement was done followed by preparing of all standard class I cavities of size 3 mm x 2 mm x 2mm dimensions. All the specimens were divided into two study groups with 10 specimens in each group as follows:

Group 1: Conventional GIC

Group 2: Metal modified GIC

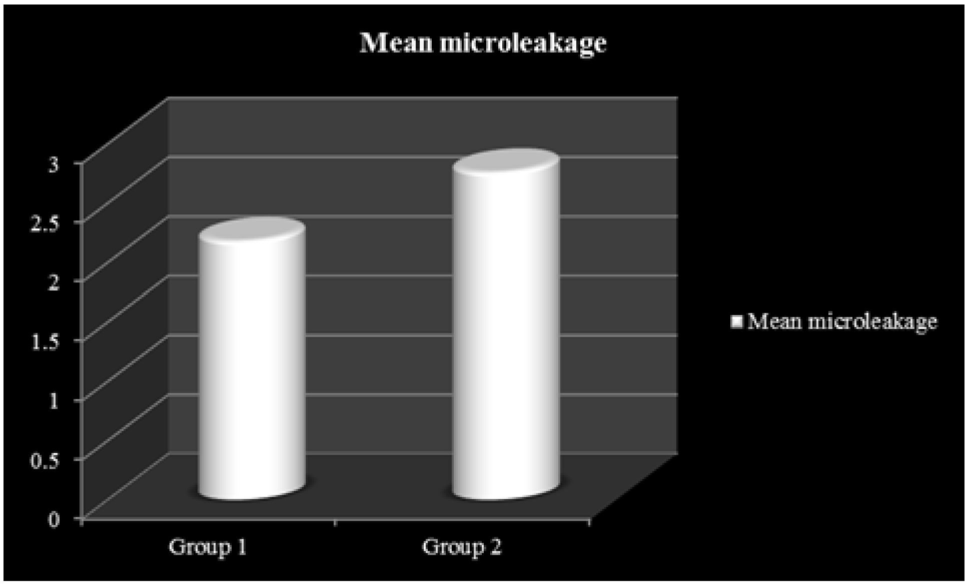
The aqueous and non-aqueous pastes were mixed as per manufacturer's instructions and the mixture was placed into the cavity following two-step incremental techniques. For preventing dehydration, all the restored teeth were stored in normal saline till further use. All the specimens were then subjected to thermocycling at 5°C with a dwell time of 30 s. This procedure was repeated multiple times. After this, coating of the test specimens was done with two layers of varnish except for 1 mm around the restoration. This was followed by immersion of the specimens in 2% methylene blue dye for 24 hours. This was followed by sectioning of the specimens bucco-lingually with a diamond disk. All the specimens were then analysed under stereomicroscope for assessment of microleakage followed by evaluation with SPSS software. Mann-Whitney U test was used for evaluation the level of significance.

RESULTS

In the present study, mean microleakage among the group 1 specimens was found to be 2.18 while among the group 2 specimens; it was found to be 2.76. While comparing statistically, it was observed that mean microleakage was significantly higher for metal modified GIC group in comparison to the conventional GIC group (p- value < 0.05).

Table 1: Comparison of microleakage

Group	Mean microleakage	SD	U value	p- value
Group 1	2.18	0.49	16	0.00 (Significant)
Group 2	2.76	0.57		



Graph 1: Microleakage in both the study groups

DISCUSSION

Successive changes have been made in conventional GIC in order to overcome the deficiency of their mechanical integrity and their ability to withstand fracture loads. Thus, several materials have emerged with different composition such as glass ionomer cements reinforced with metal or modified with resin, in addition to the high viscosity ionomer cements, as well as those with incorporation of nanoparticles. All these modifications were done to meet individual clinical needs and to improve the physicochemical properties of GICs. For many years, there have been attempts to incorporate fibers into the composition of these materials as reinforcing agents but there are variations in powder - liquid ratio and powder particle size to accommodate the desired function.[8- 10] Hence; the present study was undertaken for assessing microleakage using metal modified and conventional glass-ionomer cement in permanent teeth.

In the present study, mean microleakage among the group 1 specimens was found to be 2.18 while among the group 2 specimens; it was found to be 2.76. Masih S et al evaluated the microleakage of two modified glass ionomer cements on deciduous molars. Thirty children (10-16 years) were selected. In each patient, standardized class V cavities were prepared on the buccal surfaces of two different retained deciduous molars and these cavities were restored with GC Fuji II LC (Improved) and GC Fuji IX GP, respectively. Following a period of four weeks after the restoration, these teeth were extracted and immersed in 2% Basic Fuschin dye solution for 24 hours. The depth of dye penetration was assessed after sectioning the teeth and the microleakage determined. The results were statistically analyzed using Student 't' test. It was concluded that both the materials, GC Fuji II LC (Improved) and GC Fuji IX GP were comparable in performance and can be considered to be materials safe for usage, and decrease bacterial penetration.[10] Prabhakar AR et al assessed the efficacy of different restorative materials for supporting the undermined occlusal enamel provided by posterior restorative composite (FiltekTM P60, 3M Dental products USA), polyacid modified resin composite (F2000 compomer, 3M Dental products, USA.), radiopaque silver alloy-glass ionomer cement (Miracle Mix. GC Corp, Tokyo, Japan) and Glass Ionomer cement (Fuji IX GP). To test each material, 20 human permanent mandibular third molars were selected. The lingual cusps were removed and the dentin supporting the facial cusps was cut away, leaving a shell of enamel. Each group of prepared teeth was restored using the materials according to the manufacturer's instructions. All the specimens were thermocycled (250 cycles, 6°C- 60°C, dwell time 30 seconds) and then mounted on an acrylic base. Specimens were loaded evenly across the cusp tips at a crosshead speed of 5 mm /minute in Hounsfield universal testing machine until fracture occurred. Data obtained was analyzed using analysis of variance and Studentized- Newman- Keul's range test. No significant differences were detected in the support provided by P-60, F 2000, Miracle Mix or Fuji IX GP groups. The support provided to undermined occlusal enamel by these materials was intermediate between no support and that provided by sound dentin. Without further development in dental material technology and evidence of its efficacy, restorative materials should not be relied upon to support undermined occlusal enamel to a level comparable to that provided by sound dentin.[11]

In the present study, while comparing statistically, it was observed that mean microleakage was significantly higher for metal modified GIC group in comparison to the conventional GIC group (p- value < 0.05). Nandana K L et al compared the microleakage of three variables (Ketac Molar, Ketac Silver, Ketac N100) of GIC in primary and permanent posterior teeth. Class I occlusal cavities were prepared on 60 extracted, noncarious primary molars and premolars. Each set of dentition (primary and permanent teeth) was divided into three groups of 10 specimens each to restore with the selected restorative material - Group A (Ketac Molar), Group B (Ketac Silver), and Group C (Ketac N100). These teeth were subjected to thermocycling, dye immersion, sectioning, and examination was done under a stereomicroscope to assess the degree of microleakage. The scoring was done according to the scoring criteria put forward by Khera and Chan, which were further tabulated and statistically analyzed. There was no significant difference in microleakage between primary and permanent teeth in all the three groups. In both primary and permanent teeth, Group B showed significantly higher dye penetration scores followed by Groups A and C. The nano-filled resin-modified GIC (Ketac N100) proved to be the better restorative material than the other cements used in the study. Microleakage is the most common cause of failure for all restorative materials, since it is a major contributing factor to secondary caries and early pulpal involvement. Consequently, an interest arises in finding a restorative material which has better bonding with the dental tissues thereby minimizing the chances of microleakage.[12]

CONCLUSION

From the above results, the authors concluded that conventional GIC is of superior quality in comparison to metal modified GIC in controlling microleakage in permanent dentition. However; further studies are recommended.

REFERENCES

1. Mount GJ. Clinical placement of modern glass-ionomer cements. Quintessence Int. 1993; 22:99-107.
2. Herrin HK. Use of a posterior composite resin to restore teeth and support enamel: Report of case. J Am Dent Assoc. 1986; 112:845-6.
3. Mount GJ. Glass ionomer cements and future research. Am J Dent. 1999; 7:286-92.
4. Abo-Hamar SE, El-Desouky SS, Abu Hamila NA. Two-year clinical performance in primary teeth of nano-filled versus conventional resin-modified glass-ionomer restorations. Quintessence Int. 2015; 46:381-8.
5. Stratmann RG, Berg JH, Donly KJ. Class II glass ionomer-silver restorations in primary molars. Quintessence Int. 1989; 20:43-7.
6. Welsh EL, Hembree JH Jr. Microleakage at the gingival wall with four class V anterior restorative materials. J Prosthet Dent. 1985; 54:370-2.
7. Latino C, Troendle K, Summitt JB. Support of undermined occlusal enamel provided by restorative materials. Quintessence Int. 2001; 32:287-91.
8. Kilpatrick NM, Murray JJ, McCabe JF. The use of a reinforced glass-ionomer cermet for the restoration of primary molars: A clinical trial. Br Dent J. 1995; 179:175-9.
9. Wadenya R, Mante FK. An in vitro comparison of marginal microleakage of alternative restorative treatment and conventional glass ionomer restorations in extracted permanent molars. Pediatr Dent. 2007; 29:303-7
10. Masih S1, Thomas AM, Koshy G, Joshi JL. Comparative evaluation of the microleakage of two modified glass ionomer cements on primary molars. An in vivo study. J Indian Soc Pedod Prev Dent. 2011; 29(2):135-9. doi: 10.4103/0970-4388.84686.
11. Prabhakar AR, Thejokrishna P, Kurthukoti AJ. A comparative evaluation of four restorative materials to support undermined occlusal enamel of permanent teeth. J Indian Soc Pedod Prev Dent. 2006; 24:122-6.
12. Nandana KL, Sai Sankar AJ, Manoj Kumar MG, Naveen K, Pranitha K, Manjula BS. Comparative evaluation of microleakage using three variables of glass-ionomer cement in primary and permanent teeth: An in vitro study. J Interdiscip Dentistry. 2016; 6:110-5