International Journal of Advanced Research in Medicine

E-ISSN: 2706-9575
P-ISSN: 2706-9567
IJARM 2022; 4(1): 118-121
Received: 05-09-2022
Accepted: 11-10-2022

Dr. Neeraj Sharma
Reader, Department of Conservative Dentistry and Endodontic, Himachal Dental College, Sundernagar, Himachal Pradesh, India

Dr. Shritika Sapahiya
Senior Lecturer, Conservative Dentistry and Endodontics, Himachal Dental College Sundernagar, Himachal Pradesh, India

Dr. Saurabh Garg
Medical Officer, Department of Conservative Dentistry and Endodontic, Health and Family Welfare, Himachal Pradesh, India

Dr. Munisha Sharma
B.D.S, Consultant, Noble Dental Clinic, Kathua, Jammu and Kashmir, India

Corresponding Author:
Dr. Saurabh Garg
Medical Officer, Department of Conservative Dentistry and Endodontic, Health and Family Welfare, Himachal Pradesh, India

Assessment of microleakage in class II cavities restored with composite resin by using different placement techniques

Dr. Neeraj Sharma, Dr. Shritika Sapahiya, Dr. Saurabh Garg and Dr. Munisha Sharma

DOI: https://doi.org/10.22271/27069567.2022.v4.i2b.447

Abstract
Background: To assess microleakage in class II cavities restored with composite resins by using various placement techniques.
Materials and methods: A total of 60 samples were enrolled, 10 in each group. They were divided into 6 groups. Scoring for the degree of dye penetration at the occlusal and cervical walls were evaluated. The results were analyzed using SPSS software. The significance was determined at p-value less than 0.05.
Results: Microleakage in occlusal wall mean scores of the 6 groups are depicted. Results for occlusal wall showed significantly better score for groups 3 and 4, when compared to other groups. The mean score for dye penetration in group 1and 2 were 0.21 and 1.0.
Conclusion: Flowable composite as the first increment is better to use and hence, recommended in class II cavities.

Keywords: Flowable, resins, occlusal, microleakage

Introduction

Direct Class II composite restorations can be placed at an acceptable standard if the cervical margin is in sound enamel; when the adhesive restorations are located below the CEJ (Cemento-enamel junction) and cervical lesions have no enamel the quality of the marginal integrity is questionable [1]. Below the CEJ the bond with dentin is weaker: the polymerization shrinkage can result in gap formation between composite resin and the cavity walls. Marginal gap formation contributes to micro leakage permitting the passage of oral fluids and bacteria from the oral cavity and become a source of postoperative sensitivity, pulpal inflammation and recurrent caries [2-4]. To reduce these effects have been suggested, as a better option to the conventional resin technique, the Class II open-sandwich restorations: glass-ionomer cement (GIC) or resin-modified glass-ionomer cement (RMGIC) is placed between the dentin cervical margins and occlusal composite restoration [5, 6]. GICs and RMGICs have been shown to be less able to seal margins, can dissolve over time in the oral environment [7-9]. Recently flowable resin composites (FRC), with lower filler content and far lower viscosity, have been recommended as liners at CEJ margins of the proximal box of Class II composite restorations to improving marginal integrity and to resu lting less micro leakage and post-operative sensitivity [4, 10]: a layer of flowable materials at the gingival floor (in cementum margins) of Class II composite restorations get better the marginal seal of a restoration and is an ideal choice for use in a open-sandwich technique [11].

Light cure composite resins are being widely used for the restoration of posterior teeth. This is not only because of their more favorable esthetic properties, but also due to their adjesion to the dental tissues. Although amalgam has served dentistry for over a century, the clinicians have become more in favour of composites in the recent times. This transition is due to the alleged health concerns and environmental considerations regarding amalgam, the dental professions desire for an adhesive material that demands less invasive cavity preparations, and the patient demand for tooth-coloured restorations even in the posterior teeth [12]. The suitable esthetic posterior restorative materials are competing in the present esthetic era to best suit the above requirements.

During recent years, the resin-based composites have been substantially modified to resemble a freshly triturated mass of amalgam in their prepolymerized state, so that they can be condensed into class I and Class II cavities [13]. The newest posterior resin composites show reduced wear rate; [14] however, the marginal adaptation of these restorations particularly in the proximal boxes, has remained unacceptable. Resin composite materials undergo a volumetric polymerization contraction of at least 2.0% which may result in gap formation [15]. Such gaps can result in the passage of salivary fluids along the tooth restoration interface resulting in microleakage [16]. Hence, this study was conducted to assess microleakage in class II cavities restored with composite resins by using various placement techniques.

Materials and Methods

A total of 60 samples were enrolled, 10 in each group. Standardized class II cavities were made and were restored using composites of different consistencies with different placement techniques. They were divided into 6 groups as Group 1 with Microhybrid composite, Group 2 with Packable composite, Group 3 Microhybrid composite with a flowable composite liner, Group 4 Packable composite with a flowable composite liner, Group 5 Microhybrid composite with precured composite insert in second increment and Group 6 Packable composite with precured insert in second increment. These specimens were sectioned and evaluated for microleakage at the occlusal and cervical walls separately using stereomicroscope. Scoring for the degree of dye penetration at the occlusal and cervical walls were evaluated. The results were analyzed using SPSS software. The significance was determined at p- value less than 0.05.

Results

A total of 60 samples were enrolled. Microleakage in occlusal wall mean scores of the 6 groups are depicted. Results for occlusal wall showed significantly better score for groups 3 and 4, when compared to other groups. The mean score for dye penetration in group 1and 2 were 0.21 and 1.0.

Table 1: Frequency of dye penetration score as an indicator of marginal microleakage in occlusal wall

Groups	Number	Score				Mean
		0	1	2	3	
Group 1	10	8	2	0	0	0.21
Group 2	10	7	0	2	1	1.0
Group 3	10	10	0	0	0	0
Group 4	10	10	0	0	0	0
Group 5	10	9	1	0	0	0.16
Group 6	10	8	0	0	2	0.95

Dye penetration score as an indicator of microleakage in the cervical wall. Results for cervical wall showed highly significant difference in the groups 3 and 4, when compared to groups 1 and 2. Significant difference was seen in groups 5 and 6, when compared to 1 and 2. The least mean value was depicted in group 3 and highest in group 2.

Table 2: Frequency of dye penetration score as an indicator of marginal microleakage in cervical wall

Groups	Number	Score				Mean
		0	1	2	3	
1	10	0	0	4	6	2.46
2	10	0	0	2	8	2.80
3	10	6	2	2	0	1.02
4	10	7	1	1	1	1.16
5	10	1	1	6	2	2.08
6	10	0	1	2	7	2.21

Discussion

The microleakage process is a phenomenon of diffusion of substances, organic or inorganic; into the tooth through the interface between the restorative material and the tooth structure [17]. Microleakage occurs due to dimensional changes in restorative materials such as polymerization shrinkage, difference in co-efficient of thermal expansion, hygroscopic expansion of materials and also due to extreme temperatures in the oral cavity, which may break the adhesion between adhesive system and cavity walls forming microgaps. This results in sensitivity, recurrent caries, possible pulpal pathosis, marginal deterioration, and discoloration. Some authors claim that the polymerization shrinkage of composite resins plays an important role on the debonding of the adhesive interface, consequently increasing the microleakage [18]. Hence, this study was conducted to assess microleakage in class II cavities restored with composite resins by using various placement techniques.

In the present study, a total of 60 samples were enrolled. Microleakage in occlusal wall mean scores of the 6 groups are depicted. Results for occlusal wall showed significantly better score for groups 3 and 4, when compared to other groups. The mean score for dye penetration in group 1and 2 were 0.21 and 1.0. A study by MR *et al*., demonstrated that in the occlusal wall, packable composite, showed significantly more marginal microleakage than the other groups. In the cervical wall, teeth restored with a flowable composite liner showed less marginal microleakage when compared to all other groups [19]. Another study by Somani R *et al.*, showed that microleakage was present least in the Mat incremental group and maximum in the bulk placement group while inter comparison revealed statistically significant difference between all the groups except for split incremental and Mat incremental groups. The recently introduced Mat incremental placement technique showed least microleakage when compared to conventional techniques [20].

In the present study, dye penetration score as an indicator of microleakage in the cervical wall. Results for cervical wall showed highly significant difference in the groups 3 and 4, when compared to groups 1 and 2. Significant difference was seen in groups 5 and 6, when compared to 1 and 2. The least mean value was depicted in group 3 and highest in group 2. Another study by Poggio C *et al.*, fifty human teeth were used. The prepared teeth were randomly assigned to 5

experimental groups (of 10 specimens and 20 cavities each) and restored. Group 1: Filtek TM Supreme XTE Flowable (3MESPE) + Universal Filtek Supreme XTE (3MESPE), Group 2: GrandioSO Heavy Flow (Voco) + GrandioSo (Voco), Group 3: SDR™ (Dentsply Caulk) + Esthet-X® HD (Dentsply Caulk), Group 4: SonicFill (Kerr), Group 5: Grandio (Voco). The results demonstrated no significant leakage differences between Group 4 and Group 5, that both showed significantly higher frequency distribution of Score 0. Group 2 and Group 3 showed a significant prevalence of Score 1, whereas Group 1 showed significantly higher frequency of Score 2. None of the restorative techniques tested completely eliminated microleakage dye penetration in dentin margins; marginal adaptation in Class II composite restorations with gingival wall below the CEJ varied in both substrates and from different restorative techniques used [21]. Restoring class II cavities with resin composites has always been a point of debate, especially in deep cavities where there is no enamel and the cavity margins are formed of dentin, cementum or both. Bonding to dentin is more difficult to achieve due to the specific properties of dentin such as tubular structure and intrinsic wetness [22]. To minimize stress from polymerization shrinkage, efforts have been directed towards improving placement techniques, composite formulations, and curing methods [23]. Efforts have been made to develop methods to decrease this problem, which include techniques for light polymerization, aimed at reducing the amount of composite volumetric shrinkage, and following strategic incremental placement techniques, which help to reduce the residual stresses at the tooth restoration interface [24]. However, concerns related to the ability of "packable" composites to adequately adapt to internal areas and cavosuface margins have been raised. To solve this problem, using "Flowable" composite as a liner has been suggested. This may also act as a flexible intermediate layer that helps relieve stresses during the polymerization shrinkage of the restorative resin [25]. There is a great deal of stress at the resin dentin layer and the modifications that would reduce or eliminate the interfacial stress concentrations may reduce gap formation and microleakage [26].

Conclusion

Flowable composite as the first increment is better to use and hence, recommended in deep class II cavities.

Acknowledgement

Not available

Author's Contribution

Not available

Conflict of Interest

Not available

Financial Support

Not available

References

1. Yip KH, Poon BK, Chu FC, Poon EC, Kong FY, Smales RJ. Clinical evaluation of packable and conventional hybrid resin-based composites for posterior restorations in permanent teeth: Results at 12 months. J Am Dent Assoc. 2003;134:1581-9.
2. Attar N, Korkmaz Y. Effect of two light-emitting diode (LED) and one halogen curing light on the microleakage of Class V flowable composite restorations. J Contemp Dent Pract. 2007;8:80-8.
3. Pashley DH. Clinical considerations of microleakage. J Endod. 1990;16:70-7.
4. Burgess J, Cakir D. Comparative properties of low-shrinkage composite resins. Compend Contin Educ Dent. 2010;31 Spec No 2:10-5.
5. Besnault C, Attal JP. Simulated oral environment and micro leakage of class II resin-based composite and sandwich restorations. Am J Dent. 2003;16:186-90.
6. Loguercio AD, Reis A, Mazzocco KC, Dias AL, Busato AL, Singer JM. Microleakage in class II composite resin restorations: total bonding and open sandwich technique. J Adhes Dent. 2002;4:137-44.
7. Furness A, Tadros MY, Looney SW, Rueggeberg FA. Effect of bulk/incremental fill on internal gap formation of bulk-fill composites. J Dent. 2014;42(4):439-449.
8. Stockton LW, Tsang ST. Microleakage of Class II posterior restorations with gingival margins entirely within dentin. J Can Dent Assoc. 2007;73:255.
9. Welbury RR, Murray JJ. A clinical trial of the glass-ionomer cement-composite resin "sandwich" technique in Class II cavities in permanent premolar and molar teeth. Quintessence Int. 1990;21:507-12.
10. Neme AM, Maxson BB, Pink FE, Aksu MN. Microleakage of Class II packable resin composites lined with flowables: An *in vitro* study. Oper Dent. 2002;27:600-5.
11. Fabianelli A, Sgarra A, Goracci C, Cantoro A, Pollington S. Microleakage in class II restorations: open vs closed centripetal build-up technique. Oper Dent. 2010;35:308-3.
12. Mackenzie L, Shortall AC, Burke FJ. Direct posterior composites: A practical guide. (74-6, 79-80).Dent Update. 2009;36:71-2. passim.
13. Estafan D, Estafan A, Leinfelder KF. Cavity wall adaptation of resin – based composites lined with flowable composites. Am J Dent. 2000;13:192-4.
14. Krejci I, Sparr D, Lutz F. A three sited light curing technique for class II conventional composite resin restorations. Quintessence Int. 1987;18:125-31.
15. Feilzer AJ, de Gee AJ, Davidson CL. Curing contraction of composites and glass ionomer cements. J Prosthet Dent. 1998;59:297-300.
16. Kidd EA. Microleakage in relation to amalgam and composite restorations. Br Dent J. 1976;141:305-10
17. Bayne SC, Heymann HO, Swift EJ. Jr Update on dental composite restorations. J Am Dent Assoc. 1994;125(6):687-701.
18. Deliperi S, Bardwell DN. An alternative method to reduce polymerization shrinkage in direct posterior composite restorations. J Am Dent Assoc. 2002;133(10):1387-98.
19. MR, Sajjan GS, BNK, Mittal N. Effect of different placement techniques on marginal microleakage of deep class-II cavities restored with two composite resin formulations. J Conserv Dent. 2010 Jan;13(1):9-15.
20. Somani R, Som NK, Jaidka S, Hussain S. Comparative Evaluation of Microleakage in Various Placement Techniques of Composite Restoration: An *In Vitro* Study. Int J Clin Pediatr Dent. 2020 May-Jun;13(3):264-268.

21. Poggio C, Chiesa M, Scribante A, Mekler J, Colombo M. Microleakage in Class II composite restorations with margins below the CEJ: *in vitro* evaluation of different restorative techniques. Med Oral Patol Oral Cir Bucal. 2013 Sep 1;18(5):e793-8.
22. Eick JD, Cobb CM, Chappel P, Spencer P, Robinson SJ. The dentinal structure: Its influence on dentinal adhesion. Part I. Quintessence Int. 1991;22:967-77.
23. Deliperi S, Bardwell DN. An alternative method to reduce polymerization shrinkage in direct posterior composite restorations. J Am Dent Assoc. 2002;133:1387-97.
24. El-Mowafy O, El-Badrawy W, Eltanty A, Abbasi K, Habib N. Gingival microleakage of Class II resin composite restorations with fiber inserts. Oper Dent. 2007;32:298-305.
25. Attar N, Turgut MD, Gungor HC. The effect of flowable resin composites as gingival increments on the microleakage of posterior resin composites. Oper Dent. 2004;29:162-7.
26. Belli S, Orucoglu H, Yildirim C, Eskitascioglu G. The effect of fiber placement or flowable resin lining on microleakage in class II adhesive restorations. J Adhes Dent. 2007;9:175-81.

How to Cite This Article
Sharma N, Sapahiya S, Garg S, Sharma M Assessment of microleakage in class II cavities restored with composite resin by using different placement techniques. International Journal of Advanced Research in Medicine. 2022;4(2):118-121

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