|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
PubMed (National Library of Medicine ID: 101738825)
Index Copernicus Value 2018: 75.71
Original Research Article
Volume 3, Issue 8; August: 2019; Page No. 256-260

COMPARATIVE EVALUATION OF THREE DIFFERENT COMPOSITE PLACEMENT TECHNIQUE USING DIFFERENT MODES OF CURING LIGHT ON PRIMARY TEETH: AN IN-VITRO STUDY

Jyoti Sharma[1], Bhagwat Swaroop Sharma[2], Dr Updesh Masih[3], Manisha Upadhyay[4], Nilotpol Kashyap[5], Sunil Kumar Yadav[6]

[1]Lecturer, Dept of Pedodontics and Preventive Dentistry, Universal College of Medical Sciences, College of Dental Surgery, Bhairahawa, Nepal.
[2]Lecturer, Dept of Oral Pathology, Universal College of Medical Sciences, College of Dental Surgery, Bhairahawa, Nepal.
[3]Professor & Head, Dept of Pedodontics and Preventive Dentistry, K.D Dental College and Hospital, Mathura, India
[4]Lecturer, Dept of Pedodontics and Preventive Dentistry, Universal College of Medical Sciences, College of Dental Surgery, Bhairahawa, Nepal.
[5]Professor & Head, Dept of Pedodontics and Preventive Dentistry, Universal
[6]Lecturer, Dept of Pedodontics and Preventive Dentistry, Babu Banarasi Das Dental College, Lucknow, India

Article Info: Received 5 August 2019; Accepted 30 August. 2019
DOI: https://doi.org/10.32553/ijmbs.v3i8.509
Corresponding author: Jyoti Sharma
Conflict of interest: No conflict of interest.

Abstract

Background: For the past several years, different techniques and materials have been examined to reduce microleakage in class V restorations. Thus both the quantity and quality of polymerization can be improved with proper selection of light curing modes and clinical placement techniques

Aim: The aim of the present study was to evaluate and compare which is one of the best placement technique and mode of curing to reduce microleakage.

Material and method: Class V cavities were prepared in 135 teeth. Teeth were divided into 3 groups of 45 each using three different placement technique with two different composite. Each group was further subdivided into 15 teeth cured by different curing modes.

Results: The 'p' value of the mean scores of all the groups when cured with high intensity mode is 0.004 (≤0.05) indicating that the results are statistically significant. But the 'p' value of the mean scores of all the groups when cured with pulse delay and ramped mode is 0.603 and 2.167(≥0.05) indicating that the results are not statistically significant. The 'p' value of the mean scores of group I and group II when cured with different mode is 0.065 and 0.085(≥0.05) indicating that the results are not statistically significant. But the 'p' value of the mean scores of the group III when cured with different mode is 0.001(≤0.05) indicating that the results are statistically significant.

Conclusion: Split increment horizontal technique showed least microleakage despite of curing modes. Although curing modes did not show statistically significant results but high intensity showed least microleakage.

Keywords: composite, G.V Black Classification, polymerization shrinkage, curing modes

INTRODUCTION:

For the past several years, different techniques and materials have been examined to reduce microleakage in class V restorations[1].These efforts were directed toward improving composite resin formulation, photocuring methods, and restorative placement techniques. Bulk and incremental placement techniques are used for composite restorations. Incremental placement techniques are widely recognized as a major factor in the reduction of shrinkage stresses[2]. Type of curing lights and modes of curing have been shown to affect the degree of polymerization and related shrinkage on resin based composite. Thus both the quantity and quality of polymerization can be improved with proper selection of light curing units and clinical curing techniques[3].

The aim of the present study was to evaluate and compare which is the best placement technique and mode of curing to reduce microleakage.

Material and method:

The study was conducted in the institution on 135 extracted primary teeth.

Inclusion criteria: Extracted primary teeth with no cracks, decay, fracture, abrasion, previous restorations, or structural deformities were considered for the study.

135 teeth were collected and stored in normal saline after scaling. The class V cavities were prepared with dimensions 3mm mesiodistally, 2mm cervicoocclusally and 2mm deep[4](Figure 1).

Figure 1: Class V cavity

The teeth were randomly divided into 3 groups of 45 teeth each using different placement techniques(group I Bulk placement technique with Tetric N-ceram bulk fill (Ivolcar-Vivadent), group II Oblique placement technique with Filtek Z350(3M ESPE),group III Split increment horizontal technique with Filtek Z350(3M ESPE)(Figure 2).

Figure 2: Armamentarium used in the study

Each group was further subdivided into 3 sub-groups of 15 teeth each cured by different curing modes to evaluate the microleakage. (sub-group A:high intensity curing mode, sub-group B: pulse delay curing mode, sub-group C:ramped curing mode). Thermocycling of 500 cycles at 5°c and 55°c for 30 seconds and the dwelling time 10 seconds was done[5]. Then 2 layers of nail varnish (Lakme, India) was applied 1 mm away from the margins of the restoration. The samples were immersed in the prepared 2% methylene blue dye for 24 hours at room temperature. After 24 hours, the samples were washed under running tap water for 15 minutes to remove the excess dye. The samples were sectioned from the centre of the restoration in a bucco-lingual direction with copious irrigation.

Evaluation of microleakage using dye penetration method was done, the sectioned sample was randomly selected and observed under a stereomicroscope (Olympus SZX7) at 30x magnification. The depth of the dye penetration was evaluated and scored according to the criteria followed by Dr. Vijay Singh et al[6] by a single examiner.(**Table 1)**

Table 1: Scoring criteria for Dye Penetration Method

Score	Criteria
0	No leakage.
1	Dye penetration extended for less than or up to 1/3 of preparation depth.
2	Dye penetration greater than 1/3 of preparation depth, but not extending to the entire axial wall.
3	Dye penetration extending to the axial wall.
4	Dye penetration past the axial wall.

The results of the present study were subjected to statistical analysis. Kruskal wallis Test, Mann Whitney tests were used. The data were analyzed using statistical package for Social Sciences Version (SPSS) 17.0 for Windows. The level of statistical significance was set at 95% (p=0.05).

- If **p-value > 0.05** then **NS** Not Significant
- If **p-value < 0.05** then **S** Significant

Results:

Table 2 - The 'p' value of the mean scores of all the groups when cured with high intensity mode was 0.004 (≤0.05) indicating that the results were statistically significant. But the 'p' value of the mean

scores of all the groups when cured with pulse delay and ramped mode was 0.603 and 2.167(≥0.05) indicating that the results were not statistically significant.

Table 2: Comparison of mean microleakage scores between group I, group II and group III

Type	Group	Mean	S.D.	Median	Kruskal-Wallis Chi-Square	P-value	Inferences
A high intensity	Group I (Bulk Placement technique)	1.60	0.83	2.00	10.858	0.004	***S***
	Group II (Oblique technique)	1.33	0.98	1.00			
	Group III (Split Increment horizontal technique)	0.60	0.51	1.00			
B pulse delay	Group I (Bulk Placement technique)	1.87	0.92	2.00	0.603	0.740	***NS***
	Group II (Oblique technique)	1.60	0.99	2.00			
	Group III (Split Increment horizontal technique)	1.60	0.83	2.00			
C ramped	Group I (Bulk Placement technique)	2.33	0.90	3.00	2.167	0.338	***NS***
	Group II (Oblique technique)	2.07	0.80	2.00			
	Group III (Split Increment horizontal technique)	1.87	1.06	2.00			

Table 3: It represents that the 'p' value of the mean scores of group I and group II when cured with different modes was 0.065 and 0.085(≥0.05) indicating that the results were not statistically significant. But the 'p' value of the mean scores of the group III when cured with different modes was 0.001(≤0.05) indicating that the results were statistically significant.

Table 3: Comparison of mean microleakage scores between subgroup A, B, C of each groups I, II, and III

Group	Type	Mean	S.D.	Median	Kruskal-Wallis Chi-Square	P-value	Inferences
Group I Bulk Placement technique	A (high intensity)	1.60	0.83	2.00	5.482	0.065	***NS***
	B (pulse delay)	1.87	0.92	2.00			
	C (ramped)	2.33	0.90	3.00			
Group II Oblique technique	A (high intensity)	1.33	0.98	1.00	4.937	0.085	***NS***
	B (pulse delay)	1.60	0.99	2.00			
	C (ramped)	2.07	0.80	2.00			
Group III Split Increment Horizontal technique	A (high intensity)	0.60	0.51	1.00	14.431	0.001	***S***

	B (pulse delay)	1.60	0.83	2.00			
	C (ramped)	1.87	1.06	2.00			

Discussion:

The results of present study showed regardless of the technique used, microleakage was present. Bulk technique resulted in more polymerization shrinkage and microleakage than incremental technique. The reasons could be increased polymerization contraction stress due to great volume of composite and decreased effectiveness of polymerization at deeper portions of the composite[7].

The least amount of microleakage was observed in split increment horizontal technique than oblique and bulk placement technique despite of different curing modes. Thus could be due to reduced volume of the resin and the stress generated on the cavity walls and also due to more uniform and efficient polymerization of resin composite through its entire thickness[7, 8]. According to Khamis Hassan et al[9, 10] the split-increment technique proposed for restoring large carious cervical cavities with composite resins would be helpful to minimize the development of polymerization shrinkage stresses on the adhesive interfaces at such cavity walls, especially the gingival dentinal wall.

A number of studies propose application of the oblique technique from the gingival aspect for class V cavity restorations[8, 11]. Puckett et al[11], found no significant difference between oblique incremental and bulk techniques, while according to Tjan et al[8], and M. Moezyzadeh et al[12] ,this difference was significant. Versluis A. *et al*. (1996)[13] recognized incremental placement techniques as a major factor in reducing polymerization shrinkage. Incremental techniques ensured the complete polymerization of the composite resin.Studies by Sillias Duarte(2008), Lawrence W Stockhon, Sussan T Tang observed that all the incremental techniques showed decrease in microleakage in comparison to bulk placement techniques. Among the incremental techniques, split technique showed least microleakage scores.

Many studies have demonstrated that even with the light cured composites, slower polymerization of the first increment results in a well- adapted restoration, a technique called **"soft-start"** polymerization. This method is to reduce polymerization shrinkage-associated stresses and microleakage by providing an initial low rate of polymerization[14]. This may reduce the stress build-up by supplying extended time for stress relaxation before reaching the gel phase. This can be accomplished by using a soft-start curing technique in which the curing begins with a low intensity and finishes with a high intensity[15]. This causes the maximal possible conversion to occur only after much of the stress has been relieved. Soft-start polymerization is divided- into three techniques: stepped, ramped, and pulse-delay[16].

In present study no statistically significant difference was found in different modes of curing this is an agreement with the study done by Neeraj Malhotra et al[17] which reports no statistically significant difference in microleakage of nanofilled and microhybrid Resin Bond Composites(RBCs) cured with different soft-start polymerization modes.Yap et al[18] also observed no significant reduction in polymerization shrinkage with soft-start curing modes. Özden Özel Bektas et al[19] also studied the effects of each curing mode on two composite resins were compared and no significant difference was observed.

Thus the manipulation of composite materials is highly technique sensitive and is markedly increased by the presence of moisture, cavity surface treatment, incremental layering technique, depth of cure and adequate time of cure. All these factors were taken into consideration while manipulating the materials as per the manufacturer's instructions.

Conclusion:

Within the limits of this study, the following conclusions were drawn:

All composite placement technique under the study exhibited a certain amount of microleakage despite of different curing modes.

- Bulk placement technique showed the most microleakage among the three placement techniques, the oblique placement technique showed less microleakage than bulk placement but more microleakage than split increment horizontal placement technique despite of the curing modes.
- Although split increment horizontal placement technique showed least microleakage which was not

statistically significant. Statistically significant results was found when high intensity mode was used.

- Bulk and oblique placement technique showed no statistically significant results in different curing modes although high intensity showed least microleakage.
- Split increment horizontal technique showed statistically significant results. High intensity mode showed least microleakage than pulse delay. Pulse delay showed more microleakage than high intensity and less than ramped mode. Ramped mode showed most microleakage.

Importance of this study:

- Class V cavities are more prone in anteriors in pediatric patients
- Microleakage is one of the main drawbacks
- Of composite restorations.
- Curing modes helps in reducing microleakage.

References:

1. Owens BM, Halter TK, Brown DM. Microleakage of tooth-colored restorations with a beveled gingival margin. Quintessence Int 1998 Jun;29(6):356-61.
2. Jensen ME, Chan DCN. Polymerization shrinkage and microleakage. In: Vanherle G, Smith DC, eds. Posterior composite resin dental restorative materials. Utrecht, The Netherlands: Peter Szulc Publishing Co.;1985:243-262.
3. N Malhotra, K Mala. Light-curing considerations for resin-based composite materials: A Review. Part I. compendium Sep 2010, Vol 31, no.7:498-505
4. Yavuz I, Aydin AH, Ulku R, Dulgergil TC, Akdag MZ. New technique: measurement of microleakage volume in the marginal gaps of the dental restorations.Biotechnol Biotechnol Eq 2005; 19(3): 184 – 191.
5. Vanamala Narayana, Sri rekha Ashwathanarayana, GururajNadig, Sushma Rudraswamy, Nagabhushana Doggalli, S Vijai. Assessment of Microleakage in Class II Cavities having Gingival Wall in Cementum using Three Different Posterior Composites. J Int Oral Health. 2014 Jul-Aug; 6(4): 35–41.
6. Dr. S. Vijay Singh, Dr. Saurabh Gupta, Dr. Pragya Jain, Dr. Vaibhav Munjal. Microleakage Evaluation Of Nano Ceramics And Nano Composite Resins Using Self Etch Adhesive In Class V Cavities Using Single Increment Technique. Dental Journal of Advance Studies Vol. 1 Issue II-2013
7. Costa Pfeifer CS, Braga RR, Cardoso PE. Influence of cavity dimensions, insertion technique and adhesive system on microleakage of Class V restorations. J Am Dent Assoc 2006 Feb;137(2): 197-202.
8. Tjan AH, Bergh BH, Lidner C. Effect of various incremental techniques on the marginal adaptation of class II composite resin restorations. J Prosthet Dent 1992 Jan;67(1):62-6.
9. Salwa Khier and Khamis Hassan. Efficacy of Composite Restorative Techniques in Marginal Sealing of Extended Class V Cavities ISRN Dent. 2011; 2011: 180197.
10. Hassan K Polymerization Shrinkage Stress Reduction in Direct Occlusal Composite Restoration Placed Using Split-increment Horizontal Technique - Case Report Published on: 14 Sep 2011
11. Puckett A, Fitchie J, Hembree J Jr, Smith J. The effect of incremental versus bulk fill techniques on the microleakage of composite resin using a glassionomer liner. Oper Dent 1992 Sep-Oct;17(5):186- 91.
12. M. Moezyzadeh , M. Kazemipoor. Effect of Different Placement Techniques on Microleakage of Class V Composite Restorations Journal of Dentistry, 2009; Vol. 6, No. 3.
13. Feilzer AJ, De Gee AJ, Davidson CL. Setting stress in composite resin in relation to configuration of the restoration. J Dent Res 1987 Nov; 66(11):1636-9.
14. Jimenez-Planas A, Matin J, Abalos C et al. Developments in polymerization lamps. Quintessence Int. 2008;38(20):e74-e84.
15. Davidson CL, Davidson-Kaban SS. Handling of mechanical stresses in composite restorations. Dent Update. 1988;25(7):274-279.
16. Rawls RH, Esquivel- Upshaw JF. Restorative resins. In Anusavice KJ editor. Philip's Science of Dental Material. 11th ed. St. Louis , MO: Saunders ; 2003:399-442.
17. N Malhotra, K Mala. Light-curing considerations for resin-based composite materials: A Review. Part II. compendium Sep 2010, Vol 31, no.7:498-505
18. Yap AU, Wang HB, Siow KS, Gan LM. Polymerization shrinkage of visible light cured composites. Oper Dent. 2000;25:98–103.
19. ÖzdenÖzelBektas, FeridunHürmüzlü, DiğdemEren,(Effect of the composite curing light mode on polymerization shrinkage of resinComposites Cumhuriyet Dent J 2012;15(1):1-6