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EVALUATION OF FRACTURE RESISTANCE AND MICROLEAKAGE OF SMART DENTIN REPLACEMENT (SDR) AND SPECTRUM

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INTRODUCTION

Esthetics is a branch of philosophy dealing with the nature of art, beauty and taste, with the creation and appreciation of beauty. Dentistry progress in last decades is huge. Modern materials and emerging peak technologies allow's today dental restoration meet the highest esthetic demands[1]

Despite many advantages of composites, since their initial introduction in 1960's, they have undergone improvements in all area including esthetics wear and handling. However one important drawback i.e polymerization shrinkage continues to represent a major disadvantage as it leads to marginal leakage bond failure.[2] Microleakage being a matter of concern ; it further leads to staining of restorations, recurrent caries, post operative sensitivity and pulp pathology.[3]

Since each material has different chemical system they also have different behavior regarding the polymerization shrinkage. The aim of material development is to eliminate polymerization shrinkage by adapting the individual components. Therefore, search for a better, more reliable posterior composite with lower rate of microleakage enhanced mechanism and esthetic properties has magnified significantly.[4]

Hence to overcome the same, SDR (Smart Dentin Replacement) the first bulkfill flowable base for direct restorations had been developed specially for dentin replacement. The manufacturers claim that it can be placed in 4mm increments and combine the handling properties of a flow able composite with minimal shrinkage stress. SDR differs from conventional resin by the incorporation of SDR (stress decreasing resin) technology. When SDR is exposed to visible light, the increase of stress with time is greatly reduced. Recently another bulk fill paste composite viz Spectrum was introduced. It is based on the resin technology of TPH3 and contains nanohybrid and micro filler components. It also offers excellent color blending i.e the chameleon effect.[5]

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Since Resin based materials are rapidly becoming the primary restorative material to replace tooth structure direct composite restorations have been a subject to attention because of their superior properties. Although the use of these direct composite in restoration of posterior teeth has always been problematic[1]; hence, the dissertation focuses on in vitro evaluation of 2 recent composites in relation to the 2 major clinical drawbacks to provide a comprehensive understanding of material science and technique involved in direct bonding procedure.

AIM AND OBJECTIVE

The aim of this in vitro study was that, the new restorative composite resins can improve the fracture resistance and decrease microleakage

Objective- In vitro Comparison of

(1) Microleakage of SDR and Spectrum

(2) Fracture resistance of SDR and Spectrum

METHOD

60 freshly extracted maxillary premolars were collected .Soft tissue and calculus was removed mechanically from root surface. Teeth stored in 10% formalin until use. Specimens were randomly allocated into 2 groups with 30 teeth in each and further sub divided into 2 subgroups of 15 samples each.
Group1—microleakage
Group2 – fracture resistance
Subgroups:-

Group1	Group2
1a SDR	2a SDR
1b Spectrum	2b Spectrum

Figure 1: 60 samples

Figure 2: SDR

Figure 3: Spectrum

All samples were prepared by single operator using no-4 high speed round carbide bur. Standardized Class II cavities were prepared using straight and tapered bur having depth 1.5mm. Debris cleaned with water, Etchant was applied for 10 seconds and washed. Bonding agent applied over prepared cavities and light cured for 10 seconds. The 2 groups were restored respectively according to manufacture instructions.

30 samples (SDR- 15, Spectrum -15) were thermocycled alternatively ten cycles at temp 40^{o}C-50^{o}C . Samples were coated with nail varnish (leaving a margin of 1 mm around the filing). The prepared samples were placed in a 1% Methylene blue solution for 24 hours. For samples, section thus prepared and was cut with a diamond disc in the middle of the height of restoration parallel to occlusal surface in each restoration. The depth of dye penetration was evaluated along the side walls. For evaluation of dye penetration the

Stereomicroscope was used with a 10 x magnification to check microleakage.

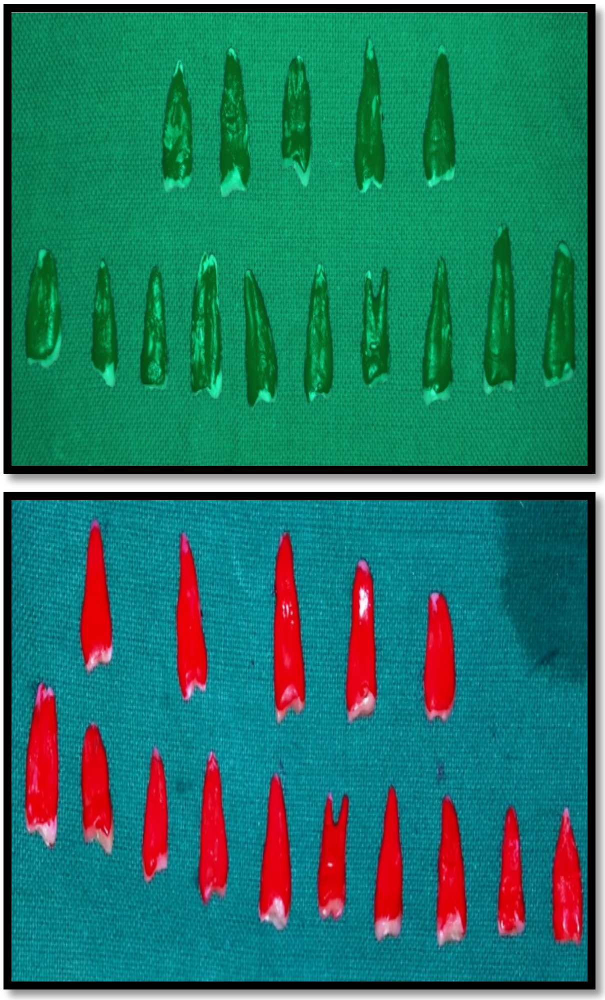
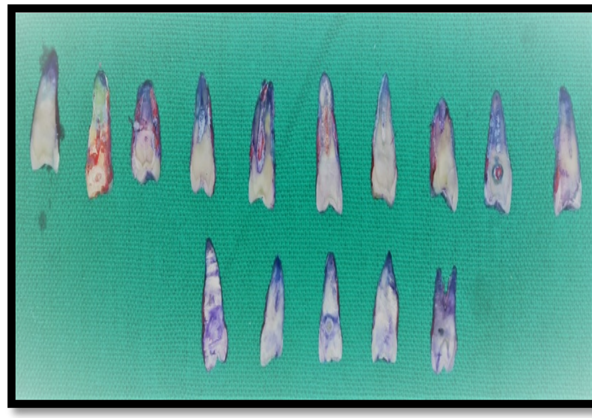


Figure 4: **GROUP 1:-microleakage** 30 specimens after cavity prepration,restoration and nail varnish application (for dye leakage)

1a- SDR



1b- Spectrum

Figure 5: **SUB GROUP 1** Specimens after immersed in dye and sectioned

Figure 6: Stereomicroscope

The remaining 30 samples (SDR-15, Spectrum- 15) were mounted in acrylic and tested using Universal Testing Machine to evaluate fracture resistance.

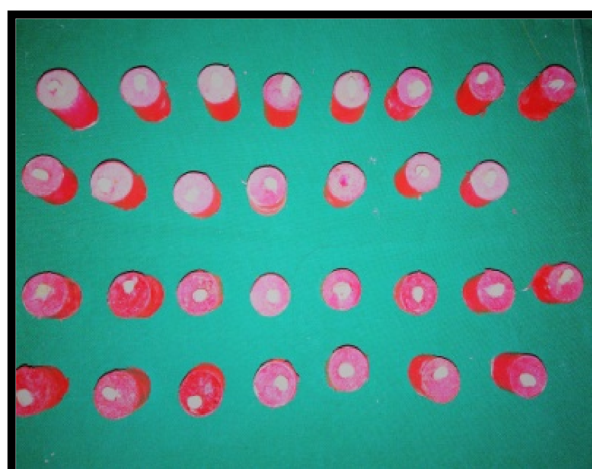


Figure 7: **GROUP 2:** Fracture resistance 30 specimens after restoration mounted in acrylic for fracture resistance

Figure 8: Fracture resistance tested under universal testing machine

Figure 9: Universal Testing Machine

The Results were then statically evaluated using T test and Chi Square test.

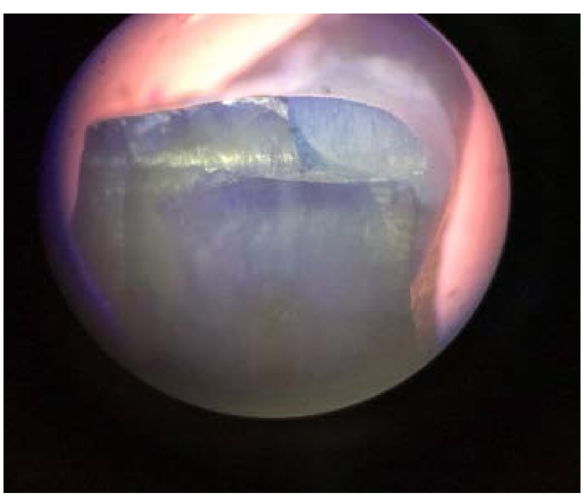
MICROLEAKAGE OF SDR GROUP
Mean value = 1.06
MICROLEAKAGE OF SPECTRUM GROUP
Mean value= 1.8

Table 1: COMPARISON BETWEEN THE SDR AND SPECTRUM GROUP FOR MICROLEAKAGE (BASED ON DYE PENETRATION)

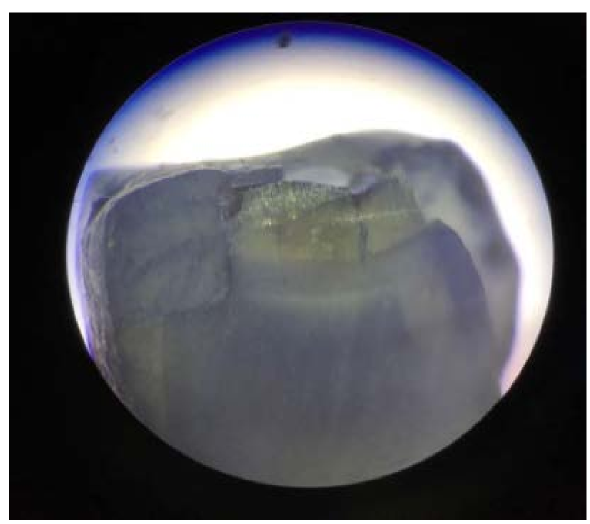
	Grade 0 (No Dye Penetration)	Grade I (one side Half Wall Dye Penetration)	Grade II (one side Full Wall Dye Penetration)	Grade III (both sides half walls)	Grade IV (both side full walls)	P value
SDR Group	02	10	03	00	00	0.001 (Significant)
Spectrum Group	01	05	05	04	00	

p≤0.05 -significant using Chi Square test

GROUP 1 -Microleakage

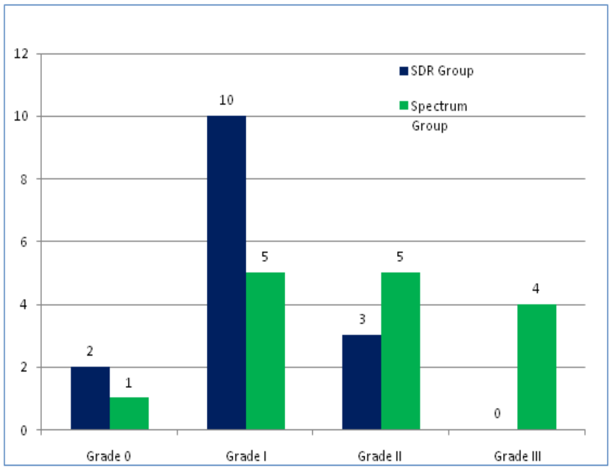


(1a) SDR



(1b) Spectrum

Figure 10: 10x view under Steriomicroscope



Graph 1: Microleakage scoring criteria of SDR and Spectrum

The mean fracture load (kg^0 F) for both groups is presented in Table2. As revealed by T test. The results were statically significant between the 2 subgroups i.e 2a and 2b

P<0.001

FRACTURE RESISTANCE OF SDR GROUP

Mean ±SD

24.10±2.06

FRACTURE RESISTANCE OF SPECTRUM GROUP

Mean ±SD

13.96±1.37

Table 2: COMPARISON BETWEEN SDR AND SPECTRUM GROUP FOR FRACTURE RESISTANCE

GPS	N	Mean	Std. Deviation	Std. Error Mean	P value	Significance
SDR Group	15	24.10	2.06	0.53	0.001	Significant
Spectrum Group	15	13.86	1.37	0.35		

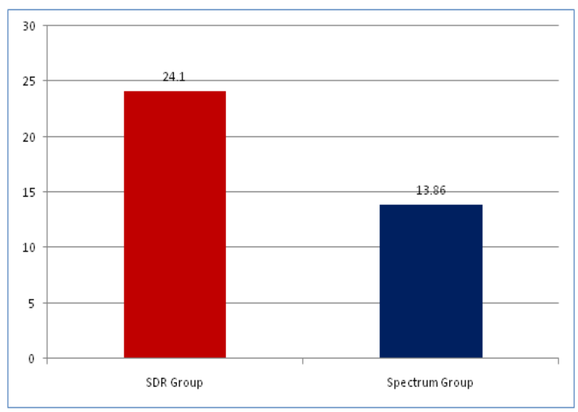
p≤0.05 -significant using Independent t test

GROUP 2 - Fracture resistance

(2a) SDR

(2b) Spectrum

Figure 11: Samples tested under universal testing machine



Graph 2: Fracture resistance of Specimens of SDR and Spectrum

Two composites were tested for microleakage and fracture resistance under Stereomicroscope and Universal Testing Machine respectively.

The Microleakage of SDR group (1.06 µm) is significantly low in comparison to Spectrum group (1.8 µm)

Fracture Resistance of SDR group (24.10kg^{o}F) is significantly high compared to Spectrum group (13.96kg^{o}F)

DISCUSSION

As there are many restorative materials; of which tooth colour restorative materials play an important role in this modern era. Fracture resistance is a complete or incomplete break in a material resulting from the application of excessive force. Fracture resistance is an important property directly connected to cracking. Loss of fracture resistance following tooth preparation leads to weaken tooth and increases their susceptibility to fracture.[1]

Another critical problem incurred with posterior composite restoration is the formation of marginal gaps due to microleakage and lack of strength. Composites are stressed when used in Class II fillings. Polymerisation shrinkage stresses of dental composites are often associated with marginal and interfacial failures of bonded restorations. The magnitude of stress depends on composite composition and its ability to flow before gelation[7].

Obtaining marginal integrity during filling cavities with composite materials determines tooth tissues protection against microleakage. The biggest drawbacks of composite material are polymerisation shrinkage and thermal expansion. In order to decrease the risk of microleakage, the appropriate techniques should be applied that reduce the polymerisation shrinkage. An important element in attempts to decrease the effect of the formation of internal stresses caused by polymerisation shrinkage is an increase in the elasticity of the filler material and bonding system[8].

The increasingly common method of compensating polymerisation stress is using thin adhesive layer, the flowable composites. They have a lower modulus of elasticity so they are effective in decreasing microleakage.[2]

CONCLUSION

The selection of the filling material determines the success of an adhesive restoration using the bulk fill technique. Within the limitations of this in vitro study, the use of the bulk fill flowable (SDR) significantly strengthened the ClassII preprations owing to higher fracture resistance and reduced microleakage compared to bulk fill paste (Spectrum) composites

In this in vitro study we can conclude that

- SDR has high fracture resistance compared to Spectrum

And

- SDR has lesser microleakage compared to Spectrum .

So SDR can be a better choice of filling material owing to its better physical properties in Class II situation. More long term clinical trials are required to support this study.

BIBLIOGRAPHY

1. Moezizadeh M, Shokripour M. Effect of fiber orientation and type of restorative material on fracture strength of the tooth. Journal of Conservative Dentistry 2011;14(4);341-345
2. Orlowski M, Tarczydlo B, Chalas R. Evaluation of marginal integrity of four bulk fill dental composite materials. The Scientific World Journal 2015;10;1-8
3. Arslan S, Demirbuga S, Ustun Y, Dincer AN, Canakci BC, Zorba YO. The effect of new generation flowable composite resin on microleakage in class V composite restorations as an intermediate layer. Journal of Conservative Dentistry 2013;16(3);189-193
4. Deliperi S, Bardwell D, Coiana C. Reconstruction of devital teeth using direct fiber- reinforced composite resins.The Journal Of Adhesive dentistry;2005;7(2);1-7
5. Wahab F, Abu-Tabra I, Amin WM. An in vitro study of microleakage of different types of composites with respect to their matrix compositions. British Journal Of Medicine and Medical Research 2014;4(9):1908-1922
6. Lotfi N, Esmaeili B, Ahmadizenouz G, Bijani A, Khadem H. Gingival microleakage in class II composite restorations using different flowable composites as liner. Caspian Journal Of Dental Research 2015;4(1):10-16
7. Karthick K, Sivakumar K, Geetha P, Shankar S. Polymerization shrinkage of composites. JIADS2011;2(2);32-36
8. Atiyah A, Baban L. Fracture resistance of endodontically treated premolars with extensive MOD cavities restored with different composite restorations. J Bagh College dentistry2014;26(1);7-15
9. Orlowski M, Tarczydlo B, Chalas R.Evaluation of marginal integrity of four bulk-fill dental composite materials. The scientific world journal 2015;10;1-8

10. Garoushi S, Hatem M, Lassila L, Vallittu P.The effect of short fiber composite base on microleakage and load bearing capacity of posterior restorations. Informa healthcare2015; 1(1);6-12
11. Hermeler L. Smart dentin replacement. Dynamic restorative journal2016;4(13):4-7
12. Holzmeier M. Smart dentin replacement a qick, aesthetic, cost- effective posterior restoration. Dynamic restorative journal2016;4(13):9-11
13. Manhart J. A new concept for dentin replacement in posterior composite restorations. Dynamic restorative journal 2015; 7(4):12-15
14. Alonso RCB, Sinhoreti MAC, Sobrinho LC, Consani S, Goes MF. Effect of resin liners on the microleakage of class v dental composite restorations. J Appl Oral Sci 2004; 12(1): 56-61
15. Sadeghi M. Influence of flowable materials on microleakage of nanofilled and hybrid Class II composite restorations with LED and QTH LCUs. Ind J Dent Res 2009; 20: 159-163.
16. Radhika M, Sajjan GS, Kumaraswamy BN, 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; 13: 9-15
17. Roggendorf, MJ Krämer, N Appelt A Naumann M Frankenberger R Marginal quality of flowable 4-mm base vs. conventionally layered resin composite. J Dent 2011; 39(10): 643-647.
18. Kwone Y, Ferracane J, Lee IB. Effect of layering methods, composite type, and flowable liner on the polymerization shrinkage stress of light cured composites. Dent Mater 2012; 28(7): 801-9.
19. Lassila LV, Nagas E, Vallittu PK, Garoushi S. Translucency of flowablebulk-filling composites of various thicknesses. Chin J Dent Res 2012; 15(1): 31-5.
20. Moorthy A, Hogg CH, Dowling AH, Grufferty BF, Benetti AR, Fleming GJP. Cuspal deflection and microleakage in premolar teeth restored with bulk-fill flowable resin-based composite base materials. J Dent 2012; 40: 500-505.
21. Ilie N, Bucuta S, Draenert M. Bulk-fill resin-based composites: an in vitro assessment of their mechanical performance. Oper Dent 2013; 38(6): 618-625.
22. Van Ende. Bulk-filling of high C-factor posterior cavities: effect on adhesion to cavity-bottom dentin. Dent Mater 2013; 29(3): 269-277.
23. Scotti N, Comba A, Gambino A, Paolino DS, Alovisi M, Pasqualini D, Berutti E. Microleakage at enamel and dentin margins with a bulk fills flowable resin. Eur J Dent 2014; 8: 1-8.
24. Garcia D, Yaman P, Dennison J, Neiva G. Polymerization shrinkage and depth of cure of bulkfill flowable composite resins. Oper Dent 2014;39(4): 441-448.
25. Leprince JG, Palin WM, Vanacker J, Sabbagh J, Devaux J, Leloup G. Physico-mechanical characteristics of commercially available bulk-fill composites. J Dent 2014; 42(8): 993-1000.
26. Francis A. Cuspal flexure and extent of cure of a bulk-fill flowable base composite. Oper Dent 2015; 40(5): 515-523.
27. Agarwal RS, Hiremath H, Agarwal J, Garg A. Evaluation of cervical marginal and internal adaptation using newer bulk fill composites: An *in vitro* study. J Conserv Dent 2015; 18: 56-61.
28. Jang JH, Park SH, Hwang IN. Polymerization shrinkage and depth of cure of bulk-fill resin composites and highly filled flowable resin. Oper Dent 2015; 40(2): 172-180.
29. Kim RJ, Kim YJ, Choi NS, Lee IB. Polymerization shrinkage, modulus, and shrinkage stress related to tooth-restoration interfacial debonding in bulk-fillcomposites. J Dent 2015; 43(4): 430-439.
30. Alshali RZ, Salim NA, Satterthwaite JD, Silikas N. Post-irradiation hardness development, chemical softening, and thermal stability of bulk-fill and conventional resin-composites. J Dent 2015; 43(2): 209-218.