

## COMPARISON OF SUCCESS RATE OF CLASS 2 DIRECT POSTERIOR COMPOSITE RESTORATIONS PERFORMED WITH BULK FILL BASE OF SMART DENTIN REPLACEMENT (SDR) AND WITHOUT BULK-FILL BASE OF SMART DENTIN REPLACEMENT (SDR). A 2 YEAR CLINICAL STUDY

<sup>1</sup>QURA TUL AIN MANZOOR, <sup>2</sup>HIRA IMTIAZ, <sup>3</sup>TABASSUM AWAIS, <sup>4</sup>MUHAMMAD SALMAN RASHID, <sup>5</sup>NIGHAT SHAFI, <sup>6</sup>HIRA ANJUM

### ABSTRACT

*Resin composites have long been advocated for use in posterior class I and II restorations with appreciable success rate. But their biggest disadvantage till date has been their polymerization shrinkage. To overcome this disadvantage, the conventional oblique incremental layering technique has been used with success over time. But recently a better solution has been brought forward with the use of SDR (Smart Dentin Replacement) which is actually a bulk-fill flowable resin composite. It was designed to facilitate fewer composite increment placement. For the purpose of reducing polymerization shrinkage and stresses, it has been advocated for use as a stress breaking liner underneath an occlusal layer of the traditional nano-hybrid composite material itself. The objective of this study was to compare the frequency of success of direct posterior class 2 composite restorations performed with and without bulk-fill base of smart dentin replacement. In this study 211 patients were included having age from 18 to 60 years, which were equally divided into two groups with both males and females. Group A (with SDR) have 68 (61.3%) males and 48 (38.7%) females while Group B (without SDR) have 73 (65.5%) males and 38 (34.5%) females. Group A (with SDR) have a success rate of 97.4% and Group B (without SDR) 89% success on 2 year follow up. In conclusion there is a clear difference in frequency of success of direct posterior class 2 composite restorations performed with and without bulk-fill base of smart dentin replacement.*

**Keywords:** SDR, Bulk-fill flowable, Composite, Polymerization shrinkage

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### INTRODUCTION

Resin composites are the most commonly used restorative materials, developed mainly to cater the esthetic demands of patients as awareness of esthetic importance has grown.<sup>1</sup> They are used mainly in the anterior region of mouth, but with the concept of con-

servative dentistry evolving and with development of stronger more durable forms of these materials, their use in the posterior restorations has evolved to great degree. They are also used in diastema closure, modifying tooth shape and size, as luting agents, for core build-ups, for masking discolored teeth as veneers and as orthodontic bracket adhesives. Their advantages are excellent esthetics, adhesion to tooth structure, can be repaired, good longevity, low thermal conductivity, allow tooth structure conservation, radiopacity and are very economical. Some major drawbacks include polymerization shrinkage stress, secondary carious lesions, post operative sensitivity, decreased wear resistance, technique sensitivity, inconsistent dentin adhesion causing marginal leakage and water sorption.

The one most important limitation is the polymerization contraction stress. Modern resin composites undergo volumetric polymerization shrinkage of 1.5% to

<sup>1</sup> Dr Qura Tul Ain Manzoor, (BDS, FCPS Operative Dentistry) Registrar Operative Dentistry, Email: qurat\_32@hotmail.com

<sup>2</sup> Dr Hira Imtiaz (BDS, FCPS Resident Operative Dentistry) Registrar Operative Dentistry, Email: hira4602@gmail.com

<sup>3</sup> Dr Tabassum Awais, (BDS, MDS Operative Dentistry) Registrar Operative Dentistry, Email: dr.tabassumawais@gmail.com

<sup>4</sup> Dr Muhammad Salman Rashid (BDS, FCPS, Operative Dentistry) Assistant Professor Operative Dentistry, Email: dr\_salman74@hotmail.com

<sup>5</sup> Dr Nighat Shafi (BDS, FCPS, Operative Dentistry) Assistant Professor, Operative Dentistry, Email: drnighatshafi7@gmail.com

<sup>6</sup> Dr Hira Anjum, (BDS, FCPS Operative Dentistry) Registrar Operative Dentistry Email: hiraanjum@hotmail.com

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5%. It causes stresses to develop within the restoration itself along with the adhesive interface and the tooth.<sup>2</sup> Due to this the material may pull away from the cavity margin hence decreased bond strengths and voids are formed by localized loss of adhesion. These polymerization stresses are actually a direct consequence of the contraction and elastic modulus development.<sup>2</sup>

Methods have been advocated to overcome this polymerization shrinkage stress. These include development of new monomeric systems called silorane, incremental layering technique, soft-start (two-step or ramped cure) light curing, addition of fillers, newer bonding agents to relieve shrinkage stress, use of a stress breaking bulk fill liner and sealing of margins with a low-viscosity resin after the restorative resin is cured (rebonding).<sup>3</sup>

Use of incremental layering technique aims to reduce polymerization shrinkage stress by decreasing the C-factor of each increment thereby decreasing overall polymerization stress. Many materials have been used as stress breaking bulk-fill liners. Glass Ionomers and Resin Modified Glass Ionomer Cements are used mainly as cements in dentistry. However their main drawback is lack of sufficient strength and toughness for use in posterior restorations.<sup>4,5</sup> Zinc oxide eugenol shouldn't be used as a base material with composites because these have low strength and are highly soluble in oral cavity.<sup>6</sup> Biodentine hasn't been advocated for use as a dentine replacement because of its weak bonding with composite resins.<sup>7</sup>

SDR (Smart Dentine Replacement) is a resin-based bulk fill lining material that was designed specifically for reducing polymerization stress and with enhanced curing depth. It was developed to facilitate fewer composite increments placement. SDR is used in a closed sandwich protocol in which a SDR base replaces dentine and a conventional nano-hybrid composite restores the enamel layer at occlusal and proximal aspects. SDR use resulted in up to 60% less shrinkage stress. It has excellent cavity adaptation consistency, it is chemically compatible with composite resins and adhesives, it is ideal for class 1,2 restorations as a liner and as a bulk-fill. In a 6-month evaluation of SDR as a bulk-fill base, showed 97.4% success.<sup>8</sup> In comparison, a 6 month evaluation of composite restorations in terms of marginal adaptation showed 92% and 89% success rates for two different bonding systems.<sup>9</sup>

The rationale of this study was to evaluate the efficacy of bulk fill flowable dentin replacement material in class 11 restorations in our population as the disease (caries) pattern is different, so depending on the results we can recommend the use of SDR with confidence in our clinical setup. The main objective of this study was to compare the frequency of success of direct posterior

class II composite restorations performed with and without bulk-fill base of smart dentin replacement.

## METHODOLOGY

Patients were selected from the Operative Outdoor Department of Rashid Latif Medical and Dental college. As the study is a Randomized Controlled Trial so the patients were randomly selected and were divided into two groups. Group A (with Bulk fill SDR) and Group B (without Bulk fill SDR). Group A (with SDR) have 68 (61.3%) males and 48 (38.7%) females while Group B (without SDR) have 73 (65.5%) males and 38 (34.5%) females. The duration of the study was 2 years. The patients were selected after the clinical examination under the supervision of a Fellows of Operative Dentistry that meet the following inclusion criteria.

- 1 Carious lesion on premolar or molar teeth involving proximal surfaces (class 2), assessed clinically and radiographically
- 2 Patients 18 years old or older.
- 3 A patient with no history of bruxism
- 4 Patients with good oral hygiene assessed clinically
- 5 Both genders male and female

The patients that have severe periodontal disease, active pulpal disease and medically compromised patients were excluded during the sample collection. Data collected as the patients were randomly allocated into group A being the one in which bulk fill base of SDR is used and Group B being the one in which bulk fill base of SDR is not used and oblique incremental technique is performed with a conventional, nano-hybrid composite. Proper informed consent by the trainee were taken before initiating the procedure, taking care that no ethical issue is involved. A detailed medical, dental and social history will be obtained. Preoperative radiographs of the patient are taken as baseline record. Patient will be anesthetized if needed and proper isolation will be performed with rubber dam. A standardized bonding procedure will be followed. Enamel is etched for 30sec, dentin for 15sec, etchant is washed for 15sec and excess moisture is removed. Primer is applied, and is thinned with air application. After this the adhesive is applied, air thinned and light cured for 20sec.<sup>2</sup> For both groups, create the proximal contact and wall with composite before the internal parts of the cavity are restored. After the bonding and proximal wall build-up is completed, the dentine is replaced with either an SDR bulk-fill base (Group A) or composite in an anatomical, oblique incremental technique (Group B). SDR and composite materials will be applied into cavities and cured.<sup>2</sup> Composite is then used for the enamel replacement layer in both groups. The occlusion will be checked and the restoration will be finished and polished. Post-op

radiographs will be taken to evaluate the restoration and to keep as a record. Follow-up visit will be set after 6 months to 2 years to evaluate the clinical success rate of the restorations using the USPHS ryge criteria in Table 1

Data will be entered and analyzed into SPSS version 20.0. Mean and standard deviation will be evaluated for quantitative variables like age of patient and success of class 2 direct posterior composite restorations in terms of marginal integrity, gross fracture and secondary caries as scored according to the Modified USPHS Ryge criteria. Frequency and percentage will be calculated for qualitative variables like patient's gender and success of the procedure in terms of marginal integrity, gross fracture and secondary caries of restorations falling under score A of Modified USPHS Ryge criteria. Chi-square test (X<sup>2</sup>) will be applied for both of groups. Effect modifiers/confounders like age and gender will be controlled through post stratification. Post stratification chi square test will be applied with P value less than or equal to 0.05.

## RESULTS

Out of 211 patients in both groups clinical success ( efficacy) of class 2 direct posterior composite restorations performed with bulk fill base of smart dentin replacement (SDR) i.e. Group A was 97.4% as evaluated according to the UPHS Ryge criteria. While in Group B class 2 direct posterior composite restorations performed without bulk fill base of smart dentin replacement (SDR) was 89.0% as elaborated in table 2. The Group that use SDR showed increased efficacy on the follow up as compare to the direct composite restoration in the class II cavities. Stratification for age and gender was also carried out with regard to clinical success for group A. As elaborated in table 3 and 4 that the age of the patients and gender doesn't influence the efficacy of material ( p value not significant). Although the efficacy of Group B was 89% a non significant p values were found when the age and gender was stratified as described in table 5 and 6.

## DISCUSSION

The use of SDR as a bulk fill base material to lower

TABLE 1: USPHS RYGE CRITERIA FOR THE EVALUATION OF RESTORATION

Criteria	Test Procedure	Ryge's Criteria
Color match	Visual inspection with mirror at 18 inches	A. the restoration matches the adjacent tooth structure in color and translucency B. Light mismatch in color shade or translucency between the restoration and adjacent tooth C. the mismatch in color and translucency is out the acceptable range of the tooth's color and translucency
Cavo surface margin discoloration	visual inspection with mirror at 18 inches	A. no discoloration anywhere along the margin between the restoration and adjacent tooth B. slight discoloration anywhere along between the restoration and adjacent tooth C. discoloration penetrated along the margin of the restorative material in pulpal direction
Marginal adaption (occlusal and proximal)	visual inspection with explorer and mirror if needed	A. no visual evidence of a crevice along the margin. B. visual evidence of a crevice along the margin into which the explorer will penetrate. C. the dentition or the base is exposed. D. the restoration is fractured, mobile or missing
Anatomical form (occlusal and proximal)	visual inspection with explorer and mirror if needed	A. the restoration continuous with existing anatomical form. B. the restoration is discontinuous with existing anatomical form. But the material is not sufficient to expose the dentin or base. C. there is a crevice and fracture on the surface of the restoration
Surface texture	visual inspection with explorer and mirror if needed	A. the restoration is as smooth as surrounding enamel B. the restoration surface is rougher than surrounding enamel C. there is a crevice and fracture on the surface of the restoration
Secondary caries	visual inspection with explorer and mirror if needed	A. no evidence of caries. B. evidence of caries along the margin of the restoration

TABLE 2: CLINICAL SUCCESS OF (SDR AND WITHOUT SDR)

Clinical Success	Yes	No	Total	P value	Success Percentage
Group A SDR	108	3	111	.16106	97.4
Group B Direct composite	99	12	111		89.0
Total	207	15	222		

TABLE 3: AGE AFFECT ON THE CLINICAL SUCCESS OF SDR

Age	Clinical success Group A		Total	P Value
	Yes	No		
18-30	54	1	55	.6264
31-45	39	1	40	
46-60	15	1	16	
Total	108	3	111	

TABLE 4: GENDER AFFECT ON THE CLINICAL SUCCESS OF SDR

Gender	Clinical success Group A		Total	P value
	Yes	No		
Male	67	1	68	.134
Female	41	2	43	
Total	108	3	111	

TABLE 5: AGE AFFECT ON THE CLINICAL SUCCESS OF COMPOSITE RESTORATION ( WITHOUT SDR)

Age	Clinical success Group B		Total	P Value
	Yes	No		
18-30	35	2	37	.1692
31-45	50	6	56	
46-60	14	4	18	
Total	99	12	111	

TABLE 6: GENDER AFFECT ON THE CLINICAL SUCCESS OF COMPOSITE RESTORATION ( WITH-OUT SDR)

Gender	Clinical success Group B		Total	P value
	Yes	No		
Male	69	4	73	.01217
Female	30	8	38	
Total	99	12	111	

the polymerization shrinkage in posterior composite restorations has been endorsed within the last few years due to the various advantages it offers over conventional posterior composite restorations. Dentists increasingly opt for this method of restoration to get better clinical results. Moreover, the placement of SDR as a bulk fill base in class 2 posterior composite restorations is sup-

ported by evidence. This study compared the success of direct posterior class 2 composite restorations performed with bulk fill base of smart dentin replacement and without bulk fill base of smart dentin replacement .

The results showed that the clinical success of SDR as posterior composite restoration is 97.4% which is comparable to a study done by Muhittin that showed

the failure rate of only 0.8% of SDR restoration, while the group that use composite have the annual failure rate of 2.5%<sup>10</sup>. These results clearly show the success of SDR as a base in class 2 composite restorations. Buczeko did study on SDR showed the failure of only 7% after a year follow up that means success is about 93% which is comparable to our study<sup>11</sup>.

A randomized clinical study of 5 year in class II posterior restoration showed the annual failure rate of SDR is 1.4% while for the composite it is 2.1% which is comparable to the results of our study<sup>12</sup>. This study also showed the comparable results of class 1 in both groups.

Another study showed the survival of SDR restorations is 92.6% while composite restorations showed the 93% survival rate in 2 year follow up study. The results of this study is comparable to our study<sup>2</sup>. Available local data on the SDR clinical success is limited, while another significant study that shows the bond strength of a SDR is higher than other restorative materials which results in less polymerization shrinkage<sup>13</sup>. The literature and the results of the present study showed more clinical success of SDR as a dentin replacement material. Although more recent research required so that long term longevity and survival can be evaluated.

## CONCLUSION

In conclusion there is a clear difference in frequency of success of direct posterior class 2 composite restorations performed with and without bulk-fill base of smart dentin replacement. SDR has now become an integral part of dental practice and its use as a bulk fill base in composite restorations has gained considerable popularity due to its evident success rate. Methods should be advocated to enhance the efficacy of this material in order to achieve clinically long-lasting restorations.

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## CONTRIBUTIONS BY AUTHORS

- |                                  |  |
|----------------------------------|--|
| <b>1 Qura Tul Ain Manzoor:</b>   | Provided useful material & wrote introduction    |
| <b>2 Hira Imtiaz:</b>            | Helped in data collection & reference correction |
| <b>3 Tabassum Awais:</b>         | Data collection and biostatistics                |
| <b>4 Muhammad Salman Rashid:</b> | Wrote the full article                           |
| <b>5 Nighat Shafi:</b>           | Read & corrected the proof of the article        |
| <b>6 Hira Anjum:</b>             | Data collection & proof reading                  |