

## EVALUATION OF POST-OPERATIVE SENSITIVITY AND SECONDARY CARIES IN POSTERIOR COMPOSITE RESTORATIONS: A 12MONTH STUDY

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### ABSTRACT

**Objective:** To evaluate post-operative sensitivity and secondary caries associated with posterior composite restoration.

**Materials and Methods:** The study involved restoration of occlusal and proximo-occlusal caries on premolars and molars of 62 patients seen at the out-patient clinic of the restorative department of the Lagos University Teaching Hospital. The restorations were completed with a micro-hybrid light curing resin composite (Unolux BCS, UnoDent, England). Following total etch procedure and use of a type 2 (5<sup>th</sup> generation/one-bottle) adhesive. The USPHSC or modified Ryge criteria was employed for direct evaluation of the restorations over the 12 month period.

**Results:** Post-operative sensitivity was 3.5% Bravo at baseline and 1.7% Bravo at 12 months. No significant change in result was recorded for post-operative sensitivity at the end of the evaluation period. 100% was recorded for the absence of secondary caries throughout the evaluation period up till the 6<sup>th</sup> month when a failed restoration scored 1.7% Bravo. At 12 months Alpha scores for secondary caries was 98.3%.

**Conclusion:** Post-operative sensitivity was kept to a minimum and there were no occurrences of secondary caries.

**Key Words:** Composite Restoration, Sensitivity, Posterior Teeth

(Accepted 24 February 2010)

### INTRODUCTION

The use of resin based composites in stress bearing areas was a cause for concern in the evolution of the practice of dentistry. Earlier materials were associated with high wear rates, inadequate marginal adaptation, secondary caries and post-operative sensitivity<sup>1,2</sup>.

Many features of resin composites have been greatly improved; wear has been reduced, colour stability has improved and handling characteristics have changed.

The improved performances of resin based composites in wear resistance and achievement of good proximal contour and contacts have also encouraged more clinicians to select them for use in posterior restorations<sup>3</sup>.

Condensable composites are also indicated for stress-bearing areas and allow easier establishment of physiological contact points in class II restorations. Research has however shown that the physical properties of packable composites are not superior to conventional hybrids<sup>3,5</sup>.

The vast improvements and the development of adhesive dentistry have further increased the

potentials for the application of resin composites including its use in posterior teeth and its acceptance in many developed countries<sup>6,7</sup>.

In Nigeria dental amalgam remains the mainstay of posterior restorations. Resin based composites are more frequently used for anterior teeth restoration<sup>8</sup>.

With the increasing demand for aesthetic dentistry and the concern for the potential toxicity of mercury, posterior resin composites were developed to replace amalgam, which has been the age-long direct, posterior filling restorative material<sup>9</sup>.

Resin based composites offer the advantage of tooth tissue conservation because retention is mainly by mechanical bonding to dentine and enamel cavity walls. They do not require removal of sound tooth tissue to accommodate bulk for retention. By bonding, the structural integrity of adjacent cuspal tissue is enhanced<sup>10,11</sup>.

Introduction of resin composite material for posterior restorations in Nigerians should be approached carefully considering differences in diet, oral habits and size of presenting lesions in this environment. Accordingly a detailed clinical review of physical, mechanical and biologic properties of resin based composites is required to highlight its performance on posterior teeth.

The clinical performance of tooth coloured resin composite material and bonding system have

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improved remarkably over the last 5 decades<sup>12,13</sup>.

The ability of composites to form a durable seal to both enamel and dentine allows modifications to cavity design such that destruction of sound tooth tissue is minimized and the performance of the restoration is enhanced<sup>14</sup>.

Bonding to tooth structure also ensures a good marginal seal with reduced chances of micro-leakage<sup>14</sup>. These properties potentially reduce dentine sensitivity and development of secondary caries.

This study seeks to evaluate the biologic performance of composite as a posterior restorative material with respect to post operative sensitivity and development of secondary caries.

## METHOD AND MATERIALS

**Patient Selection:** The inclusion criteria for the study include classes I and II caries on vital premolars and molars of adult patients presenting to the clinic. The patients were all above 16 years of age and gave informed consent. The patients had good oral hygiene. The cavities restored did not involve cusps and gingival extensions of proximal lesion were in sound enamel. The buccolingual width of cavities was no more than a third of the intercuspal apical distance.

Exclusion criteria were excessive tooth wear due to grinding or clenching habits. Patients with direct strong occlusal contact by the antagonist cusp (traumatic occlusion) were also excluded from the study.

**Restorative Materials:** The material tested is the light curing Micro-hybrid Resin Composite Unolux BCS Composite Restorative, Unodent England, Unolux Dual Bond Light/Chemical Curing Denture and Enamel Bond, Unodent England was used. This is a type 2(5<sup>th</sup> generation) adhesive used in conjunction with the total etch procedure.

Unolux BCS Flow, Unodent England is a light curing flowable composite used to line proximo-occlusal restoration prior to filling with the micro hybrid composite.

### Operative Procedures:

A dry operating field is routinely established with rubber dam. Cavity preparation were minimal and not of conventional design as with amalgam. Prior to etching of deep cavities with imminent pulpal exposure, fast setting radio-opaque calcium hydroxide cement was placed over dentine in such areas. Etching was done with 37% phosphoric acid for 15 to 20 seconds. The cavities were then rinsed copiously and air dried for 5 seconds. Bond resin was applied with applicator brushes and cured for 20 seconds. A thin tofflemire matrix was burnished into tight contact with the adjacent proximal surface in proximo-occlusal lesions at this stage. Unolux BCS

micro-hybrid composite was then placed into the cavity in an oblique layering technique. Each increment was cured for 40 seconds. The final layers are shaped to form the occlusal structure before curing. Class II lesions were additionally cured from the buccal and lingual aspects for 40s each after removal of the matrix band.

The restorations were finished occlusally with tapered white polystone finishing burs. Aluminum oxide/zirconium silicate finishing strips were used inter proximally. Aluminum oxide paste and rubber cup run on a slow speed hand piece was used to polish the finished restoration under a jet of water.

Following the occlusal adjustment, the external surfaces of the restorations were further cured for 40s.

Table 2 shows the number of restorations examined using the USPHS criteria at different assessment times and the results.

### Clinical Evaluation:

The restorations were evaluated by the authors utilizing the United States Public Health Service criteria or modified Ryge criteria for direct evaluations.

The USPHS criterion has been described as the preferred system for the evaluation in vivo of the physical, mechanical and biologic characteristics of direct resin composite restorations as was being undertaken in this study<sup>15</sup>.

The USPHS has also been described as a sensitive rating system for long-term observation of posterior composite restorations<sup>16</sup>.

The evaluators were calibrated in the technique. They utilized a dental mirror and probe, compressed air jet and magnification.

Radiographical assessments were done at 12 months to further assess for caries development. Evaluations were carried out on completion of the restoration (baseline), at one week, six weeks, 3 months, 6 months and 12 months. The following characteristics were assessed, secondary caries and post-operative sensitivity.

## RESULTS

74 direct resin composite were placed in cavities of posterior teeth of 62 patients at the start of the study. 58 restorations on 47 patients were available for assessment at 12 months.

More restorations were recorded on molars, class I 21(36.2%) and class II 16(27.6%). More restorations were also recorded in females. Table 1 also shows that there was no class I premolar restorations in the study.

A 96.5% Alpha score was recorded at baseline for post-operative sensitivity. At 12 months post-operative sensitivity was 98.3% Alpha (Table 2).

A 100% alpha score was recorded for the absence of

secondary caries at baseline till the sixth month, at which time a bravo score of 1.7% was recorded but this was due to a failed restoration.

**Table 1: Distribution of Restorations on Tooth type and Cavity type.**

	Class I		Class II		Total
	Molars	Premolars	Molars	Premolars	
<b>Males</b>	8(13.8%)	0(0%)	9(15.5%)	5(8.6%)	<b>22(37.9%)</b>
<b>Females</b>	13(22.4%)	4(6.9%)	7(12.1%)	12(20.7%)	<b>36(62.1%)</b>
<b>Total</b>	<b>21(36.2%)</b>	<b>4(6.9%)</b>	<b>16(27.6%)</b>	<b>17(29.3%)</b>	<b>58(100%)</b>

**Table 2: Post-Operative Sensitivity ratings at baseline and 12months.**

	Baseline	12months
<b>Alpha</b>	56	57
<b>Bravo</b>	2	1
<b>Total</b>	58	58

**Table 3: Post-Operative Sensitivity Ratings for Cavity and tooth type.**

	Molars		Premolars		Total
	Class I	Class II	Class I	Class II	
<b>Alpha</b>	21	14	4	17	56
<b>Bravo</b>	0	2	0	0	2
<b>Total</b>	<b>21</b>	<b>16</b>	<b>4</b>	<b>17</b>	<b>58</b>

**Table 4: Secondary Caries ratings at Baseline and 12months.**

	Baseline	12months
<b>Alpha</b>	58	57
<b>Bravo</b>	0	1
<b>Total</b>	<b>58</b>	<b>58</b>

**Table 5: Secondary Caries ratings for Cavity and tooth type.**

	Molars		Premolars		Total
	Class I	Class II	Class I	Class II	
<b>Alpha</b>	21	15	4	17	57
<b>Bravo</b>	0	1	0	0	1
<b>Total</b>	<b>21</b>	<b>16</b>	<b>4</b>	<b>17</b>	<b>58</b>

## DISCUSSION

Post-operative sensitivity was experienced by two patients, right from the time of placement of their restorations in this study. One case resolved after a week and the other complained of sensitivity to cold drinks at six weeks. Both were class II molar restorations (Tables 2 and 3). A third case complained of sensitivity well after 6 weeks, the patient was

however lost to review.

Post-operative sensitivity has been related to the dentine adhesives' ability to seal up open dentinal tubules rather than to the effects of polymerization shrinkage on cuspal deflections and marginal adaptation as was generally believed<sup>5</sup>.

Polymerization shrinkage is also one of the main concerns when placing direct, posterior, resin-based composite restorations. Evolving improvements of the material, dental adhesives, filling and light curing techniques have improved adaptation of the resin-composites to dentin and reduce enamel micro-cracks. Thus, marginal discolouration, recurrent caries and post-operative sensitivity are reduced and the longevity of these restorations improved<sup>3</sup>.

At the end of the one-year evaluation period, none of the teeth in this study showed radiographic or clinical evidence of secondary caries. However a restoration, which failed due to bulk fracture at 6months, was rated Bravo for secondary caries from 6months. Long-term clinical studies have shown longevity of posterior composite restoration with very low secondary caries rate and a high percentage of correct anatomical form indicating the clinical safety of the material as a posterior restorative material<sup>16</sup>.

Lundin and Rasmuss<sup>12</sup> were able to demonstrate at least one failed restoration due to the development of secondary caries at 24months in their study.

They found secondary caries is the main reason for failure of composite restorations especially in a general practice clientele. This suggests that carefully controlled patient and case selection may yield good results.

In this study, the authors recorded failure of one restoration due to bulk fracture at about six months. The restoration showed all signs of deterioration compared with others within the first week.

Yip et al<sup>4</sup> Using the USPHS modified Ryge criteria to evaluate the restorations, were able to demonstrate that the clinical performance of a conventional hybrid resin-based composite at 12-months was satisfactory as a restorative material in posterior permanent teeth. Wilson et al<sup>9</sup> were also able to conclude after a one year evaluation that resin

restorations used in conjunction with the recommended adhesive system may be an appropriate alternative to amalgam in the restoration of posterior teeth.

Shaba<sup>8</sup> was able to demonstrate a hundred percent success rate after a two-year evaluation of posterior resin composite restorations in Nigerians.

## CONCLUSION

Post-operative sensitivity was kept to a minimum and there were no occurrences of secondary caries.

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