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A Clinical Evaluation Of The Performance Of 3 Resin Based Composites In Posterior Restortion-An Invivo Study

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ABSTRACT

The aim of this study was to evaluate the performance of 3 different composites: Packable, Microhybrid and Nanohybrid as a posterior restorative material in class 1 carious lesion. The purpose was to evaluate and compare the clinical behaviour under the following criterias : Color match, Cavosurface marginal discoloration, Secondary caries, Anatomic form (wear), Marginal adaptation and Post operative sensitivity. 60 class 1 lesions were restored , 20 each with packable composite, microhybrid composite and nanohybrid composite. Patients with class 1 carious lesions in permanent molars were selected. The assessment were done according to USPHS criteria. It was then concluded that all materials showed satisfactory results as far as retention was concerned. But the marginal integrity and appearance of Filtek ™ Z350 was better.

Keywords: *Composite Restoration, Secondary Caries, Marginal adaptation.*

1. INTRODUCTION

For decades, the use of tooth colored restorative materials in posterior teeth was limited due to lack of appropriate material strength and resistance required during mastication. Amalgam and gold restorations were the accepted standard for posterior rehabilitation, with well reproduced contour and highly polished surfaces. Tarnish and corrosion were the major disadvantages of gold restorations, and amalgam restorations faced the problem of micro leakage and mercury toxicity.

During the last decade, composite resins have been used much more frequently in the posterior region. This has focused attention on composite resins, which possess several advantages.

- Composite resins are not only acceptable in appearance, but are also mercury-free, corrosion resistant and thermally nonconductive.
- Further, evidence exists indicating that composite resins enhance the fracture resistance of adjacent tooth structure.
- Complete control over the working time of the material is highly beneficial.
- Minor defects that may develop can be repaired without replacement of the complete restoration.

Until a few years ago, posterior esthetic materials and technique could not compete with amalgam and gold because of their biological and physicochemical shortcomings. Durability of esthetic restorations was limited by marginal degradation, wear and mechanical failure. Fortunately, recent improvements in the physicochemical properties and development of new techniques have made possible the use of these materials in posterior teeth.

The objective of this study was to evaluate the clinical performance of three different composite resins placed in occlusal cavities of posterior permanent teeth.

AIMS AND OBJECTIVES

The aim and objective of the present study was to clinically evaluate and compare the performance of three different posterior composite restorative materials:

Packable – Filtek P60 (3M ESPE)

Microhybrid – Filtek Z250 (3M ESPE)

Nanohybrid – Filtek Z350 (3M ESPE)

In class I carious lesion based on following criteria:

- Colour match
- Cavosurface marginal discoloration
- Secondary caries
- Anatomic form (wear)
- Marginal adaptation
- Post operative sensitivity

The assessment were done according to USPHS criteria.

2. MATERIALS AND METHODS

- Patients having class-I carious lesions in permanent molars were selected from all those visiting the OPD of Department of Conservative Dentistry and Endodontics.
- The chief complaint of these patients was either undesirable discoloration of teeth, sensitivity, mild pain or food lodgement in teeth.
- Most of the patients selected were young adults with good oral hygiene with no significant medical history.

Clinical technique

1. **Shade selection -** Shade selection was done before isolation under natural illumination prior to the restorative procedure while the teeth were hydrated.

2. **Isolation** - To achieve the optimal results of composite restoration, rubber dam isolation was carried out.

3. **Adhesive cavity design -** Conservative cavity preparation was carried out according to the requirements of the adhesive technique. Carious dentin was removed using slow and high speed carbide burs and spoon excavators.

4. **Cleaning of the cavity -** The cavity was thoroughly washed, dried and inspected for any debris and freshly cut enamel and dentin were cleaned with water spray. Final cavity cleaning was done with Pumice and an occlusal bristle brush.

5. **Pulp Protection** - The pulp protection procedures were carried out depending on the depth of the cavities and were conducted according to the following specific protocol:

6. **Conditioning of enamel and dentin -** The enamel of the prepared cavity was etched for 15 seconds and the dentin for 20 seconds with 35% phosphoric acid gel, followed by rinsing with water for 10 seconds.

7. **Application of the bonding agent -** A single bond 2 bonding agent was used for all three FILTEK P60, FILTEK Z250 and FILTEK Z350.

8. **Placement of the composite** - The necessary amount of restorative material was dispensed from the syringe onto the mixing pad by turning the piston of the dispensing syringe slowly in a clockwise manner. FILTEK P60, FILTEK Z250 and FILTEK Z350 was applied with a non-metallic instrument, restorative material was placed into the cavity in increments which were not thicker than 2.5mm each.

9. **Finishing, checking the occlusion, polishing -** After removal of rubber dam, the patient was asked to perform passive closure and then centric, protrusive and lateral excursions. Contouring and immediate finishing of the restoration was done with fluted finishing burs or diamonds. Initial occlusal anatomy was established with no.245 bur and final defined anatomy with a 12 fluted bur and for the final finishing of the restoration finishing stone was used.

The restored teeth were thus divided into three groups.

Group-1: Restored with Packable – Filtek P60 (3M ESPE)

Group-2: Restored with Microhybrid – Filtek Z250 (3M ESPE)

Group-3: Restored with Nanohybrid - Filtek Z350 (3M ESPE)

3. OBSERVATION AND RESULTS

For this study 60 class I lesions were restored, 20 each with packable composite (FILTEK™ P60), microhybrid composite (FILTEK™ Z250) and nanocomposite (FILTEK™ Z350) light cure composite materials.

Assessment was made and recorded at the time of placement and 1 week, 15 days, 1 month, 3 month and 6 months thereafter.

The criteria used for assessment were post operative sensitivity, color match, marginal discoloration, secondary caries, anatomic form and marginal adaption according USPHS criteria.

The following results were obtained and summarized:

Table No.I: showing assessment of "FILTEK™ Z250" Restorations after placement and at 3 months and at 6 months period.

(Results given as percentage of the teeth examined)

Sr. No.	Type of assessment	Immediately after placement (n=20)%	3 months after placement (n=20)%	6 months after placement (n=20)%
1.	COLOUR MATCH			
	A	100% (20)	65%(13)	60%(12)
	B	-	35%(07)	40%(08)
	C	-	-	-
	D	-	-	-
2.	MARGINAL DISCOLOURATION			
	A	100% (20)	95%(19)	85%(17)
	B	-	05%(01)	15%(03)
	C	-	-	-
3.	SECONDARY CARIES			
	A			
	B	100% (20)	100%(20)	100%(20)
		-	-	-
4.	ANATOMIC FORM (WEAR)			
	A			
	B	100% (20)	100%(20)	90%(18)
	C	-	-	10%(02)
		-	-	-
5.	MARGINAL ADAPTATION			
	A			
	B	100% (20)	95%(19)	85%(17)
	C	-	05%(01)	15%(03)
		-	-	-

Table No. II: showing assessment of "FILTEK™ P60" Restorations after placement and at 3 months and at 6 months period.

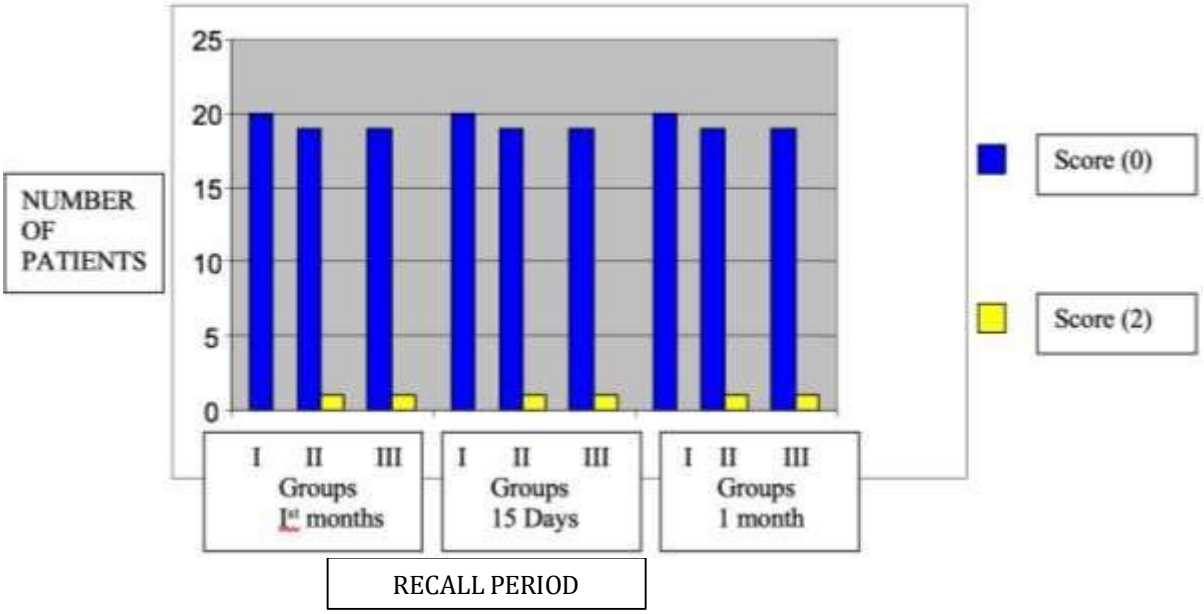
(Results given as percentage of the teeth examined)

Sr. No.	Type of assessment	Immediately after placement (n=20)%	3 months after placement (n=20)%	6 months after placement (n=20)%
1.	COLOUR MATCH			
	A	100% (20)	70%(14)	60%(12)
	B	-	30%(06)	40%(08)
	C	-	-	-
	D	-	-	-
2.	MARGINAL DISCOLOURATION			
	A	100% (20)	100%(20)	80%(16)
	B	-	-	15%(03)
	C	-	-	05%(01)
3.	SECONDARY CARIES			
	A			
	B	100% (20)	100%(20)	100%(20)
		-	-	-
4.	ANATOMIC FORM (WEAR)			
	A			
	B	100% (20)	90%(18)	80%(16)
	C	-	10%(02)	15%(03)
		-	-	05%(01)
5.	MARGINAL ADAPTATION			
	A			
	B	100% (20)	100%(20)	85%(17)
	C	-	-	10%(02)
		-	-	05%(01)

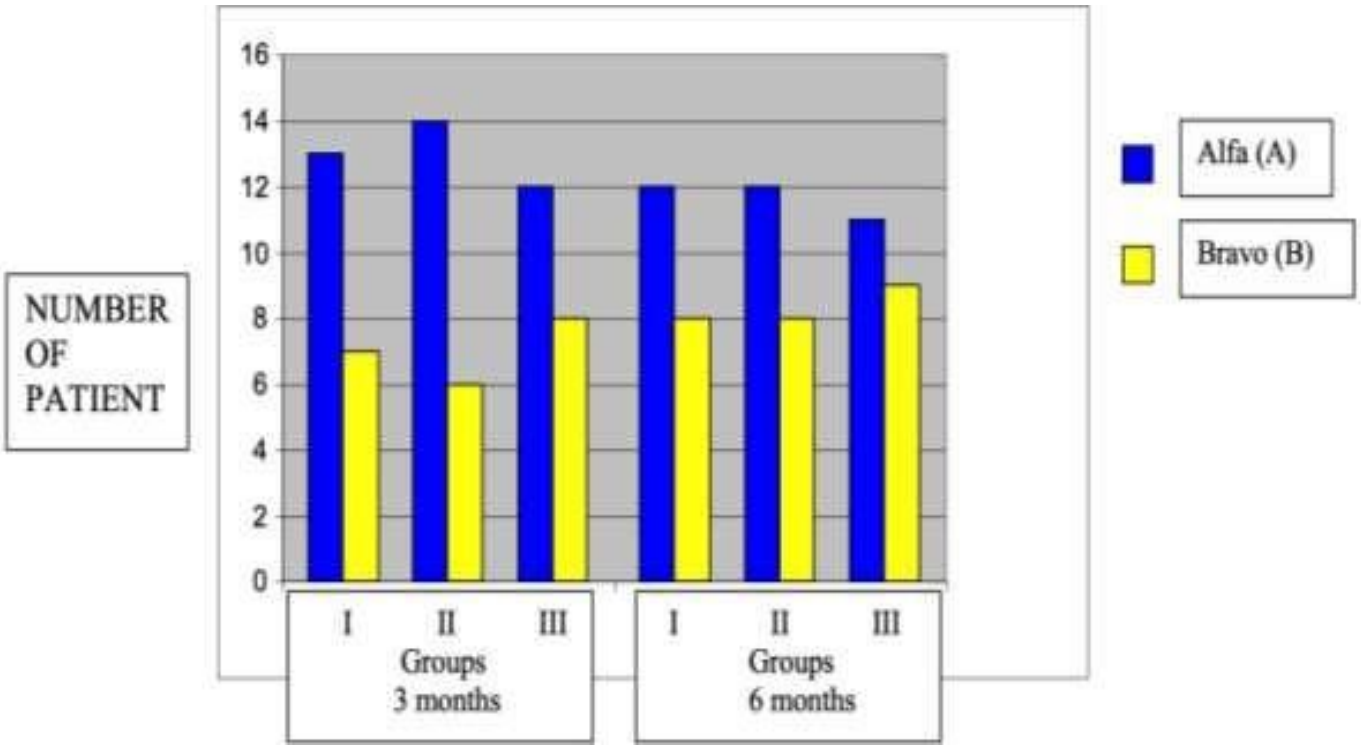
Table No. III: showing assessment of "FILTEK™ Z350" Restorations after placement and at 3 months and at 6 months period.

(Results given as percentage of the teeth examined)

Sr. No.	Type of assessment	Immediately after placement (n=20)%	3 months after placement (n=20)%	6 months after placement (n=20)%
1.	COLOUR MATCH			
	A	100% (20)	60%(12)	55%(11)
	B	-	40%(08)	45%(09)
	C	-	-	-
	D	-	-	-
2.	MARGINAL DISCOLOURATION			
	A	100% (20)	100%(20)	95%(19)
	B	-	-	05%(01)
	C	-	-	-
3.	SECONDARY CARIES			
	A			
	B	100% (20)	100%(20)	100%(20)
		-	-	-
4.	ANATOMIC FORM (WEAR)			
	A			
	B	100% (20)	100%(20)	90%(18)
	C	-	-	10%(02)
		-	-	-
5.	MARGINAL ADAPTATION			
	A			
	B	100% (20)	100%(20)	85%(17)
	C	-	-	15%(03)
		-	-	-

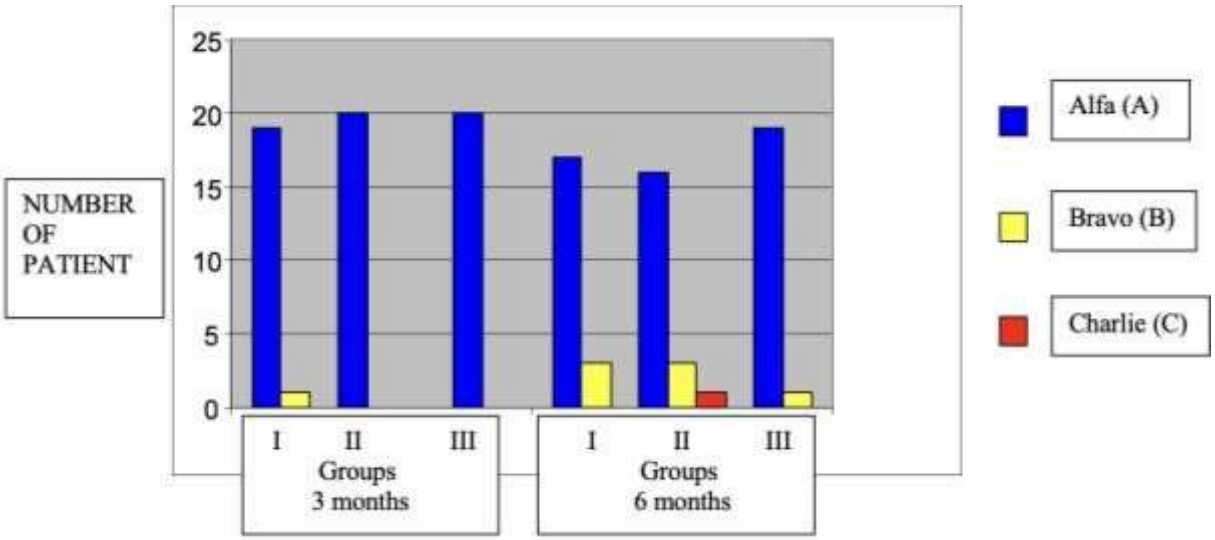


Graph representing number of patients exhibiting postoperative sensitivity out of 60 in each group at 1 week, 15 days and 1 month recall period in group I (microhybrid) , group II (packable) and group III (nano).



RECALL PERIOD

Graph representing number of patients exhibiting colour match out of 60 in each group 3 months and 6 months recall period in group I (micro hybrid), group II (packable) and group III (nano composite).



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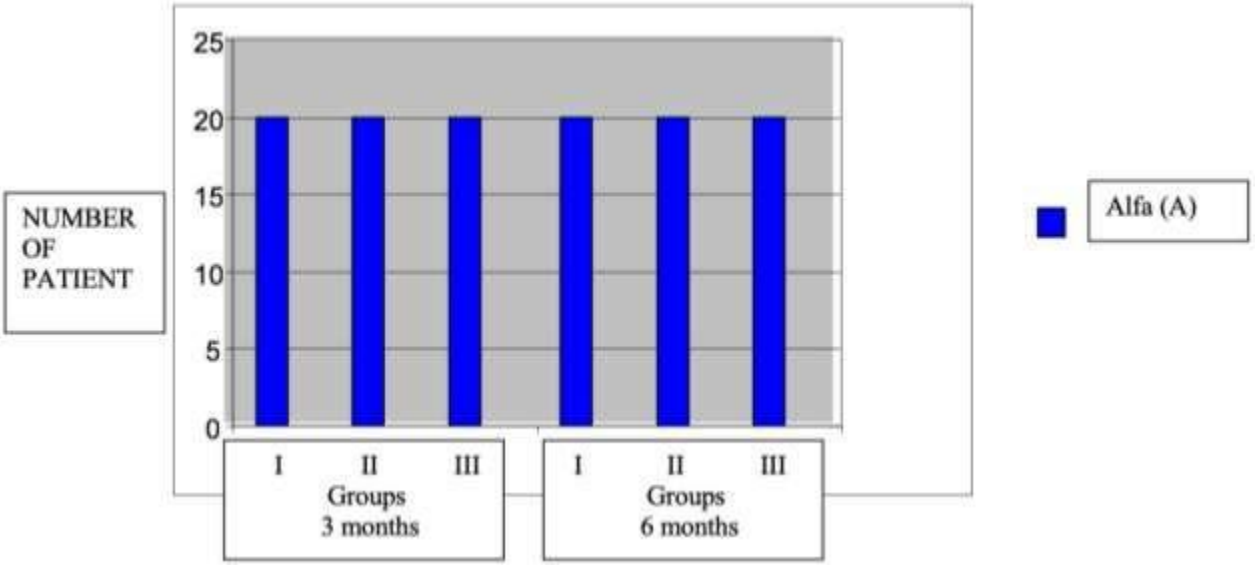
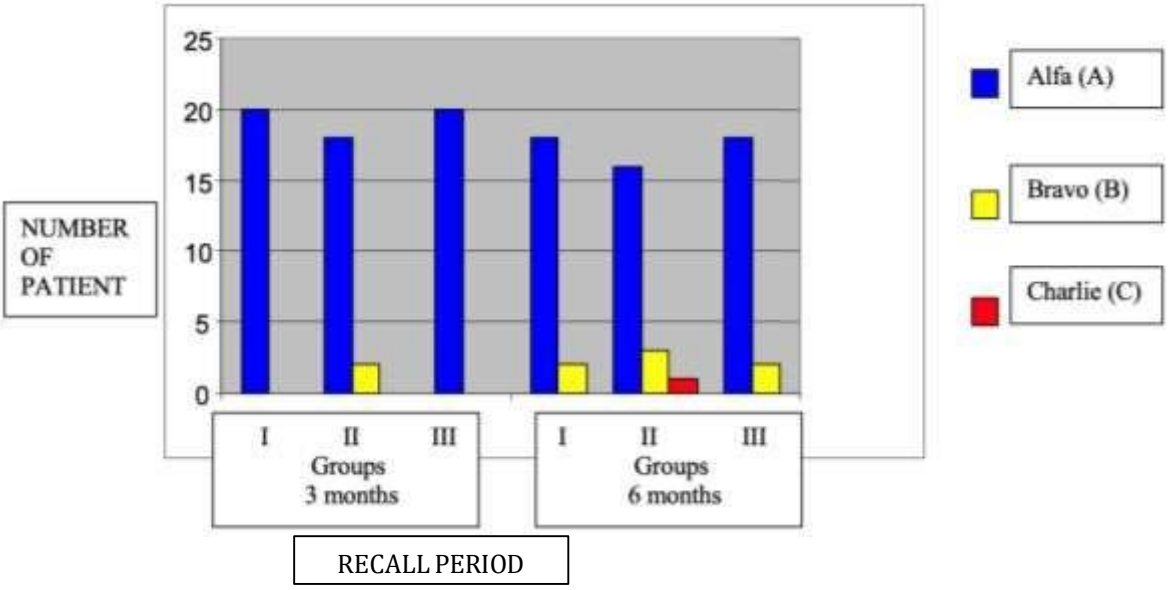
Graph representing number of patients exhibiting marginal d iscoloration out of 60 in each group at 3 months and 6 months recall period in group I (micro hybrid), group II (packable) and group III (nano composite).

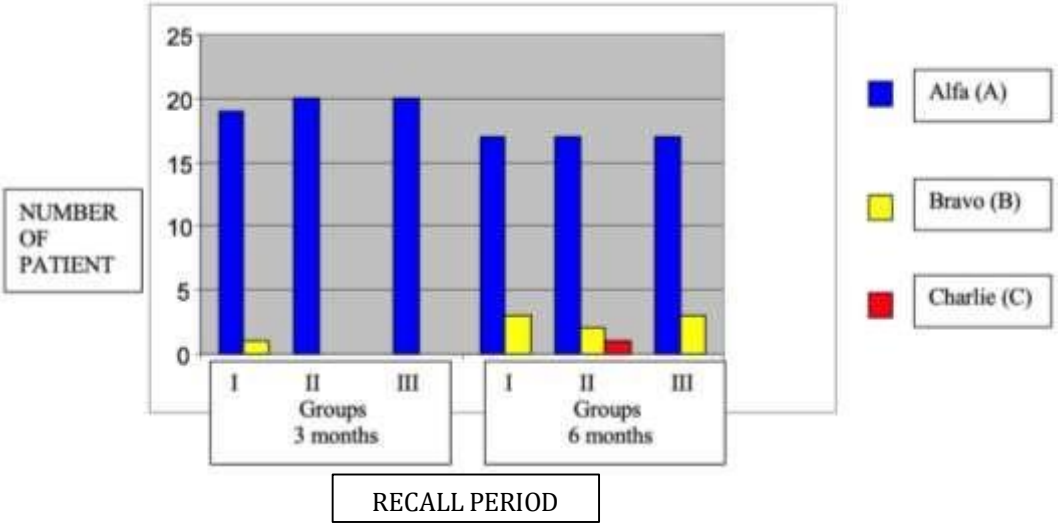


RECALL PERIOD

Graph representing number of patients exhibiting secondary caries out of 60 in each group 3 months and 6 months recall period in groupI (micro hybrid), group II (packable) and group III (nano).



Graph representing number of patients exhibiting anatomic form out of 60 in each group 3 months and 6 months recall period in group I (micro hybrid), group II (packable) and group III (nano).



Graph representing number of patients exhibiting marginal adaptation out of 60 in each group at 3 months and 6 months recall period in group I (micro hybrid), group II (packable) and group III (nano composite).

4. DISCUSSION

Resin composite technology has undergone major developments over the last two decades.

In vitro studies might provide useful data regarding the potential performance of a material; however such tests cannot adequately evaluate the clinical performance of a material or the handling characteristics.

In the recent years, there has been emphasis on relatively short-term studies to provide an early prediction of long-term clinical performance. The complexity of some masticatory system variables like temperature changes, occlusal stress and pH alterations makes reproduction of oral physiology difficult. Therefore, the clinical environment is the best medium to assess dental materials or restorative techniques.

In this study, class I carious lesions were restored with:

(I) Packable composite – Filtek™ P60 (3M ESPE)

(II) Microhybrid composite – Filtek™ Z250 (3M ESPE)

(III) Nanocomposite –Filtek™ Z350 (3M ESPE)

The purpose of this study was to evaluate and compare the clinical behaviour of these three materials under the following criteria:

- Post operative sensitivity
- Colour match
- Cavosurface marginal discoloration
- Secondary caries
- Anatomic form (wear)
- Marginal adaptation

Postoperative sensitivity:

In the present study 4% of restorations showed transitory postoperative sensitivity. Of these, one restoration was done using Filtek™ P60 and one restoration was done using Filtek™ Z350.

The low incidence of postoperative sensitivity was probably due to use of well cutting burs under abundant irrigation with cold water spray, rubber dam isolation, insertion of a liner material on deep cavities, careful drying of dentin, incremental placement of the resin composite (not thicker than 2.5 mm), polymerization technique with QTH curing light for 20seconds for each increment by exposing its entire surface to a high intensity light source and occlusal adjustment.

Colour match:

The evaluated materials showed satisfactory results with regard to colour match. Appearance of 12 (20) restorations of

Filtek™ P60, 12 (20) restorations of Filtek™ Z250 and 11 (20) restorations of Filtek™ Z350 was excellent after 6 months. There was no statistically significant difference among any of the groups tested.Although Color matching ability of all the three materials was found to be clinically acceptable, restorations restored with Filtek 350 showed more consistent color matching over a period of 6 months. 70% of class I restorations restored with Filtek 350 received Alfa (A) rating after 6 months evaluation period. These results were similar to the one obtained by Schirrmeister JF et al.

Marginal discolouration:

In the present study score B was attributed to 7 restorations (11%) which was considered acceptable according to American Dental Association specifications, which also specifies that even if more than 10% of the restorations exhibit a rating of C (clinically unacceptable) either 3 or 5 years after placement it can be considered to be clinically satisfactory.In the present study Filtek P60 higher marginal discolouration then Filtek Z250 and Filtek Z350 but these results are not statistically significant. Marginal discolouration in restorations was probably due to pooling of adhesive at the margins of the restorations or due to the presence of remnants of preexisting amalgam restorations and stains at margin.

Secondary caries:

In the present study the clinical success was obtained by the absence of secondary caries. This was probably due to adequate restorative technique and the good oral hygiene of the patients, who had received oral health motivation at the beginning of the study.

Anatomical form (Wear):

A tendency of wear was observed in all three groups (Filtek P60, Filtek Z250 and Filtek Z350), although there was no statistically significant difference between the groups. This fact could be explained by the lower concentration of inorganic filler in the microhybrid resin composite. The packable resin composite (Filtek™ P60) and nanocomposite (Filtek™ Z350) present a higher percentage of filler and smaller inorganic particles providing an increased wear resistance.

5. CONCLUSION

Based on the results obtained in this study, all the three materials showed satisfactory results, as far as retention is concerned. But the marginal integrity and appearance of Filtek ™ Z350 and Filtek ™ Z250 were better compared to Filtek ™ P60 restoration. However, the difference was statistically insignificant. All the three materials exhibited slight surface wear, but the roughness could be removed on polishing. No any significant post operative sensitivity was recorded in any restoration.

It is also necessary to emphasize that the timeframe for this study was not of such a duration to indicate long term suitability of tested materials; it may provideprofession meaningful information regarding the early changes in restorative materials that could predict their future performance.

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