

A comparative evaluation and assessment of direct anterior composite restoration performed by dental students using different techniques- An in vivo prospective study

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Abstract

Background: Restorative dentistry and esthetics have become a very integral discipline in dentistry. With the increasing use of composite resins for restoration, the techniques and implementations of the same in anterior teeth restorations is of prime importance.

Aim: The aim of the study is to assess and evaluate the quality of anterior composite restoration using different techniques performed by dental students

Materials and Method: 40 patients requiring anterior composite restorations were selected. Cavity preparation for anterior restoration was done and patients were divided in two groups. Group 1 (n=20) were treated with convention technique for composite restoration. Group 2

(n=20) were treated with newer technique for composite restoration. The final restorations were assessed based of the clinical and radiographic criteria and evaluated.

Statistical Analysis: Applied Chi square test

Results: After assessment based on tooth-restoration interface, color, contact point, gap and contour and the difference between both groups was found non-significant.

Conclusion: It can be concluded that irrespective of any technique the important aspect is the implementation and mastering the skill to provide satisfactory restorations which are not only esthetically pleasing but also long lasting and functional.

Keywords: Anterior Teeth, Composite, Esthetics, Techniques.

Introduction

Restorative dentistry being one of the main disciplines with esthetic at the center, can range from noninvasive to more invasive approaches. And anterior teeth are subjected to trauma, carious and non-carious lesions require treatment.^{1,2}

With composite resin arriving, retention and longevity of restorations owing to marginal leakage, shrinkage and wearability remain a concern. Although for the stability of restoration both tooth related factors and type of technique play a role.²

Direct restorations provide a reliable treatment to replace the lost dental structure, with a low cost, less sound dental structure removal and also good clinical performance when compared to indirect restorations. Amalgam is used to be considered the best restorative material for posterior teeth with a declined use owing to esthetic reasons and potential mercury toxicity. In 1990's, composite resin was the material of choice for anterior restorations to the fulfill the esthetic expectations of patients. With indications for use in posterior restorations but in small occlusal or occluso-proximal cavities and with little occlusal function and in premolars. In recent years, with the patient demands for non metallic restoration, the use of composite has become more common not only for esthetic reasons but also for posterior teeth.

The currently available universal composites, microhybrid, nanohybrid or nano-particulate, present volumetric shrinkage lower than 4%, mechanical strength, polishability, polish retaining and wear resistance. Such improvements associated to the state-of-the-art placement technique have led to a clinical behavior comparable to that of amalgam restorations³

Failure of a restoration may be due to major defects like fracture of restoration or tooth structure or may be due to minor defects such as marginal deficiencies, staining or microleakage. The factors in the clinical outcome type of enamel/dentin conditioning; type of resin composite; operative technique: beveling of enamel, absolute v/s relative isolation, number of composite layers are specifically evaluated.

The development of composite resins with superior mechanical properties and excellent polishability allows the clinician to mimic the natural dentition and provide a long lasting restoration to the patient. One of the benefits of composite resin restoration is the conservation of tooth structure and time factor. Recent aesthetic composite resin materials with similar physical and mechanical properties to that of the natural tooth and an appearance like natural dentin and enamel offer a wide range of shades and opacities designed specifically for layering technique¹⁰

Material and Methods

- An examination tray containing a mouth mirror, probe and a cotton forceps
- Materials and instruments required for composite restoration
- Matrix bands and wedges
- An anaesthesia equipment consisting of a syringe needle;
- A VITA shade guide for shade selection;
- A rubber dam kit
- Polishing kit

Inclusion Criteria

- Patients were selected from the Department Of Conservative Dentistry and Endodontics of Narsinhbhai Patel Dental College and Hospital, Visnagar.
- GV black's Class III and IV carious teeth for anterior permanent teeth

- Permanent teeth with midline diastema
- All other anterior permanent teeth requiring anterior composite restoration
- Healthy periodontal tissues

Exclusion Criteria

- Amelogenesis imperfecta
- Dental fluorosis
- Grade 2,3 mobile teeth
- Traumatic occlusion
- Patient allergic to the materials used in the study

Examination Criteria

Clinical Examination

- Tooth restoration interface and gingival health
- Color or translucency difference between the filling and the tooth structure
- Established contact point

Radiographic Examination

- Visible gap
- Over/under contour restoration

Examination Criteria

The restoration was rated good if

➤ **Clinically**

- The contour of restoration is in line with the tooth morphology
- No color difference and/or translucency difference between the filling and the adjacent dental structure
- Restoration did not impinge the gingiva

➤ **Radiographically**

- No visible gap seen
- Restoration followed the natural tooth anatomy and not over/under contoured

The restoration is rated “Not good” if:

Clinically

- The filling contour was not line with the tooth morphology

- There was a visible color difference and/or translucency between the filling and the adjacent dental structure
- Restoration did impinge on the gingiva.

Radiographically

- There was visible gap seen
- Restoration was over/undercontoured

Methodology

- The selection of patients was done in the Department Of Conservative Dentistry And Endodontics at Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat
- Patients were informed and explained about the study and written consent was taken from each patient.
- Patient data and personal details were recorded.
- Preoperative radiographs were taken, anaesthesia if required was administered and rubber dam was applied.
- Cavity preparation was done and restoration was completed dividing them into two categories according to the two types of techniques used in the study.
- Finishing and polishing was completed and postoperative radiographs were taken Patients were informed about the follow-up visit for examination
- Results were recorded and examined

Result

- Table 1: Distribution of study subjects based on group and tooth restoration interface.

Stress	Good N (%)	Not Good N (%)	Total N (%)	p value
Group 1	9 (45%)	11 (55%)	20 (100%)	> 0.05
Group 2	12 (60%)	8 (40%)	20 (100%)	
Total	21 (52.5%)	19 (47.5%)	40 (100%)	

Table 1 and Graph 1: Shows distribution of study subjects based on group and tooth restoration interface. Out of 20 study subjects among group 1, 9 (45%) were rated good and 11 (55%) were rated not good. Out of 20 study

subjects among group 2, 12 (60%) were rated good and 8 (40%) were rated not good. Statistically, significant difference was not observed among groups in respect to tooth restoration interface. ($p>0.05$)

Table 2: Distribution of study subjects based on group and color.

Stress	Good N (%)	Not Good N (%)	Total N (%)	p value
Group 1	11 (55%)	9 (45%)	20 (100%)	> 0.05
Group 2	11 (55%)	9 (45%)	20 (100%)	
Total	21 (52.5%)	19 (47.5%)	40 (100%)	

Table 2 and Graph 2: Shows distribution of study subjects based on group and color. Out of 20 study subjects among group 1, 11 (55%) were rated good and 9 (45%) were rated not good. Out of 20 study subjects among group 2, 11 (55%) were rated good and 9 (45%) were rated not good. Statistically, significant difference was not observed among groups in respect to color. ($p>0.05$)

Table 3: Distribution of study subjects based on group and contact point.

Stress	Good N (%)	Not Good N (%)	Total N (%)	p value
Group 1	8 (40%)	12 (60%)	20 (100%)	> 0.05
Group 2	12 (60%)	8 (40%)	20 (100%)	
Total	21 (52.5%)	19 (47.5%)	40 (100%)	

Table 3 and Graph 3: Shows distribution of study subjects based on group and contact point. Out of 20 study subjects among group 1, 8 (40%) were rated good and 12 (60%) were rated not good. Out of 20 study subjects among group 2, 12 (60%) were rated good and 8 (40%) were rated not good. Statistically, significant difference was not observed among groups in respect to contact point. ($p>0.05$)

Table 4: Distribution of study subjects based on group and visible gap.

Stress	Good N (%)	Not Good N (%)	Total N (%)	p value
Group 1	8 (40%)	12 (60%)	20 (100%)	> 0.05
Group 2	11 (55%)	9 (45%)	20 (100%)	
Total	21 (52.5%)	19 (47.5%)	40 (100%)	

Table 4 and Graph 4: Shows distribution of study subjects based on group and visible gap. Out of 20 study subjects among group 1, 8 (40%) were rated good and 12 (60%) were rated not good. Out of 20 study subjects among group 2, 11 (55%) were rated good and 9 (45%) were rated not good. Statistically, significant difference was not observed among groups in respect to visible gap. ($p>0.05$)

Table 5: Distribution of study subjects based on group and over/under counter.

Stress	Good N (%)	Not Good N (%)	Total N (%)	p value
Group 1	8 (40%)	12 (60%)	20 (100%)	> 0.05
Group 2	13 (65%)	7 (35%)	20 (100%)	
Total	21 (52.5%)	19 (47.5%)	40 (100%)	

Table 5 and Graph 5: Shows distribution of study subjects based on group and over/ under counter. Out of 20 study subjects among group 1, 8 (40%) were rated good and 12 (60%) were rated not good. Out of 20 study subjects among group 2, 13 (65%) were rated good and 7 (35%) were rated not good. Statistically, significant difference was not observed among groups in respect to over/ under counter. ($p>0.05$)

Discussion

The success of all esthetic restorations depends on the overall criteria of shade, integration of shape, surface texture, biological, functional, esthetic durability, strength of the restoration individually and in correlations with the adjacent surrounding and supporting structures. There is clearly an increasing demand for aesthetic dental

restorations; the creation of perfect direct restorations has long been an elusive goal because of the imperfect optical properties of composite resins and also because of improper clinical procedures.³

Basically a successful composite restoration depends on the operating as well as the working procedures². The purpose of the present study was to compare and evaluate the composite restorations done by two different techniques, and hence provide an improved technique better suited for composite restorations in anterior teeth.

In the conventional technique, where the use of transparent matrix and wedges has some disadvantages, the newer technique proves to be quite useful, given that the newer systems also have certain disadvantages.

For the conventional technique, due to the movement of the wedge, the transparent matrix may deform, causing it to alter the final results, however it proves to be quite challenging for the students to stabilize the matrix without the help of wedges. Moreover, because filling the space between the matrix and the tooth at the cervical level of the emergence profile with material is laborious and instrument handling is difficult.² For this reason, study carried out by Kaboré W et al 40.9% of carried out restorations were not in the tooth emergence profile.¹

For the newer technique, stabilization of the matrix band proved to be challenging. Without the use of wedge, the band was stabilized using the gingival barrier. Restoration of the tooth with such arrangement proved to be difficult, although the end results have a better marginal integrity compared to the conventional technique.

The anterior composite restoration was evaluated based on different clinical and radiographic criteria and were designated as good or not good based on the fulfillment of those. The criteria included tooth restoration interface,

color, contact point, visible gap and contour of the restorations.

For any composite restoration obtaining a quality interface also remains a big challenge. Only following a rigorous operating protocol can optimize this key area.¹ Various studies done by Kaboré W et al and many more have shown that the interface is of key importance as it can determine the longevity of the restorations, as if the interface is not smooth or in alignment with the anatomy of the tooth, secondary caries could result. For the present study in respect to these criteria the results were not statistically significant.

As per the studies by Z. A. Ijaimi et al³ maintaining a shade match to the tooth over time is important for clinical success. Color mismatch within the range of tooth shade was the most frequently found. Special attention should be given to matching the color of the natural tooth with the composite material. The shade of the tooth should be determined before the teeth are subjected to any prolonged dehydration, because dehydrated teeth become lighter in shade as a result of a decrease in translucency. Optical properties of resin composites change with time, especially related to surface degradation and chemical reaction of the tertiary amine accelerator³. The results of the present study are in agreement with these studies as there were color mismatch seen with teeth restored by both techniques, but the comparison of both was statistically insignificant.

The inference of all investigations involving margins is with regards to sensitivity and dental caries. With that in mind, gap free margins have been measured often in multiple studies⁸. For the present study the radiographic difference for both techniques was not statistically significant.

For the contour, studies by Goyal A et al and many others have concluded that direct composite restorations can be considered aesthetic, functional, and stable restorations in patients with favorable occlusion.¹⁰ Proper contouring, finishing and polishing steps must be done using appropriate sequenced protocol.

The studies by Ghada A et al¹⁵ and many others state that importance of these step is for the accomplishment of resin composite anterior restorations as a key component to the long-term success of bonded restorations, and its direct effect is on the final esthetic outcome of the restorations.

And after evaluating the criteria and results by both techniques it is quite clear that the success of an anterior composite restoration also lies in the hand of a skilled operator. Apart from the techniques used in the present study, there are many other techniques used all around, while all techniques have their pros and cons, the mutual goal is to produce an anatomically, functionally and esthetically pleasing as well as long lasting restoration for the benefit of the patients.

Conclusion

Today, composite materials allow clinicians to realize restorations on a high esthetic level while being minimally invasive, affordable to patients, and long lasting. In addition, the associated risk level over time is low and manageable. Re-intervention is relatively easy and cheap, and fractures or defects that may appear in time are repairable without the necessity to remake the whole restoration, which provides conservative and financial advantages for patients.¹⁶

Nevertheless, with the instruments and guides that have been analyzed in many studies, the stratification technique can be key to the long-term success of the restoration from both a clinical and esthetic point of view.

This enables the clinician to avoid short-term disappointments that require re-facing and a waste of time be it with any type of techniques¹¹.

This study shows that the quality of restorations depends on a rigorous implementation. Students are able to perform satisfactory restorations. However, mastering composite restorations protocols by strengthening teaching with the integration of new layering and placement techniques on one hand and preclinical and clinical supervision on the other hand can optimize them¹

Hence within the limitations of the present study, with respect to all the 5 criteria upon which the restorations were evaluated for both techniques, the results were statistically insignificant. The vigorous practice and skill of the operator also plays a crucial role to make the restoration a success.

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