



Clinical Evaluation of Conventional Cantilever and Resin Bonded Cantilever Fixed Partial Dentures: A Comparative Study

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ABSTRACT

Introduction: Ever since the introduction of the minimal preparation fixed partial dentures, the major concern of the clinicians has been its longevity.

Aims and objective: The objective of the present study was to compare the clinical performance of resin bonded cantilever bridges with conventional cantilever bridges for a period of 1 year and to evaluate the periodontal changes of abutment teeth using radio visio graphy.

Materials and methods: Fourteen patients with missing first or second premolar were selected for the study. The patients were divided into 2 groups, conventional cantilever group and resin bonded cantilever group.

Results: The results were analyzed using Student's t test and Mann-Whitney U test. The clinical success rate for both the groups was 100%. The amount of bone loss at 6 months for conventional group was 0.11 mm and for resin bonded bridge group was 0.10 mm. The amount of bone loss at 1 year for conventional cantilever group was 0.14 mm and for resin bonded fixed partial denture group was 0.16 mm. There was no statistical difference between both the groups.

The results showed that the resin bonded cantilever bridges can be used for the treatment of missing posterior tooth.

Keywords: Resin bonded bridge, Cantilever bridge.

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INTRODUCTION

Resin retained FPD's have had a variable popularity since the technique for splinting mandibular anterior teeth with a perforated metal casting was described by Rochette in 1973.¹ Unquestionably the major disadvantage of the conventional

FPD is the extensive preparation of the tooth structure, is overcome with the advent of conservative resin bonded FPD's.²

Ever since the introduction of this minimal preparation FPD's, the major concern of the clinicians has been its longevity. The major cause of failure of 3 unit RBFDP's was attributed to debonding caused by complex multidirectional inter abutment stresses associated with the 3-unit design, that challenges the retainer and adhesive bond.³⁻⁵

This failure led to the increase in popularity of the two unit cantilevered resin bonded FPD's, which produce less complex forces on the prosthesis and single abutment, thereby reducing the stresses that lead to prosthesis debonding.³

The major advantage of RBFDP's is a conservative nature of the preparation of the abutments. This is very useful for younger patients. Even so, within the profession skepticism remains as to the long-term reliability of these restorations.⁶

However, when used to replace posterior tooth, the outcome was much less predictable and the failure rate could be as high as 83.3%. Despite these variations, RBFDP's are currently accepted as an effective treatment modality for the restoration of missing teeth in various clinical situations.⁷

The purpose of the present study was to compare the clinical performance of cantilever resin bonded FPD's with conventional cantilever fixed partial dentures for a period of 1 year and to evaluate the periodontal changes of abutment teeth supporting the conventional cantilever and resin bonded cantilever FPD's using radiographs (RVG).

OBJECTIVES

1. To compare the clinical performance of cantilever resin bonded fixed partial dentures with conventional cantilever fixed partial dentures for a period of 1 year.
2. To evaluate the periodontal changes of abutment teeth supporting the conventional cantilever and resin bonded cantilever fixed partial dentures using radiographs (RVG).

MATERIALS AND METHODS

The subjects for this study were selected from the OPD, Department of Prosthodontics, including crown and bridge and implantology.

Selection Criteria

Inclusion Criteria

- Patient requiring a fixed partial denture in posterior maxillary or mandibular arch (preferably missing first premolar or second premolar, unilateral or bilateral)
- Dentition opposing the edentulous space was confirmed to be intact or if a restoration was required it was to be completed prior to the beginning of the study.

Exclusion Criteria

- Patients having severely attrited teeth
- Patients having deep bite.

STUDY DESIGN

Fourteen patients, who were in need of a fixed partial denture for the replacement of their maxillary or mandibular teeth, were selected for the study. These patients were divided on the basis of restoration they were given.

Group A: Conventional cantilever fixed partial dentures.

Group B: Resin bonded cantilever fixed partial dentures.

Method Employed

In the initial appointment, a preliminary impression was made using irreversible hydrocolloid impression material (Imprint DPI) and the diagnostic casts were mounted on a semi adjustable articulator (Hanau-wide view) using a face bow transfer. Protrusive records were made using polyether bite registration paste.

For group A the tooth preparation for the abutment teeth (Fig. 1) was done following the principles of tooth preparation given by Shillingburg.²

For group B the tooth preparation for the abutment tooth (Fig. 2) was done following the design principles for cantilevered resin-bonded fixed partial dentures given by Michael Bothelo.⁹



Fig. 1: Tooth preparation for conventional cantilever fixed partial denture



Fig. 2: Tooth preparation for resin bonded fixed partial denture

After the tooth preparation the gingival displacement was done using retraction cord (ultrapack #1,#0) and ferric sulfate astringent (Astringent, Ultradent Products, USA). A polyvinyl siloxane impression was made either by using putty reline technique or multiple mix technique. Temporization was made for group A patients using Protemp™ 11(3M ESPE, Germany) and cemented using Tempbond NE (Rely X™ Temp^{NE}, 3M ESPE, Germany).

Preparation of Wax Pattern

The master die preparation was accomplished in the conventional manner as suggested by Shillingburg using diestone (Karlock).

Group A: Wax pattern (Fig. 3) was fabricated using inlay wax (type 11) in the conventional manner.

Group B: Resin pattern (Fig. 4) was made using pattern resin.

After casting the casting was checked on the die and in the patient mouth for the proper fit and any interference was eliminated. The occlusal interferences were checked

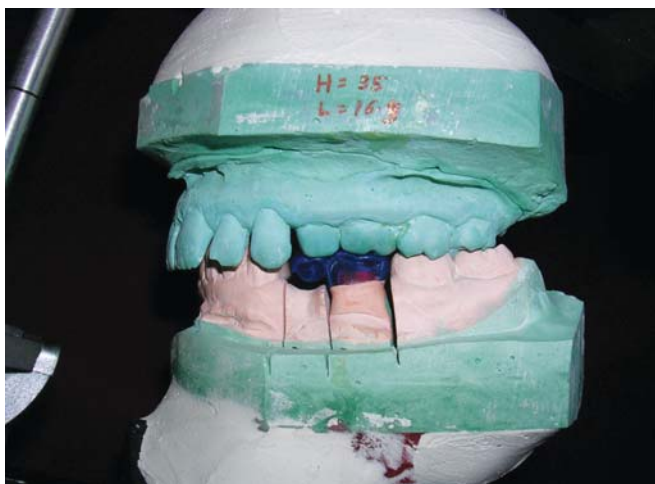


Fig. 3: Wax pattern for conventional cantilever fixed partial denture



Fig. 5: Cementation of conventional cantilever fixed partial denture



Fig. 4: Resin pattern for RBFPD



Fig. 6: Cementation of resin-bonded fixed partial denture

using articulating paper and were eliminated if present. After shade selection the ceramic firing was done.

The fixed partial dentures for both the groups were cemented (Figs 5 and 6) using resin cement after thorough isolation. A radiograph (Fig. 7) was done at this time using RVG. Then patients were recalled at 6 months (Fig. 8) and 1 year intervals (Fig. 9) radiographs were made using RVG at this time and the fixed partial dentures were examined clinically for debonding or for fracture and photographs were taken.

The radiographs were examined for bone loss. The bone height was measured from the margin of the restoration to the crestal bone level.

LIST OF FORMULAE

1. Mean = $\frac{\text{Sum of values}}{\text{Number of values}} = \frac{\Sigma x}{n}$

2. Standard deviation = $\sqrt{\frac{\Sigma(\bar{x} - x)^2}{(n - 1)}}$

- 3. Median = Middle most value of the series
- 4. Student's t-test

$$t = \frac{\{\bar{x}_1 - \bar{x}_2\}}{Sp \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Sp = Pooled standard deviation

- 5. Mann Whitney U test

$$U_1 = nn_1 + \frac{n(n+1)}{2} - R_1$$

$$U_1 = n_1n + \frac{n_1(n_1+1)}{2} - R_2$$

Smaller of the U_1 and U_2 is compared with table value for significance.

RESULTS

Clinical and radiographic evaluations were performed for both the groups at the interval of base line 6 months and 1 year and the results were tabulated. The statistical analysis of the tabulated values was done to compare the changes

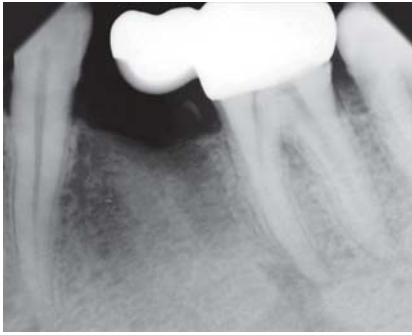


Fig. 7: RVG made immediately after cementation

Fig. 8: RVG made after 6 months of cementation

Fig. 9: RVG made after 1 year of cementation

occurring in the radiographic evaluation at 6 months and 1 year interval and between the two groups.

It was observed that the mean difference for the conventional group at 6 months interval was 0.11 with a standard deviation of ± 0.04 and for resin bonded fixed partial denture group it was 0.10 with a standard deviation of ± 0.00 . At 1 year the mean difference in the conventional (Table 1 and Graph 1) group was 0.14 with a standard deviation of ± 0.05 and for resin bonded fixed partial denture it was 0.16 with a standard deviation of ± 0.05 (Table 2 and Graph 2).

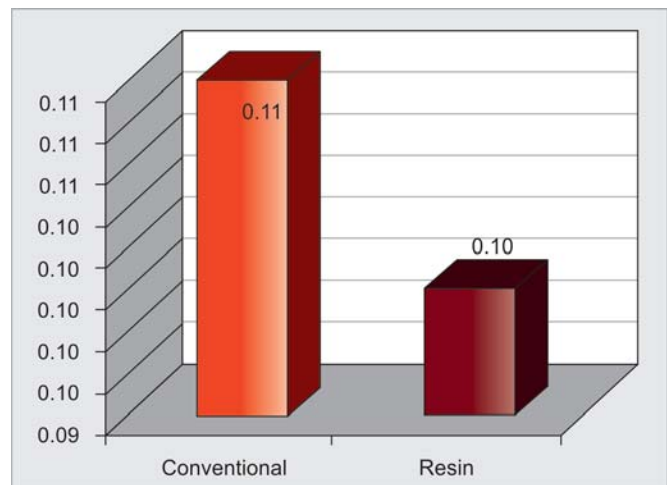
For both the group the 'p' value was not significant. Mann Witney 'U' test was performed to compare the amount of bone loss at 6 months and 1 year intervals for both the groups. There was no statistical difference between both the groups at the given time interval (Table 3).

In the clinical evaluation, the prosthesis was checked for debonding and for fracture of the prosthesis. In both the groups none of the prosthesis debonded or got fractured. Thus the clinical success rate for both the group was 100%.

Radiographic Examination

Table 1: Mean bone loss in the conventional cantilever group

Assessment time	Mean	Median	Standard deviation
Baseline	0	0	0
6 months	0.11	0.10	0.04
1 year	0.14	0.10	0.05



Graph 1: The comparison of mean bone loss in both the groups at 6 months interval

Table 2: Mean bone loss in the resin-bonded cantilever group

Assessment time	Mean	Median	Standard deviation
Baseline	0	0	0
6 months	0.10	0.10	0.00
1 year	0.16	0.20	0.05

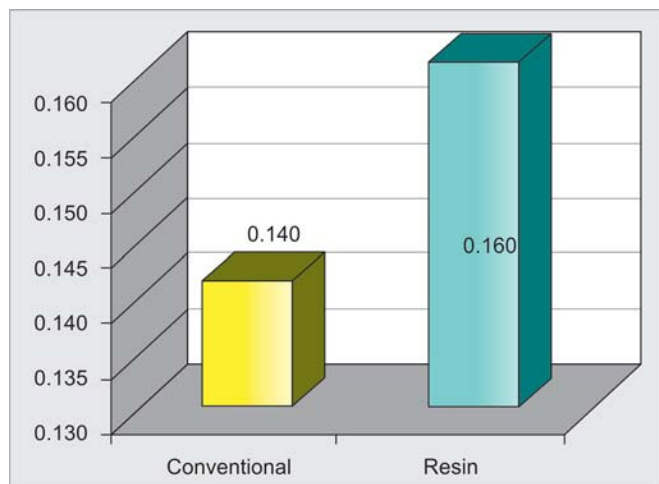
DISCUSSION

The cantilever fixed partial denture is a fixed restoration that has one or more abutments at one end while the other end is unsupported. This unique arrangement accounts for the prime disadvantage: The creation of a class 1 lever arm.¹⁰

Table 3: Comparison of both the groups at 6 months and 1 year interval

Assessment time	Conventional (mean \pm SD)	Resin (mean \pm SD)	t*-value	U#-value	Significance
Baseline	0	0	-	-	Not significant
6 months	0.11 \pm 0.04	0.10 \pm 0.00	1	21	p > 0.05 NS
1 year	0.14 \pm 0.05	0.16 \pm 0.05	0.5	21	p > 0.05 NS

*Student's t-test; Mann-Whitney U-test; NS: Not significant



Graph 2: The comparison of mean bone loss in both the groups at 1 year interval

The rigid bridge is always preferred for this reason. However, the cantilever principle, when properly applied, will serve as an excellent compromise to meet clinical conditions and give the patient prolonged periods of service at a fee level within his economic limitations.

One of the advantages of RB-FPD is that reduction of intact enamel can be minimized. It is beneficial for medically compromised patients to apply a RB-FPD rather than a conventional FPD, which requires considerable reduction of sound tooth structures.¹¹

Forces applied to the cantilevered pontic are resisted through rotational and tilting movements by the abutment teeth rather than those along the long axis. To prevent the integrity of the supporting periodontium and prevent material failure, it is crucial to understand the nature of each component of the prosthesis.

Resin Bonded Bridges

The development of resin bonded bridges has been a significant advance in modern restorative dentistry.⁶ Resin retained fixed partial dentures have had a variable popularity since, the technique for splinting mandibular anterior teeth with a perforated metal casting was described by Rochette in 1973.¹

The major advantages of resin bonded bridges are:

1. Conservative abutment preparation. This is particularly useful for younger patients.

2. It does not require temporization.
3. There is no need of local anesthesia.

The main disadvantage of resin bonded fixed partial dentures are:

1. Unnoticed partial decementation of RBBs can lead to extensive caries of the abutment.
2. Moisture control (crucial for successful adhesive dentistry) is time consuming and always difficult to achieve.
3. Temporization and the final occlusion of RBBs can be unpredictable.
4. Gray out caused by the shine through of lingual or palatal metal wings can be cosmetically unacceptable.⁴

Design of the Cantilevered Pontic

Clinical studies indicate that mucosal irritation is consistently found in the vicinity of FPD pontics. This reaction may be more severe with the cantilevered pontic because it is supported at only one end, increasing the possibility of movement and subsequent mucosal trauma during function.

This problem can be solved by designing the tissue surface of the pontic to provide only selected tissue contact, allowing minimal pressure between the pontic and the mucosa. Pontics must also be contoured to provide acceptable esthetics, adequate cheek and tongue support, and access for oral hygiene.

In the present study, the preparation design for the cantilever RBFPD was selected according to the design principles by Botelho who suggested a more rigid 'D' design.⁹ It includes 180° wraparound, with mesial, distal and palatal grooves and occlusal coverage without including the buccal and palatal cusps.

The reason for selecting this design was that:

- It gave more surface area for bonding, maximizing the surface area for bonding is one of the most important features for success for any resin bonded restorations.
- Increased abutment resistance form, this can be achieved by wraparound, occlusal coverage and grooves.
- Increased retainer resistance form, which can be achieved by increasing the retainer thickness. This is essential during functional and parafunctional movements which will create more stresses that flex the retainer and break the cement bond.

Surface Treatment

In the present study the adhesive surface was sandblasted and immediately prior to the cementation, alloy primer was applied on the bonding surface.

Cement used for Luting the RBFPD's

In the present study dual cure resin cement was used for both the conventional and resin bonded cantilever fixed partial dentures. Self-etch adhesive was applied to the enamel surface prior to cementation to enhance the bonding.

With the advent of newer preparation designs, adhesive cements, and surface treatments, the longevity of the resin bonded fixed partial dentures have been increased considerably.⁸ Infact, according to a study conducted by Thompson et al the longevity of RBFPDs is comparable with that of the conventional fixed partial dentures.¹²

The predictability and longevity of this prosthetic design is less than conventional abutments. Moreover, they offer better esthetics, easy cleaning, less biological damage and no chance of having an undetected debonded retainer with decay underneath it.¹³

Despite the high survival rate of RBBs, technical complications like deboning are frequent. This in turn means that a substantial amount of extra chair time may be needed following the incorporation of RBBs.¹⁴

CONCLUSION

- The clinical longevity of both the conventional and resin bonded cantilever fixed partial dentures groups was 100%.
- There was minimal bone loss in both the groups on radiographic examination which was not significant. It was 0.14 mm for the conventional cantilever group and 0.16 mm for the resin bonded cantilever group.

Scope of the Study

The cantilevered resin bonded fixed partial dentures can be used to restore missing tooth in the posterior region. Further clinical and radiographic study can be carried out to know the clinical longevity and periodontal response of the cantilever resin bonded fixed partial denture in the same region.

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