

# Comparitive Evaluation of Inlay Retained and Surface Retained Resin Bonded Fixed Partial Dentures

AAMIR RAFIQUE<sup>1</sup>, SAIRA KHALID<sup>2</sup>, ASIF ALI SHAH<sup>3</sup>, NAUREEN SARWAR<sup>4</sup>, MUHAMMAD AZEEM<sup>5</sup>, HAMMAD HASSAN<sup>6</sup>

<sup>1</sup>Department of Prosthodontics, PMC, Dental Institute, Faisalabad Medical University, Faisalabad.

<sup>2</sup>Department of Science of Dental Materials, de'Montmorency College of Dentistry, Lahore.

<sup>3</sup>Department of Prosthodontics, Rashid Latif Dental college, Lahore.

<sup>4</sup>Department of Operative Dentistry, de'Montmorency College of Dentistry, Lahore.

<sup>5</sup>Department of Orthodontics, de'Montmorency College of Dentistry, Lahore.

<sup>6</sup>Department of Science of Dental Materials, CMH Institute of Dentistry, Lahore.

Corresponding author: Saira Khalid, Email: [dmsmdc@gmail.com](mailto:dmsmdc@gmail.com)

## ABSTRACT

**Objective:** The objective of the study was to evaluate and compare the clinical success rate of inlay and surface retained RB-FPDs fabricated with fiber reinforced composite.

**Material and Methods:** This study was performed in Prosthodontic department de`Montmorency college of dentistry. 172 RB-FPDs were completed with two preparation designs having 86 cases in each design (inlay retained and surface retained). Restorations were done on patients for single missing molar surrounded by sound, healthy and well aligned abutments. RB-FPDs were fabricated in zirconium silicate based indirect composite (ceramage) with incorporation of glass fibers (Everstick C&B). Follow up was done after every six months till 18 months. Complications (fracture, debonding, and dislodgment or abutment tooth caries) developed during follow up were recorded and analyzed through SPSS version 17.

**Results:** Overall success rate of 76.9% was observed in both designs of RB-FPDs. P value of 0.190 showed insignificant statistical differences in success rate of two designs however there was a trend towards better performance of inlay retained RBFPDs. Fracture of the framework was most prevalent mode of failure followed by debonding of the restoration.

**Conclusion:** The fiber reinforced RB-FPD is a viable treatment option for replacement of single missing posterior tooth.

**Keywords:** Maryland Bridge, Resin bonded bridges, Resin bonded fixed partial dentures (RBFDPs), Minimum preparation bridges

## INTRODUCTION

Resin bonded fixed partial denture prosthesis, also known as minimally prepared bridges, is a very conservative treatment options for replacement of missing teeth and has gained popularity among clinicians as an effective treatment option that requires minimum tooth preparation especially in younger patients with larger pulps. Their clinical preference has been greatly increased since last three decades, due advancements in metal surface treatments, dentin bonding technologies, resin ceramics and tooth preparation methods.<sup>[1][2]</sup>

Despite many advancements and innovations, the success rate of resin bonded fixed partial dentures depends on preparation design, bonding system, abutment tooth and material selection.<sup>[3]</sup> Moreover, based on preparation design, three types of resin bonded fixed partial dentures have been proposed i.e., surface retained, inlay retained and hybrid type.<sup>[4]</sup>

Surface retained design provides axial support, therefore it offers more resistance to dislodgment, whereas, inlay retained design has shown better survival when compared to other designs. Moreover, preparation design with good volume can resist rotational dislodging forces more effectively, when bonded to healthy tooth structure, ensuring a survival rate of more than 70 percent during a period of 4.5 to 8.9 years.<sup>[5][6]</sup>

Failures in RB FPD have been observed primarily due to debonding or fracture of the frame work, however, debonding is the most common technical complication which occurs due to the loss of adhesive joint between

tooth and the restoration. In addition to various kinds of torsional forces that develop high stresses on the adhesive interface, more dentine surface availability than enamel also plays a predisposing role in dislodgment of prosthesis.<sup>[7][8]</sup> Previous studies have reported that the annual debonding rate in RB-FPD ranged between 1.22 and 12.8, with more debonding incidents observed in lower jaw, in long span areas and in the posterior replacements.<sup>[9][10]</sup>

Fracture of the framework, according to previous literature, was more commonly reported in the first molar region especially in mandible due to heavy masticatory loads and excursive mandibular movements.<sup>[11][12]</sup> Furthermore, previous studies have indicated that the weakest part of these minimum preparation prosthesis were the connectors and retainers as most of the failures were reported at these sites, especially in inlay retained all ceramic restorations.<sup>[13]</sup>

The material choice for RB-FPDs can be dental alloys, ceramics and fiber reinforced composites. Despite RBFDPs with metal framework reportedly showed better clinical performance as metals have higher strength, a compromise in esthetics was also observed in form of grayish metal hue and loss of translucency of abutment teeth. Therefore, better aesthetics can be achieved by using metal-free materials such as all ceramic restorations.<sup>[14][15]</sup> All ceramic restorations have been investigated both in vitro and in vivo conditions and amongst them, most promising results were seen using heat pressed lithium disilicate and yttrium stabilized zirconium oxide.<sup>[16][12]</sup>

Zirconium being highly esthetic and having the highest fatigue fracture strength is available in various forms, among these forms, yttrium stabilized zirconia with tetragonal crystalline pattern and specific crystalline arrangement reported better mechanical properties due to their ability to inhibit crack propagation. [17][14][8]. Zirconia can be used for both anterior and posterior restorations due to its good mechanical properties when compared to other metal free restorations [18].

Previous studies have shown varied results regarding luting procedures of zirconia restorations. Literature indicated that surface treatments like air abrasion or silanation did not improve the bonding of zirconia restorations and seemed prodigal for good adhesion. [19]. Resin cementation appears to be one of the most favorable option to obtain good adhesion and improved mechanical retention of zirconia-based restorations [20][17]. Though there is limited data available, a few clinical studies have shown promising effects of RB-FPDs when zirconium oxide was used as a frame work material. [21]

Majority of failure, according to the previous clinical data, were either due to debonding of the prosthesis, fracture of frame work or combination of both [21]. However, other complications included de-laminations, fracture of veneering material and loss of adhesive attachment at least at one of the retainers. [22][23][19][17][13]

Very limited data is available regarding the success rate of resin bonded fixed partial denture having zirconia frame work, moreover, very limited number of studies reported comparison of success rate of different preparation designs i.e., inlay retained and surface retained resin bonded fixed partial dentures using zirconia as frame work material. [20][16][12][11][9][6][5]

This research provides information about longevity of resin bonded fixed partial denture with different designs in clinical conditions. It will help to extend the clinical usage of these esthetically pleasing and conservative resin retained fixed partial dentures for single missing posterior tooth replacement.

## MATERIAL AND METHOD

It is descriptive longitudinal study, carried out at the prosthodontics department of de `Montmorency College of dentistry, after getting approval from the Institutional ethics review committee at Postgraduate Medical Institute (PGMI).

The study was conducted over a period of 18 months with six months follow up intervals. Sample size consisted of 156 subjects through probability purposive sampling; however, 10 % extra cases were done to accommodate the dropouts due to lack of follow up, as a result total sample size increased to 172 cases having eighty-six cases (86) in each design group (inlay and surface retained design). Patients visiting in outdoor department of Prosthodontics, de `Montmorency college of dentistry/ Punjab dental hospital, Lahore were selected according to inclusion and exclusion criteria. Inclusion criteria were male or female patients having age ranging between 15-30 years, with missing first molar. Exclusion criteria were patients with para-functional habit, periodontal compromised teeth, multiple missing teeth, carious or restored abutment teeth, tilted abutment teeth, maligned or crowded teeth. Patients selected for study with odd serial numbers were provided

inlay retained design of resin bonded fixed partial denture, whereas, patients with even serial numbers were provided with surface retained design of resin bonded fixed partial dentures. All participants signed informed consent forms, their demographics were noted, clinical procedure was performed and were recalled regularly at a six-monthly interval. The clinical procedures were performed in two clinical sessions, first tooth preparations were done and impressions were taken, and later in the second session, try in, cementation and finishing of the restoration was done.

Abutment teeth were prepared using high-speed hand piece with water cooling system. Occluso-distal preparation was done for the premolars, whereas occluso-mesial preparation was done for the molars. The depth and dimensions of the preparation cavities were made similar by using identical burs with depth marked on it with the help of permanent marker. After preparation, depth was verified by measuring wax thickness in inter occlusal record.

A Total of 78 patients received Inlay retained design. The inlay preparation was done on abutment tooth. The occlusal inlay outline was started by entering the mesial pit with tapered round diamond bur having iso no 198/018 parallel to the long axis of the tooth. Depth of 2mm was achieved under continuous air water spray. Preparation for occlusal box was done around the cusp distally into distal pit to sufficiently expose the junction of proximal enamel and dentin. The Mesio-distal dimension of 4mm (premolar) and 6mm (molar) was maintained. The width of inlay cavity was equal to 1/3 of intercuspal width with 15° -20° torque of occlusal convergence (TOC). Isolation of distal enamel was done by cutting a proximal ditch. While penetrating gingivally, the proximal ditch was extended facially and lingually with tapering round diamond bur having ISO No 198/018. Two cuts were made at lingual and facial limitations of the proximal ditch. Preparation of proximal box was finished with depth of 4mm, mesio-distal dimension of 3mm and 15° -20° torque of occlusal convergence. Finishing of all margins and line angles was done with fine grit tapered round diamond bur no 198.

Similarly, a total of 78 patients received Surface retained design. The surface retained preparation begun with proximal box that was made by cutting a proximal ditch parallel to path of insertion with tapered round diamond bur no 198/018. The ditch was extended to a bucco-lingual width of 3mm. The depth of the box was maintained up to 2mm with round line angles and torque of occlusal convergence (TOC) of 15° -20°. The mesiodistal dimension of the box was 3mm. The enamel on buccal and lingual surfaces of abutments was reduced 0.5mm parallel to the path of insertion. A plain enamel area of about 3mm in height and 3mm in length was achieved in this way. The proximal wing extension of final finished resin bonded fixed partial denture was minimum 3mm in length and 0.6 mm thick. Margins of the all preparations were finished at least 1mm supra-gingival with tapered round diamond bur. After preparation, impressions were taken in addition silicon with 2 step putty wash technique. Patients were provided with temporary restoration till the period of final restoration was made in dental laboratory.

RB-FPDs were fabricated with zirconium silicate indirect restorative material for crown and bridge (Ceramage, Shofu, Japan) and for reinforcement of the material glass fibers were also incorporated in the material according to manufactures instructions. The fiber used in framework consisted of unidirectional pre impregnated fiber bundles (Ever stick C & B, Stick Tech Ltd, Finland) having a diameter of 17  $\mu\text{m}$  were embedded in a matrix of PMMA. The glass fiber bundle was sectioned with a scissor according to the required dimension on the stone cast. The fibers were placed on the cast. A thin layer of flow able composite was applied to hold the fiber in place at the retainer area and light polymerized. After light polymerization, the framework was veneered with indirect resin composite (Ceramage). The composite resin was built incrementally using a heat-light polymerization oven (triad VLC unit). The fabricated RB-FPD was checked for complete seating and marginal adaptation on the respective study model.

After removal of provisional restoration, trial was done and adjustments were made. The fitting surface of the restoration was treated with monomer resin which was left uncured for three minute to ensure complete penetration of the monomer fluid. Later on, the restorations were luted with composite resin cement (Multilink Automix, Ivoclar) following manufacturer's guidelines. After final curing, the restoration was reexamined for any occlusal disharmony or premature stops. The restoration was finally finished and polished using composite polishing discs and rubber cups. The patient was educated about routine hygiene protocol for better plaque control and recalled for scheduled follow up visit.

In this study the parameters characterized as failure

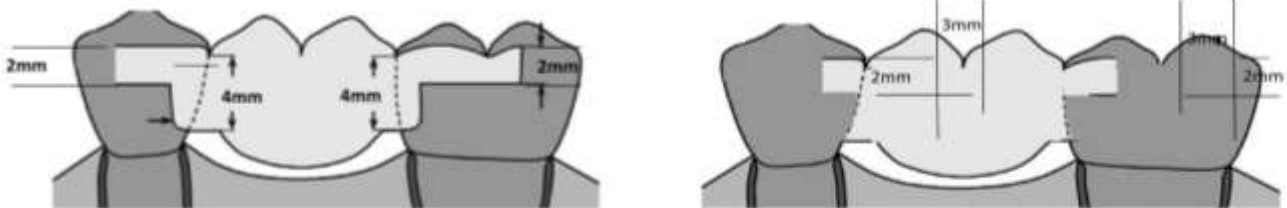
were (1) debonding (2) dislodgement (3) fracture (4) biological considerations (including caries and gingival health). Initial examination of cemented RB-FPDs was performed immediately after final polishing and after one week for any occlusal disharmony. Patients were recalled for three follow up visits after 6, 12 and 18 months. On every recall visit, the resin bonded fixed partial denture were examined. During follow up visits, the patients were also questioned about post-operative sensitivity. At baseline, and at 6, 12 and 18 months follow up clinical examinations were done to find out any marginal discrepancy developed, secondary caries, debonding and framework fracture.

Gingival health around abutment teeth and contra-lateral control teeth was also measured using gingival index (Loe and Silness, 1963). Teeth with gingival index score of more than 1(One) was considered as periodontal problematic teeth.

The patients that could not come for clinical examination were telephonically interviewed for any complication or any retreatment other than minor occlusal adjustments regarding the cemented RB-FPD.

Debonding or dislodgement of RB-FPDs, abutment tooth caries and framework fractures were considered failures. RB-FPDs requiring prophylaxis and minor occlusal adjustments were considered successful.

All information based on clinical examination or telephonic interview was recorded on the Performa (Appendix). All interventions done on patient follow up visit were also recorded. It varied from minor occlusal adjustment, finishing, prophylactic scaling to re cementation or complete replacement of prosthesis due to irreparable failure.



(a) (b)  
Fig 1: Inlay retained and Surface retained Fixed Partial Dental Prosthesis

## RESULTS

The study compared success rate of resin bonded fixed partial denture in posterior segment after observation period of 18 months with two different designs of fabrication. 10 % more cases (16 cases) were done to overcome the chances of dropouts due to loss of follow up. Including 10% extra cases, total of 172 cases were included in study (two groups of 86 cases). The group A involved inlay preparation design whereas group B involved the surface retained design. Follow up was done for these resins bonded fixed partial dentures after 6, 12 and 18 months. After follow up of 18 months a total of 25 (14.5%) subjects were considered dropouts as they were unable to come for follow up examination. Out of remaining 147 resin bonded fixed partial dentures, 34 (23.2%) cases showed

failure due to development of one of the major complications (fracture of framework (13.6%), debonding (5.4%), dislodgement (4.7%) or abutment tooth caries (2%)). Only 04 (2.7%) RB-FPDs caused gingival inflammation around abutment tooth which was addressed by prophylactic scaling. 76.9% of all RB-FPDs showed success after follow up of 18 months. It was found that during 18 months follow up inlay and surface retained preparation designs did not had significant effect on the success rate.

The data collected was analyzed through SPSS version 17. Percentage and frequency were calculated for variables. Chi square and fisher's exact test was applied to evaluate the significance of mode of failures. P value of < 0.5 was considered significant.

There were 25 (14.5%) cases, due to the fact that patients did not report back for the follow up visit at one of the three follow up visit, were considered as dropouts and were excluded from the study. There were 11 dropouts from group A while 14 dropouts were from group B.

In terms of gender, a total of 109 (63.3%) recruited individuals for study were males and 63 (36.7%) were females. In group A, 61 (70.9%) were males and 25 (29%) were females, whereas in group B, 48 (55.8%) males and 38 (44.2%) females were included. There was no statistical association of gender with study groups as indicated by p-value i.e., 0.057.

A total of 86 subjects were chosen in each study groups i.e., group A & group B. In group A, the mean age was observed as  $25.44 \pm 3.91$  years with minimum recorded age of 15 years and maximum recorded age of 30 years. In group B, the mean age was  $24.28 \pm 4.08$  years with minimum recorded age of 15 years and maximum age of 30 years, same as in group A. The statistical difference of age among the two groups was insignificant (p-value=0.073).

Out of 147 RBFPD's studied, 34 (23.2%) developed some kind of failure. Among these 34 failures, most of the cases 20 (58.8%) had fracture of framework followed by debonding 8(23.5%). Dislodgment of framework was observed in 7 (20.6%) cases. Only 3(8.8%) cases showed abutment tooth caries. Periodontal problem was found in 4(11.7%) patients.

Out of 147 total number of RBFPDs 20 (13.6%) cases developed the complication of fracture of framework. 7 RBFPDs (9.3%) were from group A and 13 (18.1%) were

from group B. Remaining 127 (86.4%) RBFPDs showed no signs of fracture of framework. No statistical association of fracture of framework could be established with any of the study groups (p-value= 0.123).

Out of total 147 RBFPDs, 8 (5.4%) had debonding. In group A, 5 (6.7%) and in group B, 3 (4.2%) RBFPDs showed debonding. As evident from description, there was no association of debonding with study groups (p-value=0.719)

Among total of 147 resin bonded fixed partial dentures, 7 (4.8 %) developed dislodgment. In group A, 2 (2.7%) RBFPDs developed dislodgment where as in group B, 5 (6.9%) developed dislodgment. 140 (95.2%) RBFPDs did not show any dislodgment of framework of the prosthesis. There was no statistical association of dislodgment with any of the study groups (p-value= 0.269).

Out of overall sample, only 3 (2%) developed abutment tooth carries. In group A, 2 (2.7%) patients developed abutment tooth carries where as in group B, only 1 (1.4%) showed abutment tooth caries. There were no statistical association of abutment tooth carries with any of the study groups (p-value > 0.999).

Out of total subjects, 4 (2.7%) had gingival inflammation around one of the abutment teeth. Majority of these were from group B 3 (4.2%) whereas group A showed only 1 subject with periodontal problem. Theses gingival inflammations was addressed by prophylactic scaling and were not not considered in failures. However no statistical association of periodontal problem on abutment teeth was found with the study groups (p-value=0.360).

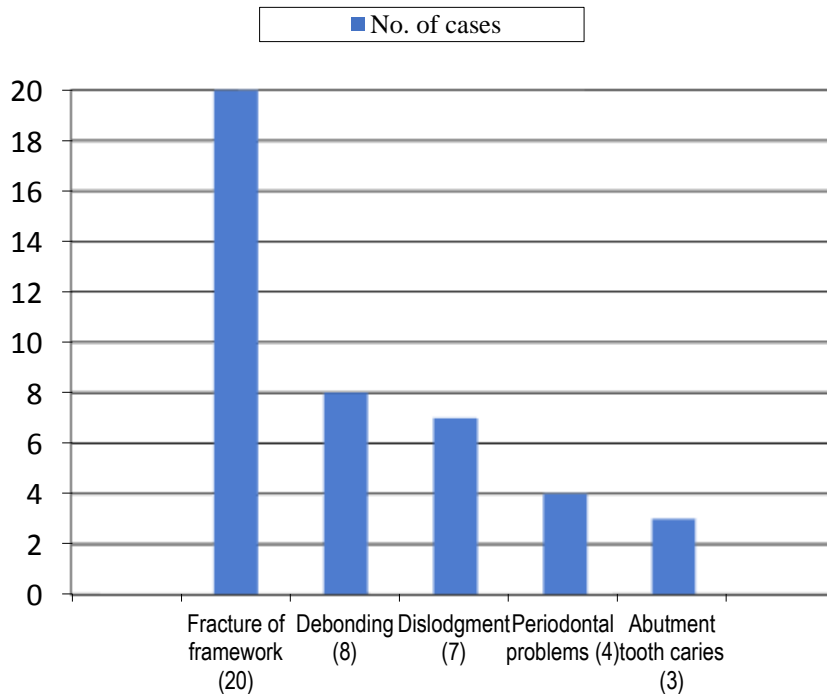


Fig-2: Mode of failure in all cases

Graph shows a comparison of modes of failures. Out of the total failures due to fracture of the frame work, more fractures were seen in surface retained resin bonded fixed

partial dentures as compared to other design. Debonding was more in inlay design and dislodgment was again more in surface retained design.

The success rate after 6 months of follow up of overall 157 RBFPDs was 89.8%. In group A, 73 (91.3%) were successfully managed and in group B, 68 (88.3%) were managed successfully. Whereas, the failure was 8.7% in group A and 11.6% in group B. No significant difference in success rate was seen statistically among the two groups after 1<sup>st</sup> six months (p-value= 0.543).

The success rate after 12 months of follow up of overall 151 RBFPDs at the clinic was 84.1%. A total of 67 (87.0%) were successfully managed in group A and 60 (81.1%) were managed successfully in group B. Failure was 13.0% in group A and 18.9% in group B. No significant difference in success rate was seen statistically among the two groups after 12 months (p-value= 0.377).

The success rate after 18 months of follow up in all the 147 RBFPDs was 76.9%. Among all the subjects of group A, 61 RBFPDs (81.3 %) were successfully managed and 52 (72.2%) were managed successfully in group B. The failure was 18.7% in group A and 27.8% in group B. The overall failure of two groups was 23.2%. No significant difference in success rate was seen statistically among the two groups after 18 months (p-value= 0.190).

Success rate of 89.8% (141) was seen after 6 months of follow up at clinic which was reduced to 84.1% (127) after 12 months and eventually sustained at 76.9% (113) after 18 months of follow up.

Table 1: Comparison of Failures in both Study groups

Type of Failures	Inlay Retained (%)	Surface Retained (%)	Mean	p value
Fracture	9.3	18.1	13.7	0.123
Debonding	6.7	4.2	5.45	0.719
Dislodgement	2.7	6.9	4.8	0.269
Abutment Tooth Caries	2.7	1.4	2.05	> 0.99
Periodontal Problems	1.3	4.2	2.75	0.360

Comparison of complications among study groups



Fig-3: Comparison of complications among study groups

Table 2: Comparison of Success achieved in Clinic after 6 months in both Study groups

Duration	Inlay Retained (A)	Surface Retained (B)	Overall Success
After 6 Months	91.3%	88.3%	89.8%
After 12 Months	87.0%	81.1%	84.1%
After 18 Months	81.3%	72.2%	76.9%

Chi Square value = 1.715  
P value = 0.190

Overall Percentage of success at different follow ups

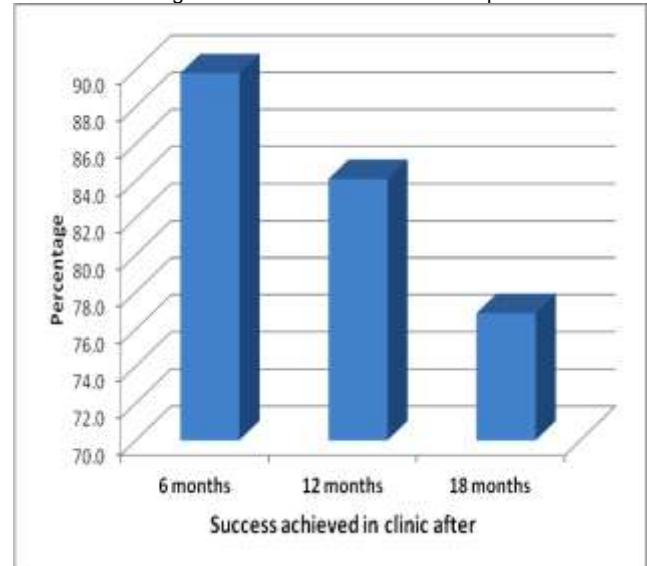


Fig 4: Percentage of patients who achieved success at different follow ups

## DISCUSSION

The study reports and compares clinical success of two design (inlay and surface retained prosthesis) types of resin bonded fixed posterior partial dentures after follow up of 18 months in three intervals.

A continuous drop, in success rate was observed at each follow up visit. 89.8% was achieved at the 1<sup>st</sup> follow up and it dropped to 84.1% at 12 months follow up. Success rate seems to sustain at 76.9% at 18 months follow up. This success rate is found comparable to work on fiber reinforced resin bonded fixed partial dentures reported in literature with different follow up periods. [6],[25],[26]. The success rate (76.9% after 18 months follow up) also shows competitive and promising results when compared with conventional metal framed and all ceramic resin bonded fixed partial denture. [26].

This study also reports comparison of success rate of two preparation designs (inlay and surface retained preparation designs) as shown in Table 2. Results showed that the success rate of inlay retained fiber reinforced resin bonded fixed partial denture dropped from 90.6% to 81.3% during 6 to 18 months follow up period Whereas success rate for surface retained resin bonded fixed partial denture was dropped from 88.3% to 72.2% for same follow up observation periods. A p-value of 0.190 shows insignificant statistical difference between success rates of two preparation designs (inlay and surface retained) at 18 months follow up period. However close observation of results suggests a shift towards superior performance of inlay retained RB-FPD over surface retained design of RB-FPD which can be explained due to the fact that increased resistance is provided by inlay retainer against the rotational forces. The greater volume available for fibers and composite on occlusal part of inlay retained RBFPD may be responsible for this success rate. [25],[3]

It was observed that 14.5% [25] cases did not come back for the follow up visits despite being contacted and reminded. Reason for not coming back was uncertain.

Either the patients were highly satisfied or rejected this treatment option. Due to high uncertainty, these cases were considered as drop outs and were excluded from the study.

There was no statistically significant association of gender with any of the study group. Male patients were dominant (63.3%) as compared to females as male patients reported more in the outdoor department of prosthodontics, Punjab dental hospital. Patients of young age group (15-30 years) were selected for this study. The mean age varied between 24.28 years to 25.44 years among both study groups. The p value of 0.073 showed insignificant statistical difference of age among both study groups. This young age group was selected to standardize the study as younger patients have more likely disease-free healthy teeth.

Results of this study reported different modes of failures developed during follow up visits. The most prevalent type of failure was fracture of framework followed by debonding of the retainer and dislodgment of the restoration as shown in Fig 2. However, very small numbers of failures were seen due to abutment tooth caries.

Results presented in Table 1 of this study report 13.6% failures due to fracture of the framework. Most of the fractures were observed at retainer site for both study groups. The statistical analysis showing a p value of 0.123 suggests insignificant association between fracture of framework and design of fabrication. However, close observation of Table 1 and Fig 3 reflects that fractures were more common 65% (13/20) in surface retained design of Resin Bonded Fixed Partial Denture. This increased number of fractures in surface retained design may be attributed to less occlusal volume (3x3x2) available for restoration material when compared to the inlay retained design (6x3x2) of Resin bonded fixed partial dentures. The amount of occlusal volume available after preparation is occupied by glass fibers and indirect resin composite. The low fiber volume results in decreased strength of restoration leading to higher number of fractures in surface retained design. It is observed that the strength of restoration improves as the quantity of fibers is increased [26]. Results of current study seem to be in coherence with the systematic review reporting fracture of framework being the prevalent mode of failure.[27]

Results of this study show that 23.5% (Fig 2) of all failures were due to debonding of the restoration. A p-value of 0.179 shows that there is no significant association of number of debonding with respect to study designs.

Results (Fig 2) shows 20.6% of total failures were due to dislodgment of restoration. Statistical analysis (p value 0.269) shows insignificant effect of preparation design on dislodgment of restoration.

Debonding and dislodgment are due to loss of adhesive bond between the restoration and tooth structure. Comparable results have been observed in a five year follow up study of fiber reinforced resin bonded fixed partial denture [6]. The numbers of adhesive failures in current study were much less when compared to conventional metal framed resin bonded fixed partial dentures (92.6% of all failures) [27].

Adhesive failure of restoration takes place when tensile and compressive stresses are developed between framework and luting cement due to mastication. These stresses at the interface lead to fatigue failures. These unwanted forces can be minimized by using a framework material with lower modulus of elasticity.[27]. The metal framed RB-FPD having un-favorable modulus of elasticity cause increased stress on luting cement leading to increased number of adhesive failures in metal framework restorations. On the other hand, fiber reinforced composite has favorable modulus of elasticity and better adhesive properties with tooth. Therefore, the stresses developed are potentially minimized [25] which reduce the number of adhesive failures. Elastic nature and good bonding ability of fiber reinforced zirconium silicate indirect restorative material may be considered a key factor for decreased adhesive failures when compared to metallic resin bonded fixed partial dentures. Another factor responsible for a smaller number of adhesive failures of resin bonded fixed partial dentures in current study is use of luting cement with improved adhesive properties and similar nature as both luting cement and material of fabrication are resin based in nature showing better compatibility. The luting cement used in this study was 'multilink automix', which has superior adhesive properties and reportedly showed better adhesion as compared to other adhesive cements in a number of studies. (Panavia 2.0, Relyx ultimate, Nexus 3 optibond, Duo link all bond) (Multilink automix scientific documentation)

Only 8.8% of all failures were reported due to caries of the abutment teeth and 11.7% due to periodontal problem of the abutment teeth. However more periodontal issues were observed in surface retained RB-FPDs as compared to inlay retained. It may be due to increased plaque accumulation on the surface of buccal and lingual extension in the form of wings in surface retained RB-FPDs.

No veneering composite delamination was observed during 18 months of observation as compared to 20% of all failures in 5-year observation period [6]. This is most likely due to good strength of the veneering zirconium silicate based indirect restorative material and sufficient support provided by framework fibers for the pontic area. It was further seen that the clinical evaluation of these fiber reinforced resin bonded fixed posterior partial dentures showed no change in color, texture or any sign of wear during 18 months follow up. Other factors playing role in success of this conservative technique were incorporation of glass fibers as a framework material (Ever stick, Stick tech limited, Finland) and zirconium based indirect resin composite (Ceramage). The position of fibers plays an important role in strengthening and supporting the layering material in a continuous manner. The fibers incorporated in restoration not only increase the strength but also improve stiffness of restorations along the direction of fibers applied in the framework [28]. The veneering material used in this study was zirconium silicate-based Hybrid ceramic composite material (Ceramage). The zirconium silicate particles have made it strong, durable, stable, wear resistant and esthetically superior than other available composite resins.[29]

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