Original Article

CLINICAL SUCCESS OF THE FIBER REINFORCED COMPOSITE FIXED PARTIAL DENTURE (FRC FPD) IN ANTERIOR REGION FOR MISSING ONE OR TWO MISSING TEETH IN ANTERIOR REGION. AN ORIGINAL STUDY

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Abstract

The advancement in adhesive dentistry is increased the success rate and the longevity of the prosthetic rehabilitation with their use. The present study is to evaluate the longevity of the missing teeth in the anterior region.

MATERIAL & METHODS Two groups were made, one of them was single missing tooth and the other group was for 2 missing anterior teeth. Both groups were evaluated for the constant interval of 3 months up to 1 year. The all data was collected for the duration of the time and the data charts was prepared according to the data the statistical analysis done.

RESULTS Kaplan Meier Survival Analysis for the statistical analysis was used to get the results. The p value obtained after the analysis for the single missing tooth was more significant than the double teeth.

CONCLUSION Fibre reinforced composite fixed dental prosthesis (FRC FPD)for single tooth can be used as fixed conservative treatment as comparing to the two missing anterior teeth. The future is holding more of the variation. The study needs to be done for longer duration of time.

Keywords Composite, Anterior teeth, Fibre Reinforced Composite, Fixed Partial Denture

Introduction

The advancement in the adhesive materials changes the world and its influence to the other specialities of dentistry. The adhesive material come up with the options where the limitation of the prosthetic were evident as like of conventional FPD or the implant. Implants include the invasive surgical part while FPD need to remove the tooth material for existence.[1-2] Implants also come up with the problem lack of surgical approach and pink aesthetic score, emergence profile etc. Fiber reinforced composite (FRC) FPD can also be alternative to conservative treatment approach for fixed dental treatment. Advancement in the adhesive dentistry increased the longevity of

the prosthesis which were previously used as the interim prosthesis[3]. The present study is used to evaluate the longevity of the prosthesis with modified techniques as well as the advancement in the adhesive dentistry.

MATERIAL & METHODS

A total 40 patient were ready for treatment and subsequent follow up appointments. Certain inclusion and exclusion criteria were formulated for selection of the patients on the basis of medical history, thorough clinical examination and radiological examination. Among which the age and health related to bone was taken consideration for the most as well as the approach of the patient towards the treatment. All the selected patients were divided into two groups ***Group 1*** is of 3 unit fiber-reinforced composite fixed partial denture while ***Group 2*** is of more than 3 unit fiber-reinforced composite fixed partial denture. The treatment plan was formulated which was carried out in the following stages. In Stage 1 Pre-prosthetic Preparations done by diagnostic impressions of maxilla and mandible with alginate were made, casts were poured in type III dental stone; Bite registration records were then made and casts obtained were mounted on semi-adjustable articulator. In the next stage Prosthetic Protocol. The definitive prosthesis PFM pontic (porcelain fused to metal crown) was fabricated with the shade and shape of the pontic stabilized with wax from the palatal side on the cast. Putty matrix was fabricated by covering the labial surface and incisal edges of the teeth. The palatal grooves were prepared in the middle of the palatal surface of the abutment tooth. The grooves on the abutment and the pontic should be at the same level which helped in an easy adaptation of the fiber. The width of the groove was around 3mm and depth was around 1-1.5 mm. Fiber piece of the required length was cut by measuring the distance from the distal of one groove to the distal of another groove on the abutment. Prepared abutment tooth surface was etched with the 37% phosphoric acid for 20 sec and PFM pontic groove was etched for 1-2 minutes with 10% hydrofluoric acid, followed by rinsing and drying of the abutment and pontic. The bonding agent was applied on the abutment and light-cured for 15 secs and coupling agent was applied on the pontic (chemical cured). Pontic was then placed in the patient's mouth with the putty matrix. The first increment of the composite is placed in all the rooves and then fiber was properly embedded in the composite and light-cured for 60 sec. Finally a flowable composite was placed over the fiber giving the smooth, glossy appearance on palatal surfaces, followed by the occlusion evaluation with articulating paper was done to eliminate the premature contact, followed by the finishing and polishing of the composite resins.

Longevity Assesment

Clinical examination was done to collect data to evaluate the incidence of fracture, incidence of debonding of fiber, incidence of debonding of pontic, incidence of fiber exposure and longevity of the fiber-reinforced composite fixed partial denture at regular interval of 3 months. Along with these parameters incidence of carries in the abutment tooth along with the hard and soft tissue changes in the fiber-reinforced composite fixed dental prosthesis were clinically evaluated by grading them excellent, good, fair and poor at the same.

GROUP-1

Fig. 1 Edentulous site in the maxilla showing missing 11.

Fig. 2 Putty index.

Fig.3 Etching with 37% phosphoric acid.

Fig.4 Stabilization of the pontic with putty matrix. index.

Fig.5 Composite resin applied over the fiber.

GROUP-2

Fig. 1a Missing 31 and 41 in mandibular jaw.

Fig.2a PFM pontics for 31 and 41 edentulous space.

Fig. 3a Etching with 37% phosphoric acid.

Fig. 4a Intra oral stabilization of the PFM pontics with the putty

Fig. 5a Finished Polished PFM pontics at the edentulous space in mandible.

Fig.6 Intraoral view of the finished and polished 3 unit FRC FDP.

Fig. 6a Intraoral view of the finished and polished >3 unit FRC-FDP

Results

The data was collected and statistical analysis done by Kaplan Meier Survival Analysis was used. Incidence of fracture and debonding of the fiber, the incidence of debonding of pontic, the incidence of fiber exposure along with aesthetic biological and functional parameters at the regular interval of 3 months for 1 year. The results obtained were subjected to statistical analysis and tabulated in the Table No: 1 & 2. The statistical analysis software for data analysis was used was SPSS 20.

Table 1: Distribution of study subjects.

Group		Gender		Age	
		Male	Female	Mean	SD
Group 1	n	12	08	29.55	7.32
	%	60.0	40.0		
Group 2	n	13	07	33.45	8.05
	%	65.0	35.0		
Total	n	25	15	31.50	7.85
	%	62.5	37.5		

SD – Standard Deviation

Group 1 – 3 unit fiber reinforced composite fixed dental prosthesis.

Group 2 – more than 3 unit fiber reinforced composite fixed dental prosthesis.

Table 2: Comparison of incidence of fracture and fiber debonding, debonding of pontic, fiber exposed and longevity of prosthesis in between group 1 and 2 after 9 months.

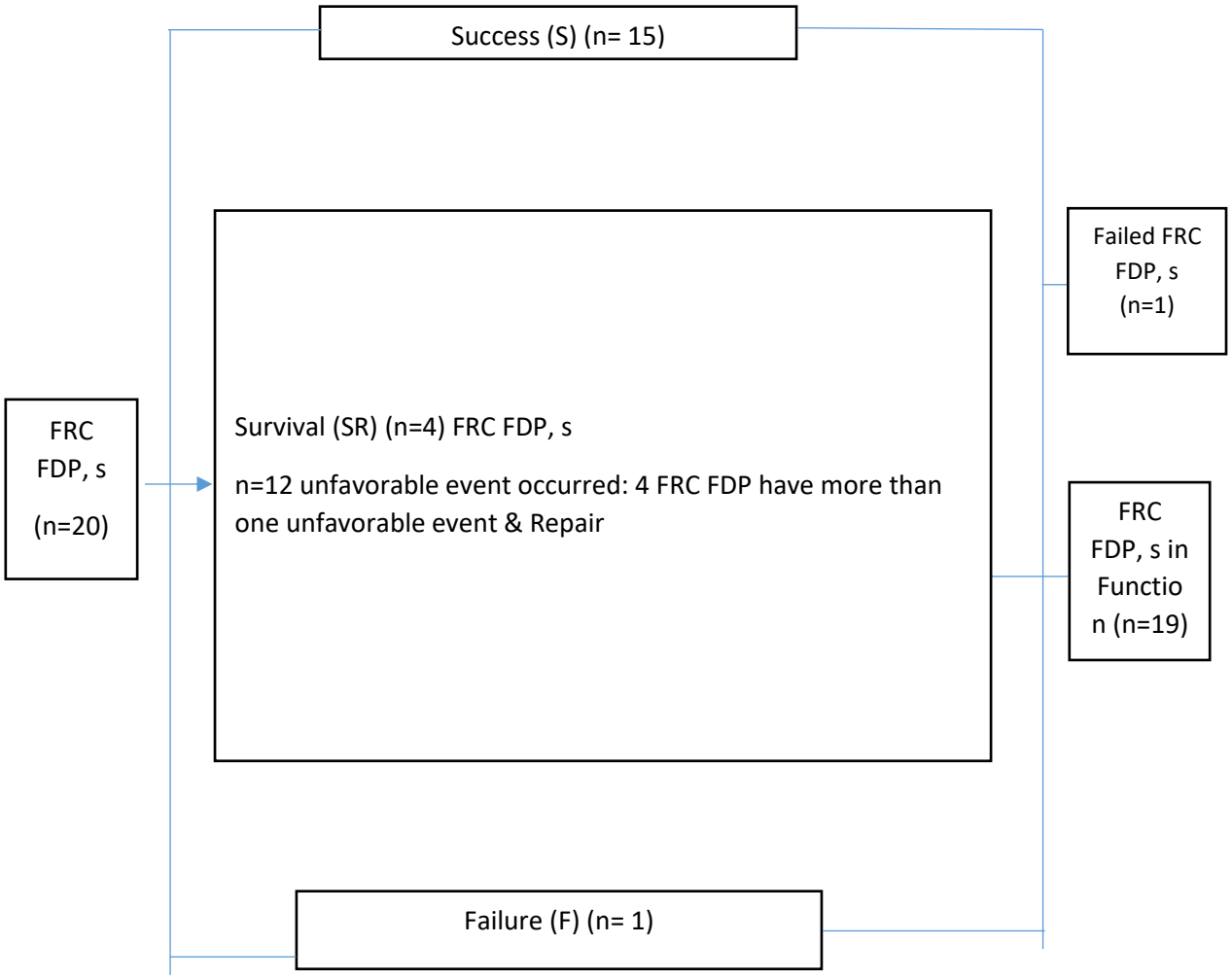
Group		Fracture at 9 months		Chi Square Test	p - Value
		Absent	Present		
Group1	n	19	00		
	%	100.0%	00.0%	2.367	0.124

Group 2	n	15	02		(NS)
	%	88.2%	11.8%		
		Fiber debonding at 9 months			
		Absent	Present		
Group1	n	18	01		
	%	94.7%	5.3%	0.496	0.481
Group 2	n	15	02		(NS)
	%	90.0%	11.8%		
		Pontic debonding at 9 months			
		Absent	Present		
Group1	n	18	01		
	%	94.7%	5.3%	0.920	0.337
Group 2	n	17	00		(NS)
	%	100.0%	00.0%		
		Fiber exposed at 9 months			
		Absent	Present		
Group1	n	18	01		
	%	94.7%	5.3%	0.920	0.337
Group 2	n	17	00		(NS)
	%	100.0%	00.0%		
		Longevity at 9 months			
		Survived	Not Survived		
Group1	n	19	01		
	%	95.0%	5.0%	3.137	0.077
Group 2	n	15	05		(NS)
	%	75.0%	25.0%		

NS-Not significant. S- Significant.

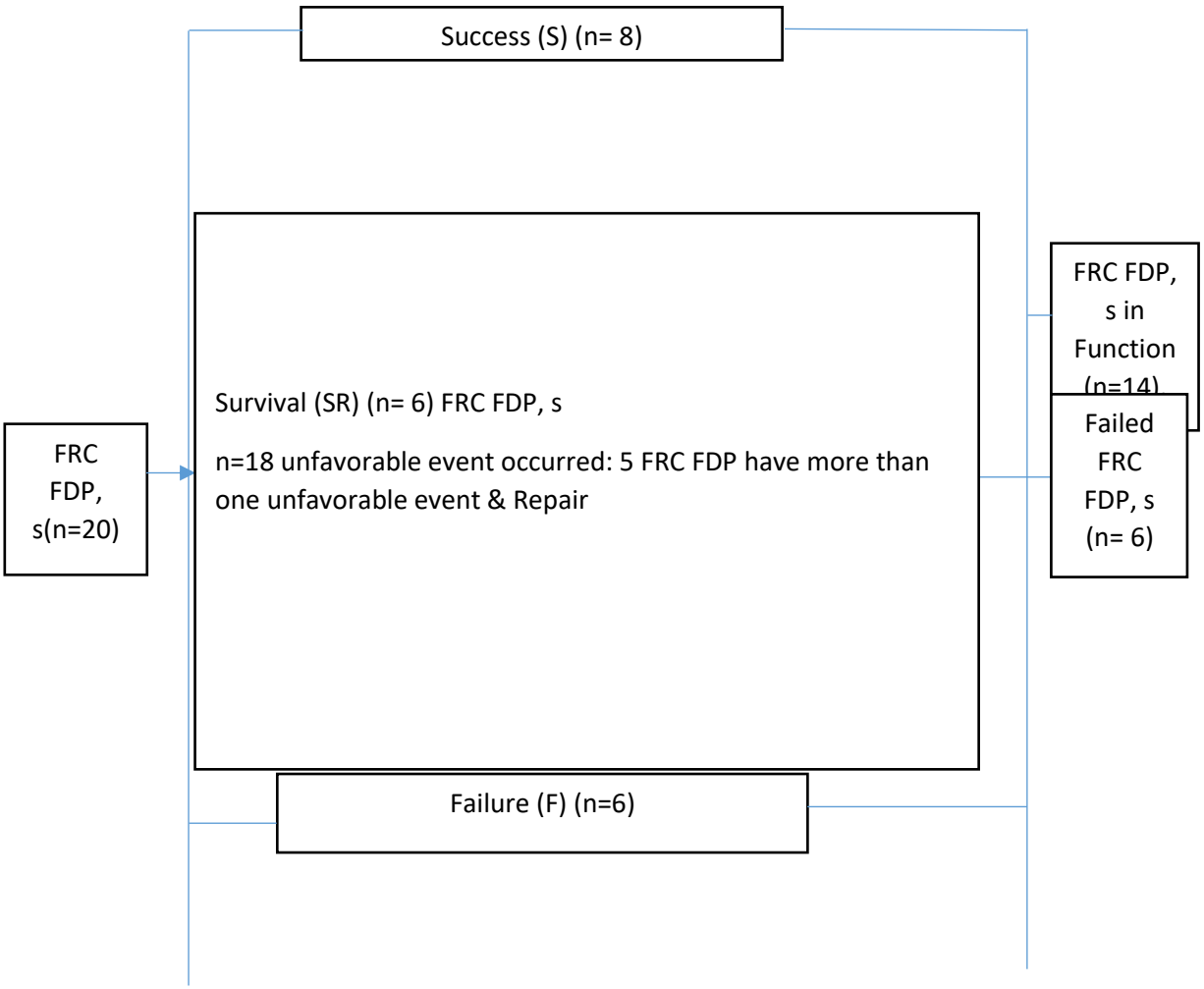
GROUP- 1 FRC-FDP, s

(3 Unit)



GROUP- 2 FRC-FDP, s

(More than 3 Units)



Discussion

With minimal preparation and excellent aesthetics the FRC FPD can be taken in comparison to more invasive techniques like implants, complete crown preparation for metal and all-ceramic crowns. The preparation geometry of fiber-reinforced composite fixed dental prosthesis offers favourable prerequisites for the adhesive cementations technique to achieve adequately strong dental restorations and enhance the longevity of the prosthesis along with it. With all these benefits fiber-reinforced composite fixed dental prosthesis is more economical than the conventional FDPs and even needs less diagnostic aids in the complete procedures, with also decreased chairside time.

Fiber-reinforced composite fixed dental prosthesis being considered as an interim restoration but with modifications in the preparation geometry and the prepared pontic of PFM for the evaluation of the longevity of the fiber-reinforced fixed dental prosthesis. The fiber-reinforced composite fixed dental prosthesis can be used in the anterior region with enhanced function with the PFM pontic with an excellent esthetics, along with the longevity in both maxillary and mandibular anterior regions.

The study was conducted on two groups where twenty patients were given three-unit FRC FPD and the rest twenty patients were given more than three-unit FRC FPD. FRC FPD was assessed by observing different clinical parameters which was the incidence of fracture and debonding of the fiber, debonding of pontic, fiber exposure with all above the overall esthetic, biological and functional parameters at the regular interval of three months for

one year. The finding showed that the clinical outcome and the parameters of the three-unit FPD was better in terms of longevity and fracture incidence in comparison to more than three-unit FPD.

The parameters like esthetic, biologic and functional parameters were assessed at the follow-up time by the United States Public Health Services (USPHS) criteria. The minimal or no change assessed in the soft tissue around the pontic and around the periodontal tissue of the abutment teeth.

The chi- square test and Kaplan-Meier method for survival analysis of both the groups, by the data obtained during the study the results obtained the p value of the 0.041 for the survival analysis and that value obtained was significant obtained with the Kaplan-Meier method (Table no.-2). The significant p-value for the longevity of the prosthesis of groups 1 and 2 was (0.037) after the follow up of 12 months with the Chi-square test (Table no.-2). The outcome of the study was that the longevity of the FRC FPD of group 1 was high than compared to the group 2.

In the study results showed the most common instances of debonding of fiber and minimal or no periodontal tissue changes. The prime reason for the debonding and the fiber fracture instances might be due to biting the hard food material, prolong time of impact of force, lack of bonding between the composite and the fiber matrix, may be due to improper application of the silane coupling agent during the procedure, lack of the proper curing cycle of the resins. The chances of the debonding can be multifactorial as ***Wolff et al. (2018)[4]*** stated the same cause for the failure of the restorations as debonding and periodontal health was not affected because of the use of the FRC FPD. [5-7]

The delamination of the composite resins might be due to improper occlusal adjustment, deep bite or contamination during binding processes or incomplete curing of the composite resin. The instances of the chipping in the prosthesis may be because of the abnormal eccentric movement during the chewing cycle of the patient which ultimately cause the loss adhesive material to certain focal sites.[8-11]

The functional survival of the fiber-reinforced composite fixed partial dentures for group 1 was of 12 months for 19 fiber-reinforced composite fixed partial dentures while it was 14 for group 2 fiber-reinforced composite fixed partial dentures. The findings from the study also seem to be coinciding with the findings of ***Frese et al. (2014)[31].*** They suggested that the common cause for the failure of the fiber-reinforced composite fixed partial dentures were debonding. But the clinical survival is not improved by the higher fiber fraction. In the present study the most common cause of the failure of the fiber-reinforced composite fixed partial dentures was the debonding and the fracture of the fiber rather on the other side the PFM pontic provides the better esthetic and no instance of lustere loss or pontic fracture recorded due to its better properties than the prefabricated acrylic tooth or the customized composite crowns.

Kumbuloglu and Ozcan (2015)[34] also showed that fiber-reinforced composite fixed partial dentures commonly fail due to debonding which is similar to the results of the present study. The present study results also support the findings of ***Malmstrom et al. (2015)[38]*** where they stated that the success rate does not depend on the location of the missing tooth, retention type or fiber material. The use of PFM pontic teeth in the present study was used while the prefabricated acrylic resin teeth were used by ***Perea et al. (2014)[30]***. They said that the composite filling material along with pre-shaped acrylic resin teeth found to have a good ability to withstand masticatory force whereas the better esthetics and function were achieved by the PFM pontic in our study.[37-39] The advantages of the present study are less time consuming, esthetically pleasing and good long term alternative especially to replace missing anterior teeth.41

V. Yamuna et al [42] compared the longevity of the FRC FPD in the anterior region. At the end of 9 months, slight surface roughness was seen in 4 restorations and debonding of one restoration was found. The debonded restoration was rebonded in place using composite resin. At the end of 12 months, one restoration got debonded but the same was rebonded using composite resin. At the end of 24 months, 6 out of 10 restorations are successful with satisfactory esthetics.

It was concluded that the longevity of the FRC FPD was high in the three-unit FRC FPD as in comparison to the more than three-unit's FRC FPD based on the obtained results. Results support that the FRC FPD can also be used as a definitive prosthesis not just as an interim restoration.

As this was a limited single-center study, the different kinds of FRC FPD were homogeneously distributed, and comparisons between anterior FRC FPD groups was made because of the equal group sizes. Hence the present study demonstrate that the survival rate is high in case of single missing anterior in comparison to the double adjacent missing anterior teeth. A long term follow-up should be required before going to the further definitive conclusion can be made.

CONCLUSION

With all advancement in the material increasing the scope of FRC FPD as a permanent prosthesis with the conservative and non-invasive approach as a treatment. FRC FPD can be the permanent restorative approach rather than the interim prosthesis. The study needs to be done for longer duration of time for getting more accurate and precise.

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