

Comparison of marginal adaptation of fiber reinforced composite and metal ceramic full veneer crown

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Abstract

Fiber reinforcement was introduced to clinical dentistry for the first time in the 1960s when investigators attempted to reinforce polymethyl-methacrylate dentures with glass or carbon fibers. It has recently been shown that crowns, bridges and posts made of FRC can be used successfully in dental practice and on the basis of marginal adaptation they are more acceptable than conventional metal ceramic crown. A prospective comparative cross-sectional study was performed involving 60 patients who attended in the out patients department of Prosthodontics, Faculty of Dentistry, BSMMU during the period of January 2007 to December 2008. Clinical data were recorded for the selected 60 patients who were divided into two groups "experimental" and "control". Marginal adaptation was indexed after California Dental Associations quality evaluation system. The age of the patients ranged from 18 to 42 years in group A and 17 to 38 years in group B. The highest number of patients was in the age group 21-30 years in both the groups. The mean age was 24.9±5.8 years and 25.0±4.8 years in group A and group B respectively. There were 26 male and 34 female patients in the study and male female ratio was 1:1.3. In group A patients, 12(40.0%) were male and 18(60.0%) female. In group B patients 14(46.7%) were male and 16(53.3%) were female. After 4 months all the patients were in grade I in both the groups. After 8 months all the patients were in grade I in group A and 27(90.0%) patients in grade I in group B. After 12 months all the patients were in grade I in group A and 25(83.3%) patients were in grade I in group B. The difference was not statistically significant ($p>0.05$) after 8 months, however after 12 months the difference was significant ($p<0.05$). The Fiber Reinforced Composite crown represents a valuable development in the field of Prosthetic Dentistry.

Key words: Marginal adaptation, Fiber reinforced Composite crown, Metal ceramic crown.

Introduction

Metal-ceramic crowns are clinically successful¹. But the visibility of metal and the change in natural tooth translucency is aesthetically unfavorable. The desire for natural looking restorations has encouraged research in the last decades on metal-free, tooth colored materials for dental restorations.²

In early all-ceramic restorations exhibited high failure rates,³ an alternative has been found in the use of reinforced composite materials. In recent years, there have been several in vitro⁴⁻⁶ and in vivo studies^{7,8} of the properties of these composites and promising results have been reported for crowns,⁹ and for fixed partial dentures.¹⁰

However, although these materials seem to provide excellent aesthetics,¹¹ some authors do not recommend composite materials for permanent restorations,^{12,13} because of their unstable aesthetics, their increased wear¹⁴ and their liability to plaque accumulation.¹⁵

With the introduction of fiber reinforced composites, it seemed to be possible to eliminate these disadvantages of composites and to exploit their advantages, including the simple laboratory procedure, the lower costs and the possibility of repair.

Additionally, this new generation of composites has given promising in vitro results with respect to color change,¹⁶ wear¹⁷ and fracture resistance.¹⁸

The objective of this present prospective clinical study was to assess marginal adaptation of a new experimental fiber reinforced composite anterior crowns, compared with a metal-ceramic control group.

Methods

Participants for this study were recruited from patients visiting the Department of Prosthodontics Faculty of Dentistry, BSMMU during the period of January 2007 to December 2008. The university's review board approved the study and all patients signed an informed consent form. Criteria for including was-Fracture teeth with healthy periodontal tissue,

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discolored anterior teeth, endodontically treated tooth (Root canal treated tooth), abrasion, erosion of anterior teeth and excluding premolar and molar teeth, periodontally compromised teeth, para functional habit (bruxer), vertical fracture, grossly damaged teeth, developmentally defective teeth; all evaluated by the researcher.

Clinical treatment – at chair side and in laboratory site a standardized procedure was followed. After the removal of old restorative materials and caries excavation, the teeth were built up according to the manufacturer's instructions.

Adaptation of Fiber: Pre impregnated resin, flat & unidirectional Dentapreg fiber strip manufactured by Prestige Dental, UK was used for fabrication of framework of crown. Bucco-lingually length of the restoration was measured by scale & Dentapreg fiber strip was cut down according to measurement.

Covering paper of Dentapreg strip was removed and adapted one side of the fiber –reinforced composite (FRC) on the buccal side teeth and visible light (Litex) was applied for 20 seconds. Then the fiber –reinforced composite was shaped and adapted slowly lingual side teeth and light curing was applied for 20 seconds. Then the transparent plastic protective film on the strip was removed.

Composite build up: By the incremental way the hybrid veneering composite (ceramic nano-Densply) was applied over the abutments/die and light curing was applied for 40 seconds. The medial and distal proximal contact was made up with the help of cellophane strip. Gingival embrasure was prepared by the application of standard dental wedges. Final light curing, shaping, polishing and finishing were done by standard ways. The fiber Reinforced Composite full veneer crown was polished by standard composite plastic polisher and light cure bonding agent.

Cementation: The inside of the crown of Fiber Reinforced Composite (FRC) was sand blasted with aluminum oxide. The internal surface was then treated with a bonding agent and delivered with a low viscosity, hybrid, and composite luting agents. These luting agents were bonded to the inside of the crown to the etched dentine and enamel of the abutments.

Procedure of Metal Ceramic crown: The tooth reduction was done in all aspects with ideal procedure. Impression was taken with alginate. Cast was poured with die stone. Die was prepared with ideal method and trimming was done for wax pattern.

Waxing was done with inlay casting wax. Investing and casting were done with standard procedure. Metal framework was tried in for proper fit. Porcelain was bonded over metal framework. Porcelain bonded prostheses was trailed. Final polishing and glazing was done. Cementation was done with Glass-ionomer luting cement.

Instruction was given to the patients and advised them to report after 4 months, 8 months and 12 months interval. Esthetic status was indexed after California Dental Association's quality evaluation system¹⁹.

Marginal adaptation

Grade I: No visible evidence of a crevice along margin into which explorer will penetrate.

Grade II: Visible evidence of slight marginal discrepancy with no evidence of decay; repair can be made or is unnecessary.

Grade III: Discoloration on the margin between the restoration and the tooth structure.



Initial Photograph



Fiber Adaptation



Incremental Composite Buildup



After Cementation of FRC

Data Collection: Data were collected from the patients who attended to report their prostheses condition after 4 months, 8 months and 12 months.

Data analysis: All the collected data were compiled on a master chart first. After coding and editing, the collected data were analyzed by using statistical package for social science (SPSS). The result was presented in tables. Chi-square test was done by using Epi Info (version 12). P-value <0.05 was considered significant.

Results

The prospective comparative study was conducted among the patients who fulfilled the inclusion criteria. The patients who attended in the out patient department of Prosthodontics, faculty of Dentistry at Bangabandhu Sheikh Mujib Medical University (BSMMU), from January 2007 to December 2008 were included in this study, among them, 30 were in group- A (experimental), were treated with Fiber Reinforced Composite crown and another 30 were in group- B (control), were treated with Metal ceramic crown.

The observation was done after 4 months, 8 months and 12 months interval of the cementation of crowns and data were collected for selected variables of marginal adaptation of prostheses. Collected data were presented in tabular form and statistical analysis was done to observe the statistical significance.

Table I: Distribution of patients by age (n=60)

Age (years)	Group A (n=30)		Group B (n=30)	
	f	%	f	%
	≤20	6	20.0	6
21 – 30	18	60.0	19	63.3
31 – 40	5	16.7	5	16.7
> 40	1	3.3	0	0.0
Mean ± SD	24.9	±5.8	25.0	±4.8

The table I shows the distribution of patients of both the study groups. The age of patients ranged between 18 and 42 years in group A and 17 and 38 years in group B. The highest number of patients was in the age group 21-30 years in both the groups. The mean age was 24.9±5.8 years and 25.0±4.8 years in group A and group B respectively.

Table II: Distribution of patients by sex (n=60)

Sex	Group A (n=30)		Group B (n=30)		p value
	f	%	f	%	
	Male	12	40.0	14	
Female	18	60.0	16	53.3	

There were 26 male and 34 female patients in the study groups and male female ratio was 1:1.3. In group A patients, 12(40.0%) were male and 18(60.0%) female. In group B 14(46.7%) were male and 16(53.3%) were female. The difference was not statistically significant (p>0.05).

Table III : Distribution of patients according to marginal adaptation of full veneer crown after 4 months (n=60)

Marginal adaptation	Group A (n=30)		Group B (n=30)		p value
	f	%	f	%	
	Grade – I	30	100	30	
Grade – II	0	0.0	0	0.0	
Grade – III	0	0.0	0	0.0	

The table III shows the distribution of patients according to marginal adaptation of full veneer crown. After 4 months all patients were in grade I in both groups.

Table IV: Distribution of patients according to marginal adaptation of full veneer crown after 8 months (n=60)

Marginal adaptation	Group A (n=30)		Group B (n=30)		p value
	f	%	f	%	
	Grade – I	30	100	27	
Grade – II	0	0.0	3	10.0	
Grade – III	0	0.0	0	0.0	

The table IV shows the distribution of patients according to marginal adaptation of full veneer crown. After 8 months all patients were in grade I in group A and 27(90.0%) patients were in grade I in group B. The difference was not statistically significant (p>0.05).

Table V: Distribution of patients according to marginal adaptation of full veneer crown (n=60)

Marginal adaptation	Group A (n=30)		Group B (n=30)		p value
	f	%	f	%	
	Grade – I	30	100	25	
Grade – II	0	0.0	5	17.7	
Grade – III	0	0.0	0	0.0	

The table V shows the distribution of patients according to marginal adaptation of full veneer crown. After 12 months all patients were in grade I in group A and 25(83.3%) patients were in grade I in group B. The difference was statistically significant (p<0.05)

Discussion

The prospective comparative study was conducted among the patients who fulfilled the inclusion criteria. The patients who attended in the out patient department of Prosthodontics, faculty of Dentistry

at Bangabandhu Sheikh Mujib Medical University (BSMMU), from January 2007 to December 2008 were included in this study, among them, 30 patients were in group-A, who treated with Fiber Reinforced Composite Crown and another 30 patients were in group-B who were treated with Metal ceramic full veneer crown. The main objective of this study was to compare the effect of Fiber Reinforced Composite Crown and Metal ceramic full veneer crown.

After cementation of Prosthesis the patients were requested to come and maintain follow up visits after 4 months, 8 months and 12 months and data were collected according to marginal adaptation of the prosthesis.

The age ranged of both groups was from 17 to 41 years. The highest number of patients was in the age of 21-30 years in both the groups. In this study out of 60 patients, 26 were male and 34 were female and male female ratio was 1:1.3.

Marginal adaptation was examined in accordance with the California Dental Association's (CDA)¹⁹ quality evaluation system described above (materials and methods). According to marginal adaptation after 4, 8 and 12 months it showed that all the patients of group -A were in grade -I i.e. excellent. After 4 months all the patients of group -B were also in grade -I and after 8 and 12 months 27(90.0%) and 25(83.3%) patients were in grade-I in group B. The marginal adaptation of Fiber Reinforced Composite crown was better than Metal ceramic crown. The difference was not statistically significant ($p>0.05$) after 8 months, however after 12 months the difference was significant ($p<0.026$).

Cho et al (2003)²⁰ evaluated the marginal adaptation of FRC crowns with respect to the various types of finish lines. Forty crowns were prepared with different finish lines. The marginal adaptation of crowns with a shoulder finish line was significantly better than crowns with a chamfer finish line before and after cementation ($P<.001$).

Previous study²¹ on effect of Fiber reinforced composite in fixed partial denture (FPD) was conducted in the Department of Prosthodontics at BSMMU, among forty patients were divided into two groups. In that study it was shown that there were no change in esthetic status and no attrition of opposing teeth. Only 2(10.0%) patients were found to chip out composites. Fiber reinforced composite fixed partial denture is an innovative alternative to conventional metal ceramic fixed partial denture.

Conclusion

The Fiber Reinforced Composite crown is a valuable development in the field of Prosthetic Dentistry. This study shows that Fiber reinforced composite crown provides a life like esthetical appearance, better fracture resistance, good marginal adaptation and no attrition of opposite teeth as well as it is a time saving restoration, easy to repair and cost effective.

Recommendations

Within the limitations of this study it is strongly recommended that Dentists can use Fiber Reinforced Composite crown to ensure esthetically pleasant and durable restorations.

The following recommendations are put forward for establishment of the procedure:

- a) The study should be conducted on a long term basis. A larger period of observations is required to test the hypothesis.
- b) As it is a technique sensitive restoration, proper curing and high strength composites should be used to increase the longevity of the prosthesis.
- c) The study conducted only at BSMMU among a small group of patients, further study with a large sample size should be done for better conclusion of this result.

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