

Impact of Full Veneer Crown Restoration on the Periodontal Health of Posterior Teeth

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Abstract

Background: Periodontal health plays a vital role in the longevity of prosthodontic restorations. Full veneer crown (FVC) is one of the most common modalities in restoration of single tooth for preservation of function and health of oral tissues.

Objectives : The study was done to critically evaluate the impact of FVC restoration providing standard procedures on the periodontal health of posterior teeth, also to observe the changes of periodontal health in terms of their status of gingival index, plaque index, periodontal pocket depth, bleeding on probing in different stages of treatment.

Materials & methods: This prospective study evaluated the impact of FVC on periodontal health of 30 endodontically treated posterior teeth with FVC and 30 contralateral natural teeth of 19 patients in different stages of treatment for 2 years duration in the Dept. of Prosthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital. To assess the periodontal health gingival index, plaque index, periodontal pocket depth, bleeding on probing were used. Collected data were analyzed using SPSS software (version 22) according to the study objectives.

Results: The study result showed that the mean differences of gingival index and plaque index between abutments and

contralateral natural teeth were non significant ($p > 0.05$) at baseline, 4th month visit; but the differences were significant ($p < 0.05$) at 8th month, 12th month visits. Regarding periodontal pocket depth the mean differences between abutments and contralateral natural teeth found non significant ($p > 0.05$) throughout the follow up period. Same thing observed in bleeding on probing except 12th month follow up visit, where highly significant ($p < 0.01$) mean differences observed. Also the study found that the gingival index, plaque index, bleeding on probing, periodontal pocket depth increased a bit in 4th, 8th, 12th month visits gradually in abutments, which was almost same in contralateral natural teeth in case of gingival index, periodontal pocket depth; and increased a bit in case of plaque index, bleeding on probing. **Conclusion :** If the FVC is fabricated maintaining all standard procedures equigingival margin with proper marginal adaptation, oral hygiene as well as general health of the patient is maintained although less but there is a chance of detrimental effects on periodontal health in comparison to contralateral natural teeth.

Key words: Full veneer crown; Periodontal health; Gingival index; Plaque index; Impact.

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Introduction:

The relationship between periodontal health and the restoration of teeth is intimate and inseparable.¹

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Periodontal health plays an important role in the longevity of prosthodontic restorations. A healthy periodontium provides stable gingival margins and stable tooth position prior to tooth preparations for indirect restorations. Good periodontal health allows easier tissue handling during tooth preparation, impression taking and restoration fitting. Periodontal health is integral to successful restorative care. In recent decades full veneer crowns (FVC) have been the major type of restoration used in fixed prosthodontics, as they serve as an excellent means of protection of a weakened tooth structure, as well as with the improvement of esthetics and restoration of tooth function.^[2] There are many factors which may influence the long term biological success of FVC like the location of crown margin, marginal adaptations, the contour of the crown, maintenance of oral hygiene as well as the periodontal health through establishing a physiologic periodontal

environment.³⁻⁵ Regarding the restorative margins, it is widely accepted that the best one is placed coronal to marginal tissue. But most restorations have margins in the gingival crevice, therefore permanent tissue damage is common.^[6] Undoubtedly it is preferable if margins can remain coronal to the free gingival margin. Even though subgingival margin placement is often unavoidable in clinical dentistry.^[1] Moreover if the restoration is located in anterior zone, the aesthetic requirements should be fulfilled as well; also the adequate thickness of porcelain along with equigingival or subgingival margin placement need to consider.^[7,8] Patients with FVC need to be instructed to maintain a good oral hygiene by using oral hygiene aids and supplementary cleaning instruments for effective removal of dental plaque.^[9] Also these patients need a periodic recall to maintain an excellent health of the periodontium. Several studies reported that frequent careful cleaning and maintenance of teeth by the patients with FVC help in maintaining a good gingival health as well as periodontal health.^[9,10] Therefore present study aimed to critically evaluate the impact of FVC restoration on the periodontal health of posterior teeth, also observed the changes of periodontal health in terms of their status of gingival index, plaque index, periodontal pocket depth, bleeding on probing in different stages of treatment.

Methods:

This prospective study was conducted in Prosthodontics Dept. of Bangabandhu Sheikh Mujib Medical (BSMMU) Hospital for 2 years duration from July 2017 to June 2019 among 19 prosthodontic patients. Consecutive sampling technique was used to select the cases for this study. Among these patients 30 endodontically treated teeth with healthy periodontal tissue that needed FVC restoration and 30 contralateral natural sound teeth of the same patients were included in this study to assess the impact of FVC restoration on the periodontal health of posterior teeth in different stages of treatment. To assess the periodontal health of posterior teeth; gingival index, plaque index, periodontal pocket depth, bleeding on probing were used. The gingival index and the plaque index mainly assess the gingival health; along with these two indexes bleeding on probing and periodontal pocket depth collectively assess the periodontal health. These indexes scored as 0,1,2,3 against the categories Grade 1, Grade 2, Grade 3, Grade 4 respectively which have specific criteria for each

grade in case of gingival index, plaque index and periodontal pocket depth.^[11,12] For bleeding on probing the scores are 0,1,2,3,4 against the categories Grade 1, Grade 2, Grade 3, Grade 4, Grade 5 respectively with the specific criteria for each grade.^[13] The gingival index, plaque index, periodontal pocket depth, bleeding on probing were recorded from the contralateral natural teeth which were considered as control to assess and compare the periodontal health of posterior teeth with FVC and without FVC in different stages of treatment. The selected endodontically treated teeth were examined, isolated and followed the standard principles of tooth preparation for FVC. Biological consideration was maintained by conservation of tooth structure, avoidance of over contouring, placing equigingival margins and providing harmonious occlusion. Retention and resistance form was given for mechanical consideration and to fulfill the aesthetic requirement minimum display of metal, maximum thickness of porcelain, porcelain occlusal surfaces, equigingival margin was provided. During margin placement care was taken for preservation of the periodontium and the gingival care was taken with placement of retraction cord. The inclusion criteria of the study were endodontically treated posterior tooth having healthy periodontal tissues, along with adequate clinical crown height (at least 4-5 mm), good endodontic seal with no exudates, no pain, no mobility. On the other hand, the exclusion criteria of the study were study subjects below 18 years, having very poor oral hygiene, having missing, treated or diseased contralateral natural tooth, congenitally malformed tooth and the patients with systemic diseases like diabetes mellitus which may influence the periodontal health. After cementation of FVC baseline data were recorded for the parameters of gingival index, plaque index, periodontal pocket depth and bleeding on probing; also in the follow up visits at 4 months, 8 months and 12 months data were recorded. Ethical clearance was taken from the Institutional Review Board (IRB) of BSMMU and the reference number is BSMMU/2018/4926. Along with the written informed consent from the respondents to participate in the study, confidentiality and anonymity of the respondents were maintained strictly. Finally the collected data were analyzed using SPSS software (version 22) according to the study objectives. Both descriptive statistics (mean, SD, frequency, percentage) and inferential

statistics were applied to obtain the results. Test of significance such as student's t test was performed to compare the mean differences of different indexes between the study and control group in different stages of treatment (statistical significance was accepted at $p < 0.05$).

Results:

Table I shows out of 19 (100.0%) patients, the mean age was $36.9 (\pm 9.7)$ years with range 22 – 54 years, more than half 10 (52.6 %) were female, 7 (36.8 %) were housewives.

Table III shows the comparison of mean values of gingival index between abutments and contra-lateral natural teeth in different stages of treatment. At baseline the mean value was 1.13 ± 0.35 , at 4th month was 1.20 ± 0.41 , at 8th month was 1.37 ± 0.49 and at 12th month was 1.67 ± 0.61 in abutments; whereas in the contralateral natural teeth the mean values found 1.13 ± 0.35 , 1.10 ± 0.31 , 1.10 ± 0.31 and 1.10 ± 0.31 respectively. The mean differences of gingival index of abutments and contra-lateral natural teeth was not significant at baseline and at 4th month follow up visits, but it was significant ($p < 0.05$) at 8th month and highly significant ($p < 0.01$) at 12th month follow-up periods.

Table IV shows the comparison of mean values of plaque index between abutments and contra-lateral natural teeth in different stages of treatment. At baseline the mean value was 1.20 ± 0.41 , at 4th month was 1.17 ± 0.38 , at 8th month was 1.53 ± 0.51 and at 12th month was 1.97 ± 0.41 in

abutments; whereas in the contralateral natural teeth the mean values were 1.23 ± 0.43 , 1.27 ± 0.45 , 1.33 ± 0.48 and 1.67 ± 0.55 respectively. The mean differences of plaque index of abutments and contra-lateral natural teeth was not significant at baseline, 4th month and 8th month follow up visits, but it was significant ($p < 0.05$) at 12th month follow up visit.

Table V shows the mean values of periodontal pocket depth in both abutment and contra-lateral natural teeth of the participants in different stages of treatment. The mean value of contra-lateral teeth at baseline, at 4th month, at 8th month and at 12th month follow up was unchanged and it was 1.10 ± 0.31 whereas the mean value of abutment at baseline was 1.07 ± 0.25 , at 4th month was 1.1 ± 0.18 , at 8th month was 1.07 ± 0.25 and at 12th month was 1.13 ± 0.35 . The result was non significant ($p < 0.05$) throughout the follow up period between abutment and contralateral natural teeth.

Table VI shows the mean values of bleeding on probing in both abutment and contra-lateral natural teeth of the participants in different stages of treatment. At baseline the mean was 1.17 ± 0.38 , and the value was 1.20 ± 0.41 at 4th month, 1.63 ± 0.67 at 8th and 2.13 ± 0.43 at 12th month whereas the mean values of contralateral natural tooth were 1.17 ± 0.38 , 1.23 ± 0.43 , 1.40 ± 0.50 and 1.73 ± 0.45 respectively. Bleeding on probing was non significant at baseline, 4th month and 8th month follow up visit but at 12th month follow-up period the changes between abutment and natural teeth were statistically highly significant ($p < 0.01$).

Table-I

Socio demographic attributes of the patients (N=19)

Socio demographic attributes	N(%)	
Age group (in years)	21-30	8(42.1)
	31 – 40	4(21.1)
	41-50	5(26.3)
	> 50	2(10.5)
	Mean (\pm SD) : 36.9 (\pm 9.7), Range : 21-54 years	
Sex	Male	9(47.4)
	Female	10(52.6)
Occupation	Student	2(10.5)
	Housewife	7(36.8)
	Business	3(15.8)
	Service holder	4(21.1)
	Other	3(15.8)

Table-II

Assessment of periodontal health by Gingival index, Plaque index, Periodontal pocket depth, Bleeding on probing (Score and criteria)

Periodontal health assessment	Score/Value	Status (Grade) and criteria
Gingival index	0	Grade 1 : No inflammation (normal gingiva)
	1	Grade2 : Mild inflammation (slight change in colour, slight oedema, no bleeding on probing)
	2	Grade 3 : Moderate inflammation (redness, oedema, glazing, bleeding on probing)
	3	Grade 4 : Severe inflammation (marked redness, oedema, ulceration and tendency to spontaneous bleeding)
Plaque index	0	Grade 1 : No plaque (absence of microbial plaque)
	1	Grade 2 : Mild plaque (a thin film of microbial plaque along the free gingiva)
	2	Grade 3 : Moderate plaque (moderate accumulation of plaque in sulcus and free gingiva)
	3	Grade 4 : Abundant plaque (abundance of microbial plaque in sulcus or pocket along the free gingival margin)
Periodontal pocket depth	0	Grade 1: Normal depth of gingival sulcus (1-2 mm)
	1	Grade2 : 2-3 mm gingival sulcus depth
	2	Grade 3 : 3-4 mm gingival sulcus depth
	3	Grade 4 : > 4 mm gingival sulcus depth
Bleeding on probing	0	Grade 1 : No bleeding
	1	Grade 2: A single discreet bleeding point
	2	Grade 3: Several isolated bleeding points or a single line of blood appears
	3	Grade 4: The interdental triangle fills with blood shortly after probing
	4	Grade 5 : Profuse bleeding after probing, blood flows immediately into the marginal sulcus

Table-III

Comparison of Mean (\pm SD) of gingival index score between abutment and contra lateral natural tooth (N=60)

Different stages of treatment	Abutment teeth / With full veneer crown (n ₁ =30)	Contra lateral natural teeth /Without full veneer crown(n ₂ =30)	t value	p value
	Gingival index score			
	Mean (\pm SD)	Mean (\pm SD)		
At baseline	1.13 (\pm 0.35)	1.13 (\pm 0.35)	0.000	1.000 ^{ns}
At 4 th month	1.20 (\pm 0.41)	1.10 (\pm 0.31)	1.077	0.286 ^{ns}
At 8 th month	1.37 (\pm 0.49)	1.10 (\pm 0.31)	2.530	0.014 ^s
At 12 th month	1.67 (\pm 0.61)	1.10 (\pm 0.31)	4.572	0.001 ^{hs}

Data were expressed as mean \pm SD

p value calculated by students t-test

s = significant, ns = not significant, hs = highly significant

p value was significant at <0.05.

Table-IV

<i>Comparison of Mean (\pm SD) of plaque index score between abutment and contra lateral natural tooth (N=60)</i>				
Different stages of treatment	Abutment teeth / With full veneer crown (n ₁ =30)	Contra lateral natural teeth /Without full veneer crown (n ₂ =30)	t value	p value
	Plaque index score			
	Mean (\pm SD)	Mean (\pm SD)		
At baseline	1.20 \pm 0.41	1.23 \pm 0.43	-308	0.759 ^{ns}
At 4 th month	1.17 \pm 0.38	1.27 \pm 0.45	-931	0.356 ^{ns}
At 8 th month	1.53 \pm 0.51	1.33 \pm 0.48	1.569	0.122 ^{ns}
At 12 th month	1.97 \pm 0.41	1.67 \pm 0.55	2.397	0.020 ^s

Data were expressed as mean \pm SD
 p value calculated by students t-test
 s = significant, ns = not significant
 p value was significant at <0.05.

Table-V

<i>Comparison of Mean (\pm SD) of periodontal pocket depth between abutment and contra lateral natural tooth (N=60)</i>				
Different stages of treatment	Abutment teeth / With full veneer crown (n ₁ =30)	Contra lateral natural teeth /Without full veneer crown (n ₂ =30)	t value	p value
	Periodontal pocket depth			
	Mean (\pm SD)	Mean (\pm SD)		
At baseline	1.07 \pm 0.25	1.10 \pm 0.31	-460	0.647 ^{ns}
At 4 th month	1.03 \pm 0.18	1.10 \pm 0.31	-1.027	0.309 ^{ns}
At 8 th month	1.07 \pm 0.25	1.10 \pm 0.31	-460	0.647 ^{ns}
At 12 th month	1.13 \pm 0.35	1.10 \pm 0.31	.396	0.694 ^{ns}

Data were expressed as mean \pm SD
 p value calculated by students t-test
 s = significant, ns = not significant
 p value was significant at <0.05.

Table-VI

<i>Comparison of Mean (\pm SD) of bleeding on probing score between abutment and contra lateral natural tooth (N=60)</i>				
Different stages of treatment	Abutment teeth / With full veneer crown (n ₁ =30)	Contra lateral natural teeth /Without full veneer crown (n ₂ =30)	t value	p value
	Bleeding on probing			
	Mean (\pm SD)	Mean (\pm SD)		
At baseline	1.17 \pm 0.38	1.17 \pm 0.38	0.000	1.000 ^{ns}
At 4 th month	1.20 \pm 0.41	1.23 \pm 0.43	-308	0.759 ^{ns}
At 8 th month	1.63 \pm 0.67	1.40 \pm 0.50	1.533	0.131 ^{ns}
At 12 th month	2.13 \pm 0.43	1.73 \pm 0.45	3.505	0.001 ^{hs}

Data were expressed as mean \pm SD
 p value calculated by students t-test
 hs = highly significant, ns = not significant
 p value was significant at <0.05.

Discussion :

This study critically evaluates the impact of FVC restoration on the periodontal health of posterior teeth, also observed the changes of periodontal health in terms of their status of gingival index, plaque index, periodontal pocket depth, bleeding on probing in different stages of treatment. To observe the impact of FVC on periodontal health, 30 posterior abutment teeth with FVC of 19 patients were examined and compared to their contralateral natural sound teeth. Among these 19 patients, 10 (52.6%) were female, the mean age was 36.9 (± 9.7) years with different occupational variability. The study result indicated that initially at baseline and after 4 months of treatment the mean differences of gingival index was non significant between abutments and contralateral natural teeth ($p > 0.05$); but it was significant ($p < 0.05$) at 8th month and highly significant ($p < 0.01$) at 12th month follow-up between the two groups. In a study Koth [10] showed gingival inflammation is irrespective either of a supragingival, equigingival or subgingival margin, when the patient attends a strict recall program, which is consistent with the present study as it did not show significant changes till 8th month. But after 8th month, significant changes occur as the patient might have not maintained oral hygiene instructions. Similarly the mean differences of plaque index was not significant at baseline, 4th month or 8th month follow up period in abutments and contralateral natural teeth ($p > 0.05$), but the mean differences found significant at 12th month follow up visit ($p < 0.05$). The result in terms of plaque index found similar with the study conducted by Bader *et al.* [14] where they showed an equi-gingival margin is the most desirable location of a margin for the best control, adaptation and effective cleaning. In present study the margins of the FVC were placed equigingivally, that's why no significant impact of plaque index had been observed till 8th month follow up between abutments and contralateral natural teeth. The present study did not show significant plaque index till 8th month follow up, slight difference was at 12th month follow up. The difference can be explained that the objective of this present study was not self performed plaque control, so it varied with the study conducted by Morris [15], Carnevale *et al.* [16] Regarding periodontal pocket depth it was found that the mean differences of periodontal pocket depth between abutments and contralateral natural teeth was non significant

throughout the follow up period ($p > 0.05$). Also it was found that the mean differences of bleeding on probing between abutments and contralateral natural teeth was non significant at baseline, 4th month, 8th month follow up visit ($p > 0.05$), but it was highly significant at 12th month follow up visit ($p < 0.01$). The results of present study showed that gingival index increased a bit in the area restored FVC in comparison to contralateral natural tooth, which was consistent with Alqahtani *et al.* [17], Al-Sinaidi *et al.* [18] Also present study found that the gingival index, plaque index, bleeding on probing, periodontal pocket depth increased a bit in 4th, 8th, 12th month visits gradually in abutments, which was almost same in contralateral natural teeth in case of gingival index, periodontal pocket depth; and increased a bit in case of plaque index, bleeding on probing. This findings indicate that higher indices increase the progress of inflammation of the surrounding gingival and periodontal tissue of abutments compare to contralateral natural teeth. A significant number of clinical studies showed that the subgingival crown margin is more likely to cause gingival inflammation than equigingival and supragingival margin, [18-25] hence present study maintained equigingival margin in all FVC fabrication.

Conclusion :

The health of the periodontal tissues depend on properly designed restorations. From the study findings it can be concluded that if the FVC is fabricated with proper anatomical contour, placed an equigingival margin with proper marginal adaptation, thorough removal of all cement remnants or even moisture control during cementation and oral hygiene as well as general health of the patient is maintained, although less but there is a chance of development of adverse effects on periodontal health in comparison to contralateral natural tooth.

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