EVALUATION OF PLAQUE AND GINGIVAL INDEX AROUND ABUTMENT TOOTH RESTORED WITH FULL VENEER CROWN FOLLOWING SURGICAL CROWN LENGTHENING

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ABSTRACT

Surgical crown lengthening facilitates restorative procedure where tooth structure is inadequate to retain a long-standing prosthesis. The purpose of this study was to evaluate the effect of surgical crown lengthening on periodontium after placement of full veneer crown. For six months, this quasi-experimental study was carried out on thirty participants from the Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. One tooth was selected from each participant as per inclusion criteria and repeatedly measured with a periodontal probe before and after surgical crown lengthening and full veneer crown placement. Baseline data were the control group data, and follow-up data were case group data. Surgical crown lengthening was performed after the recording of baseline data. Plaque deposition and gingival probing were recorded at one, three, and six month's intervals. The result showed that statistically non-significant ($p \geq 0.05$) changes in the periodontium were revealed by plaque index and gingival index. In conclusion, the impact of surgical crown lengthening on periodontium was non-significant from the baseline value to the end of six months.

Keyword:- *Periodontium, Crown lengthening, Plaque deposition, Gingiva.*

1.INTRODUCTION

Periodontium is the supporting and investing tissues of the teeth, having several attachments and combined called dentogingival unit [1]. These tissues permit oral health maintenance in response to environmental insults by physiologic homeostasis [2]. The successful outcome of all prosthetic and restorative therapies requires a healthy periodontium. The periodontal-restorative relationship, particularly at the restorative margin, dramatically influences the dentition's esthetic comfort and function [3]. Even precise restoration may induce periodontal inflammation in case of altered gingival biological width [4]. Garguilo et al. [5] reported a 2.04 mm occlusoapical length between the crest of alveolar bone and the apex of gingival sulcus as biological width. It has connective tissue attachment (mean value: 1.07mm) and epithelial attachment (mean value: 0.97 mm), which was varied in the investigations of Pontoriero R et al. [6]. It also separated the osseous crest by a safe 3-mm distance from the plaque associated with crown margins [7].

It is generally accepted that chronic inflammation due to loss of periodontal attachment can be minimized by placing a restorative margin 3-mm from the osseous crest. It has been reported that the supragingival restorative margin allows ease of impression making and cleansing. It is also associated with the least gingival inflammation, secondary caries development, and maintainable probing depth compared to biologically altered

subgingival restorative margin [8][9]. Alveolar bone resorption occurred when biological width was violated and resulting in an attempt to provide space for newly formed connective tissue attachment and increasing probing depth [10][11].
Osseous respective procedures were efficient in periodontal stabilization [12]. Therefore, the violation of periodontium could be avoided by surgically increasing crown lengthening. It also provides an adequate clinical crown structure with more coronally placement of restorative margin [10][13]. Our previous study showed that the biological width of periodontium could be restored to its original dimension six months following surgical crown lengthening [14]. This six-month follow-up study has been designed to evaluate plaque deposition and gingival probing depth before and after surgical crown lengthening and on the fixed prosthesis.

2. MATERIALS AND METHODS:

Thirty healthy individuals participated in this Quasi-Experimental study and were carried out in the Department of Prosthodontics, Faculty of Dentistry, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. Each participant required surgical crown lengthening in endodontically treated teeth. This one-year study was carried out with convenience sampling procedure. The inclusion criteria were inadequate tooth structure remaining, short clinical crown but the root length adequate, grossly loss of tooth structure following endodontic treatment, and participants who required the subgingival restoration with the age range of 19 to 50 years.

2.1 Study procedure:

Thirty participants were selected from the outpatient with inadequate teeth structure. Each tooth required restoration with full veneer crown followed by surgical crown lengthening. The written consent and satisfactory periodontal therapy were performed before selection. Participant's symptoms, clinical signs, and a detailed medical and dental history were recorded. One tooth from every 30 samples was assigned to the repeated measurement of periodontal tissue. This was recorded by baseline measurement at first (Figure – 1 A & B), then surgical crown lengthening was done (Figure – 1 C & D), and finally, follow-up measurement was recorded at one, three, and six months (Figure – 1 E, F, G, H & I). All teeth measured in four positions as mesiobuccal, mesiolingual, distobuccal, and distolingual.

For the measurements graduated periodontal probe and preoperatively prepared, acrylic stents were used. Stents were trimmed to the height of contour of all teeth. The margin of the probing stents was marked with a black permanent marker which acted as a fixed reference point. Vertical grooves were made at the measured sites with a fissure bur, guiding the probe to maintain site-specificity.

2.2 Pre-operative planning:

A diagnostic impression was made from every participant with a metallic stock tray and alginate impression material. Treatment procedure, cost, benefits, and risk were described, and a baseline examination was performed on each participant.

2.3 Surgical Phase:

Participants were assured that the surgical procedure is free from pain and anxiety. At first, Pulse, BP, respiratory rate was measured, and then the extraoral and intraoral examination was completed thoroughly. Local anesthesia was administered with 2% Xylocaine HCL with adrenaline 1:80,000, and an incision was made in the gingiva surrounding the treated tooth with a butterfly blade no. 15. Incised tissue was then excised with the full thickness of mucoperiosteum labially, palatally, and proximally.

The remaining gingival tissue was thoroughly removed with small periodontal curettes. Ostectomy was performed with rotary instruments under saline irrigation and the hemostasis with a hemostatic agent and pressure pack. A periodontal pack was provided in the crown lengthening area, and antibiotics were prescribed for 07 days along with analgesic and antiulcerants. Postoperative instructions were given, and participants were advised to report at 24 hours, 7 days following the completion of the surgery.

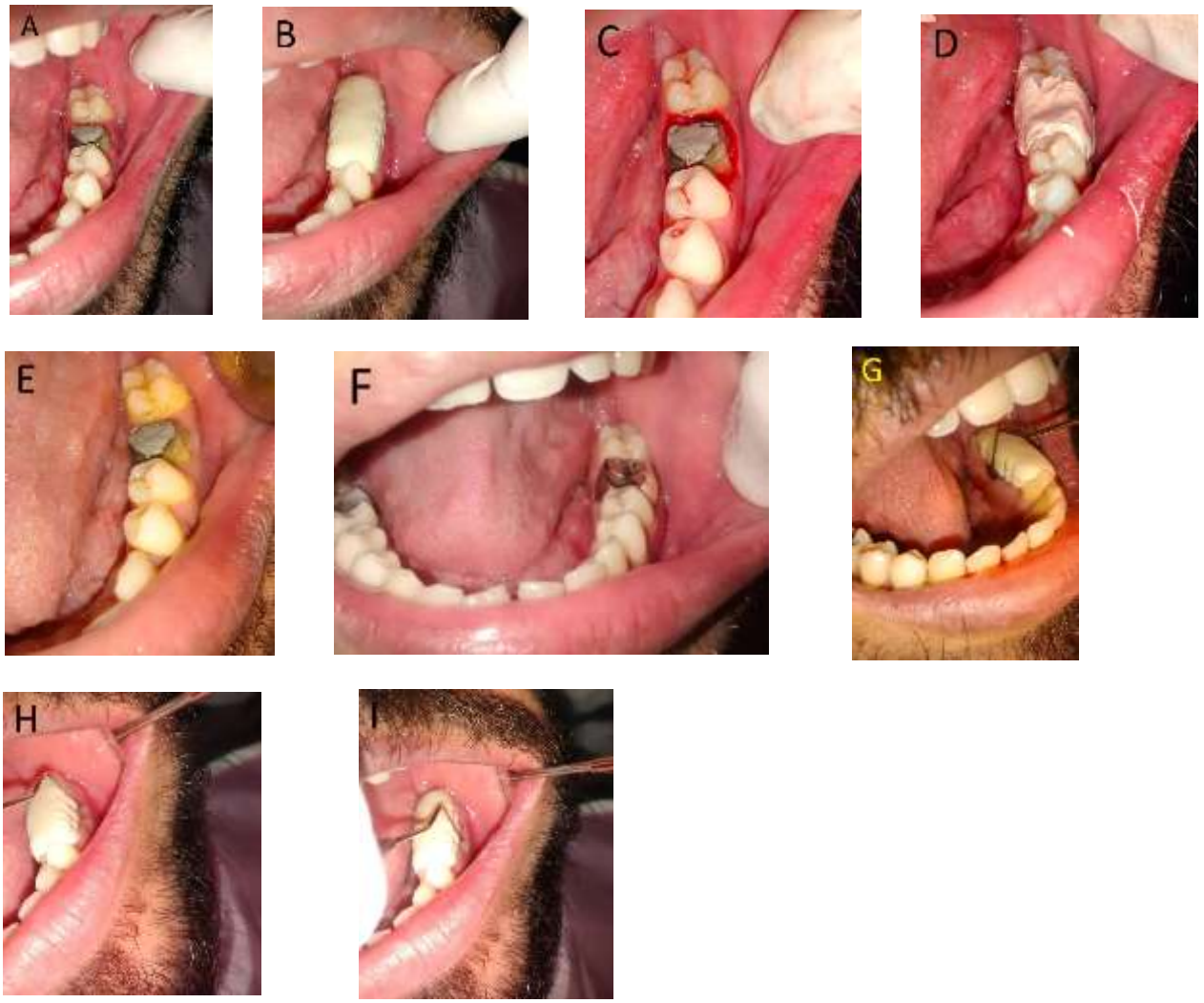

Figure -1: Photographs of this study. Pre-operative (A); Initial measurement with acrylic stent (B); After surgical crown lengthening (C); Periodontal pack placement (D); Tooth crown after one month (E); Full veneer crown placement (F); Follow up after 1 month (G); Follow up after 3 month (H); Follow up after 6 month (I)

2.4 Follow up visits:

The participants were recalled for clinical evaluations after 1, 3, and 6 months intervals. After one month, all participants were evaluated with clinical parameters, and teeth preparation was done and teeth were restored with a full veneer crown. At three and six months after surgery, clinical parameters were assessed. Finally, Plaque deposition evaluation by plaque index (Silness and Loe, 1964) and gingival condition evaluation by gingival index (Loe and Silness, 1963) were performed.

2.5 Evaluation Criteria:

a) Assessment plaque deposition on experimented teeth by plaque index:

Plaque index was assessed according to Silnes and Loe protocol, 1964. Each of the four surfaces of the teeth (buccal, lingual, mesial, and distal) is given a score from 0-3. The scores from the four areas of the tooth are added and divided by four to provide the plaque index for the tooth with the following scores and criteria:

Plaque Index Scoring System (Silness and Loe, 1964)
Score 0: No plaque
Score 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after the application of a disclosing solution or by using the probe on the tooth surface.
Score 2: Moderate accumulation of soft deposit s within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
Score 3: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

b) Assessment of gingival condition on experimented teeth by gingival index:

The gingival index was assessed according to Loe and Silnes protocol, 1963. Each of the four surfaces of the teeth (buccal, lingual, mesial, and distal) is given a score from 0-3. The scores from the four areas of the tooth are added and divided by four to provide the plaque index for the tooth with the following scores and criteria:
Gingival Index Scoring System (Loe and Silness, 1963)
Score 0: Normal gingiva.
Score 0.1 to 1.0: Mild inflammation – a slight change in color and slight edema but no bleeding on probing.
Score 1.1 to 2.0: Moderate inflammation – redness, edema, and glazing, bleeding on probing.
Score 2.1 to 3.0: Severe inflammation – marked redness and edema, ulceration with a tendency to spontaneous bleeding.

2.6 Data Processing:

The data were presented in the form of tables and recorded in millimeters. SPSS 20.00 version was used in statistical analysis. Paired student t-test and repeated measurement ANOVA were performed. 95% confidence interval (p-value <0.05) were followed for the testing level of significance.

3. RESULTS:

Table 1 showed the results of the study. The assessment of plaque deposition showed that changes in mean values from baseline to 01, 03, and 06 months which were 1.26, 1.29, 1.22, and 1.12, respectively. The mean values at baseline, 01, and 03 months were nearly the same, which were 1.26, 1.29, and 1.22. It indicates almost the same amount of plaque deposition. At six months, follow-up sites showed relatively lesser deposition of plaque.
The assessment of gingival condition showed that almost the same mild inflammation mean level. It indicated that crown lengthening did not influence periodontium and its attachment.
Repeated measure ANOVA in Table 2 showed non-significant changes in Plaque deposition from baseline to 6 months (P>0.05). Comparisons between follow up periods also showed non-significant plaque depositions (P>0.05). The assessment of Gingival condition showed non-significant inflammatory changes in Repeated measure ANOVA from Baseline to 6 months (P>0.05). Comparisons between follow up periods also showed non-significant inflammatory changes (P>0.05).

Table -1: Results of the study

Variables	Baseline (n=30)	1 month (n=30)	3 months (n=30)	6 months (n=30)
Plaque deposition evaluation by plaque index (PI)	1.26±0.28	1.29±0.35	1.22±0.40	1.12±0.32
Gingival Condition evaluation by gingival index (GI)	0.67±0.58	0.88±0.30	0.81±0.34	0.77±0.31

Table -2: Results of statistical analysis

Statistical analysis of plaque index	t/F value	p-value
[a]Baseline vs 1 month vs 3 month vs 6 month	1.407	0.224 [ns]
[b]1 month vs 3 month	0.807	0.426 [ns]
[b]1 month vs 6 month	1.79	0.093[ns]
[b]3 month vs 6 month	1.509	0.142[ns]

[a] Repeated measure ANOVA test, [b]Paired student t-test, s = Significant, ns = Not significant

Statistical analysis of gingival index	t/F value	p-value
[a]Baseline vs 1 month vs 3 month vs 6 month	2.168	0.096 [ns]
[b]1 month vs 3 month	1.70	0.09[ns]
[b]1 month vs 6 month	1.89	0.07 [ns]
[b]3 month vs 6 month	0.67	0.51 [ns]

[a] Repeated measure ANOVA test, [b]Paired student t-test, s = Significant, ns = Not significant

4. DISCUSSION:

4.1 Changes in the plaque index:

There was a statistically non-significant change in the deposition of plaque in the gingival margin and adjacent areas of a tooth from baseline to 6 months. So surgical crown lengthening did not significantly influence the gingiva to deposit an excessive amount of plaque. Almost similar findings were reported to the studies of Pontoriero R et al. [6], Knoernschild KL et al. [9], Ganji KK et al. [11], Nemcovsky CE et al. [13].

4.2 Changes in gingival index:

At all sites, there was a slight increase in the mean when probing was performed from baseline to 6months. This increase was not statistically significant at baseline and follow up visits, which is in similarity with that reported by Ganji KK et al. [11], Nemcovsky CE et al. [13], Shobha KS et al. [15], Deas DE et al. [16], Lanning SK et al. [17], Naser S et al. [18].

There was no statistically significant change in periodontium & deposition of plaque compared from baseline to follow up periods and in between follow-up periods. So, after surgical crown lengthening, not only the biological width but also gingival health was restored.

5. CONCLUSION:

The principal objective of this study to evaluate the effect of surgical crown lengthening on periodontal health before and after full veneer crown placement. The result showed there was a non-significant change in the biological width as well as periodontium around the abutment tooth after surgical crown lengthening. Surgical crown lengthening allows exposure of adequate tooth structure to facilitate full veneer crown placement without altering periodontal health.

6. CONFLICT OF INTEREST:

The authors declare no conflict of interest.

7. REFERENCES:

[1] Posnick JC. Periodontal Considerations in the Evaluation and Treatment of Dentofacial Deformities. In: Principles and practice of Orthognathic Surgery, Elsever: Saunders; 2014: 171-208.
[2] Lee EA, Dent DC. Aesthetic Crown Lengthening: Classification, Biologic Rationale, and Treatment Planning Considerations. Pract Proced Aesthet Dent. 2004; 16(10):769-778.
[3] Padbury Jr A, Eber R, Wang HL. Interactions between the gingiva and the margin of restorations. J Clin Periodontol. 2003; 30:379-85.
[4] Planciunas L, Puriene A, Mackeviciene G. Surgical lengthening of the clinical tooth crown. Stomatologija. 2006; 8: 88-95.
[5] Gargiulo AW, Wentz FM, Orban B. Dimensions of the dentogingival junction in humans. J Periodontol 1961; 32: 261-67.
[6] Pontoriero R, Carnevale G. surgical Crown Lengthening: A 12-Month Clinical Wound Healing Study.
J Periodont. 2001;72(7):841-48. Quintessence Int. 2009;40(10):809-18.
[7] Nugala B, Kumar BBS, Sathiya S, Krisna PM. Biologic width and its importance in periodontal and restorative dentistry.J Conserv Dent. 2012;15(1):12-17.
[8] Reitemeier B, Hansel K, Walter MH, Kastner C, Toutenburg H. Effect of posterior crown margin placement on gingival health. The journal of Prosthetic Dentistry. 2002;87(2):167-72.
[9] Knoernschild KL, Campbell SD. Periodontal tissue responses after insertion of artificial crowns and fixed partial dentures.The journal of Prosthetic Dentistry. 2000;84(5):492-98.
[10] Silberberg N, Goldstein N, Smidt A. Excessive gingival display—Etiology, diagnosis, and treatment modalities. Quintessence Int. 2009;40(10):809-18.
[11] Ganji KK, Patil VA, John J. A Comparative Evaluation for Biologic Width following Surgical Crown Lengthening Using Gingivectomy and Ostectomy Procedure. Int J Dent. 2012; 479241:1-9.
[12] Hildebrand CN. Crown lengthening for optimum restorative success. Compend Contin Educ Dent. 2003;24(8):620-29.
[13] Nemcovsky CE, Artzi Z, Moses O. Preprosthetic clinical crown lengthening procedures in the anterior maxilla. Prac Proced Aesthet Dent. 2001;13(7): 581-89.
[14] Das S, Rahman MD. M. Assessment of Biological width of Abutment tooth restored with Full Veneer Crown following Surgical Crown Lengthening. Int J of Adv Research and Innovative Ideas in Education. 2020; 6(3):929-34.
[15] Shobha KS, Mahantesha, Seshan H, Mani R, Kranti K, Clinical evaluation of the biological width following surgical crown-lengthening procedure: A prospective study. J Indian Soc Periodontol. 2010;14: 160-67.
[16] Deas DE, Moritz AJ, McDonnell HT, Powell CA, Mealey BL. Osseous Surgery for Crown Lengthening: A 6-Month Clinical Study. J Periodontol. 2004;75(9):1288-94.
[17] Lanning SK, Waldrop TC, Gunsolley JC, Maynard JG. Surgical crown lengthening: evaluation of the biological width. J Periodontol. 2003; 74: 468-74.
[18] Naser S, Arab HR, Amir M, Habinollah G, Evaluation of Height of Facial Alveolar Crest and Pocket Depth Following Periodontal Flap Surgery with and without Crestal Bone Exposure. J Mashhad Dent School. 2007;31(1):55-62.