

Assessment Of Two Techniques For Aesthetic Crown Lengthening (Flapless Piezo-Surgery And Open Flap Technique). A Randomized Controlled Clinical Split Mouth Trial

Research Article

Jihad ALSahli¹, Khaldaon hossein Alhroob¹, Muaaz Alkhoul^{1*}

Department of Periodontology, Faculty of Dentistry, Damascus University, Syria.

Abstract

Aim: This study aimed to evaluate the aesthetic crown lengthening using flapless and an open-flap Technique to manage gingival smile.

Materials and Methods: In this study, 32 aesthetic crown lengthening surgeries were performed for 16 patients in the anterior area of the upper jaw in a split-mouth, where one of the sides was treated (randomly) by flapless Technique // Test group // and the other sides treated with open-flap Technique // Control group // . - Clinical parameters were taken and included: Plaque index (PI); Pocket depth (PD), Bleeding on probing (BOP); Width of keratinized tissue (WKT), Relative clinical attachment level (RCAL), Relative Bone level (RBL), Relative Gingival Margin (RGM).

Results: Sixteen patients (9 females, 7 males), aged 26.5 ± 1.3 years (range: 20-36 years), were enrolled at the start of the study. The outcomes showed that using piezo surgery in bone resection is efficient with both surgical techniques. Both techniques created a noticeable improvement in the length of clinical crowns compared to baseline ($p < 0.05$) without significant contrasts between the groups ($p > 0.05$). and results showed a noticeable improvement in the pain amount values and the index of bleeding on probing in the test group ($P < 0.05$).

Conclusion: Within the limits of this study, the use of piezo surgery aesthetic crown lengthening with flapless Technique provides a reliable alternative to traditional aesthetic crown lengthening Technique.

Keywords: Piezo-Surgery; Esthetic Crown Lengthening; Exaggerated Gingival; Gingival Smile.

Introduction

The exaggerated gingival display is a prevalent condition that unfavorably affects the aesthetic of the smile [1]. For the periodontal surgeon, Altered passive eruption (APE) is believed as the main sign for the treatment of gingival smiles [2]. APE is identified when there is an Exaggerated gingival display with short clinical crowns and healthy periodontal tissues. There should also be an ideal length and regular muscular adequacy of the upper lip, no vertical skeleton-related defects, and no dentoalveolar distortion [3].

The altered passive eruption is classified Based on the amount of gingival tissue as type 1 when there is an excess amount of gingival tissue between the free gingival margin and the mucogingival junction and type 2 when there is a standard amount of keratinized gingiva. It was then ordered into two subtypes relying upon the relation between the Cemento-enamel junction (CEJ) and the

alveolar bone crest (ABC). Subtype A is the point at which the distance among BC and CEJ is approximately 1.5 mm. Subtype B is the point at which the BC is at or coronal to the CEJ, and for this situation, there is no adequate distance for the regular Biological width (BW) [4].

Aesthetic crown lengthening (ECL) is still one of the most widespread surgical treatments of APE [5]. It has become requisite to compare its different surgical techniques and to evaluate the related difficulties to prove the best procedure that gives the required results with the greatest patient satisfaction [6].

Gingival tissue coronal rebound is one of the most noted post-operative difficulties of traditionally used techniques. The surgical techniques that incorporate flap elevations showed more coronal movement of the gingival margin [7]. The osteotomy during conventional ECL is performed using different hand or rotary tools, which may cause numerous injuries like thermal or physical dam-

*Corresponding Author:

Muaaz Alkhoul¹, MSc, DDS,
Department of Periodontology, Faculty of Dentistry, Damascus University, Syria.
E-mail: alkhoul@outlook.com

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age to bone and extreme trauma to the periodontal tissues, blood vessels, especially when there is limited or difficult access to the surgical area [8]. This traditional surgery needs a long duration to do all procedures including flap reflection and surgical suturing, which causes more pain and draining [9].

It has been proposed that minimally invasive techniques should be done in ECL as experts expect to speed up healing and to decrease surgery duration, and pain [10]. The flapless approach is believed to be a promising alternative technique and atraumatic, invasive technique that has been shown to increase patient relief [11]. Piezo-surgery was additionally proposed as a minimally invasive surgical technique [12].

Piezo surgery provides high accuracy in osteotomy, and an electric cut of mineralized tissue while saving gingiva. This innovation utilizes a cavitation impact where bubbles are created from the serum, which prompts interior explosions and creates shock waves that cause microscopical coagulation [13].

The Researches does not show a lot of information about the differences between Flapless/Open-flap techniques in ECL. Therefore, this study was done which aimed to compare the clinical results of Flapless/Open-flap techniques in ECL for the treatment of gingival smile using piezo surgery.

Materials and Methods

Study Design and Participants

This study is a randomized controlled clinical trial with a split mouth design. The study included 16 patients (7 males and 9 females) who had reported to the faculty of dentistry in Damascus university in Syria, with ages between 20 and 36 years (mean 26.5 ± 1.3); all patients were diagnosed with Altered passive eruption (1B) and required Aesthetic crown lengthening in the anterior region of the maxilla.

The sample size was determined based on the null hypothesis, which states that the test group flapless technique and the control group open-flap technique weren't equal. The confidence level was determined by 95%, the desired sample power was 95%, then G power (version 3.1.9) was used, and the required sample size was 16 patients (32 subjects).

After the study was explained to the patients, all patients completed a health history questionnaire to ensure the absence of systemic or local conditions that could compromise the periodontal Piezo-surgical procedures. The study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000, and was approved by the internal Ethical Committee of the Damascus University No. 2657/SM. Written informed consent was obtained from all subjects who participated in the research study.

Inclusion criteria

- 1) Older than 20 years old.
- 2) Bone thickness type: (thin to moderate).
- 3) Patients with gingival smile due to APE 1B in at least 3 maxilla teeth (central and lateral incisors, canines, or premolars) per half contralateral quadrant

- 4) Clinical attachment non-loss.

Exclusion criteria

- 1) Smokers and Alcoholics (≥ 10 cigarettes).
- 2) Patients with systemic diseases that could interfere with the healing.
- 3) Pregnant women and breastfeeding mothers.
- 4) Patients with protheseson treated tooth.
- 5) Patients with an orthodontic appliance.

Between November 2019 and December 2020, 16 patients were in need of bilateral aesthetic crown lengthening surgeries. Patients were randomly assigned to a test group flapless (FL) or a control group Open-flap (OF) in a split mouth design, via a randomization table; by a computer-generated randomization list (SPSS v23.0). The treatment methods (16 for FL test group / 16 for OF control group).

Surgical procedures

At the time of surgery, 2% BETADINE (povidone-iodine) was used for rinsing the oral cavity for 2 minutes. Following local anesthesia using lidocaine hydrochloride with 1:100,000 epinephrine, gingivectomy was surgically performed with a 15c blade. This was followed by an intra-sulcular incision; After that, the surgery proceeded as follows:

For the control group, (Figure.1)

- 1) Raise a full-thickness mucosal flap by sharp dissection.
- 2) Piezo-Surgical tip CE3 (Satelec[®]) was used for osteoplasty to achieved new distance between the gingival margin and the bone crest.(Figure.2)
- 3) Gracey-curette 5/6 (LM-Dental[™], © LM-Instruments Oy, Finland) was used to carry out the Root Debridement of the uncovered root surfaces.
- 4) Positioning and fixating the flap with interrupted non-resorbable sutures (Nylon 5.0, Ethilon[®]).

For the test group,(Figure.1)

- 1) Piezo-Surgical tip CE3 (Satelec[®]) was used for osteoplasty to achieved new distance between the gingival margin and the bone crest without flap raise.
- 2) The root surfaces were also debrided carefully via incisions.
- 3) Sutures were not performed in the flapless group.

Routine postoperative instructions and medications were given. Patients were scheduled for postoperative follow up after 1 week (T1), 12 weeks after the surgery (T2). Baseline clinical measurements were taken and immediately after surgery (T0), and again after 3 months after surgery, special Vacuum splints were made to standardize the location during measurements as shown in (Figure 3). And The stents were furrowed vertically at the, (facial, mesial and disto-facial) surfaces of each tooth treated in-stent as reference points; and measurements was done using a periodontal probe (UNC -15, Hu-Friedy Manufacturing Co., Chicago, IL).

The following Clinical parameters were the primary focus of the study:

- a) Plaque index (PI).
 - b) Probing depth (PD).
 - c) Bleeding on probing (BOP).
 - d) Width of Keratinized tissue (WKT): from the margin of free gingiva to the muco-gingival line.
 - e) Relative CAL (RCAL): from a fixed point in the stent to the deepest point of the gingival sulcus [14].
 - f) Relative Bone level (RBL): from a fixed point in the stent and the Bone Crest, and was recorded before and immediately after the surgery (11). It was clinically measured using UNC-15 probe.
 - g) Relative Gingival Margin (RGM): from a fixed point in the stent to the highest point of the Gingival Margin. RGM and WKT were assessed at baseline, 1 Week, and 3 months after the surgery (11).
- A secondary objective for the study was assessing morbidity in both groups. A questionnaire was handed out to the patients and used 100 mm visual analog scores (VAS) to evaluate the amount of pain, ranging from 0 (no pain) to 100 (worst pain), and the patients were asked to fill the questionnaire in the VAS scales 24 hours and 48 hours after the surgery.

Statistical analysis

The patient was considered a statistical unit for statistical analysis. Statistical analyses were performed using a statistical package for social sciences program SPSS v23.0 (SPSS Inc, Chicago, IL, USA), (P<0.05) was considered Statistically significant for this study at 95% confidence interval, and we used Independent t-test, and paired t-test to analyze the results.

Results

The study population consisted of 16 Patients with 32 bilaterally placed sides. The mean age was 26.5 ± 1.3years Old and the male/female ratio was 7:9. None of the patients dropped out During

the 3 months follow-up. The two Contralateral sides in each patient Were assigned to the test group (FL; 16 sides) or the control group (OF; 16 sides).

One side in each patient was randomly assigned to either the test group (FL; 16 sides) or the control group (OF; 16 sides), while the contralateral side was assigned to the other group.

The healing process in the control group (OF) and the test group (FL) was uneventful. At baseline, both groups showed similar values for periodontal health, plaque accumulation, gingival inflammation.

- At baseline, the mean of the BOP measurements was 0.07 ± 0.06 and 0.08 ± 0.07 for the FL group and OF group respectively, with nosignificant statistical difference between those values (P>.05). After 3 months of healing (T2), the mean of the BOP was 0.04 ± 0.03 and 0.14 ± 0.10 in the FL group and the OF group respectively, with a significant statistical difference between those values (P<.05).
- At baseline, the mean of the GI values was 0.033 ± 0.04 and 0.051 ± 0.07 for the FL group and OF group respectively, with no significant statistical difference in those values (P>.05). After 3 months of healing (T2), the mean of the BOP was 0.003 ± 0.02 and 0.059 ± 0.07 in the FL group and the OF group respectively, with a significant statistical difference between those values (P<.05), and there is a significant difference between baseline and 3 months after surgery for the test group (FL) (P<.05).
- After 3 months of healing (T2), RCAL & PD measurements decrease to both FL group and the OF group (P<.05), without any significant statistical difference between those groups (P>.05), and there is a significant difference between baseline and 3 months after surgery for both groups (FL/OF) (P<.05). (table 4)

Figure 1. A. Before surgery: Exaggerated gingival display. B. Altered passive eruption (APE) before surgery. C. Marking the bleeding points using UNC-15 probe. D. Gingivectomy on the test side. E. Gingivectomy on the control side. F. Osteotomy using CE3 tip on the test side without flap. G. Osteotomy using CE3 tip on the control side with flap elevation. H. Immediately after the surgery for both sides. I. 3 months post-operative. J. Treatment of Altered passive eruption (APE) after 3 months follow up.

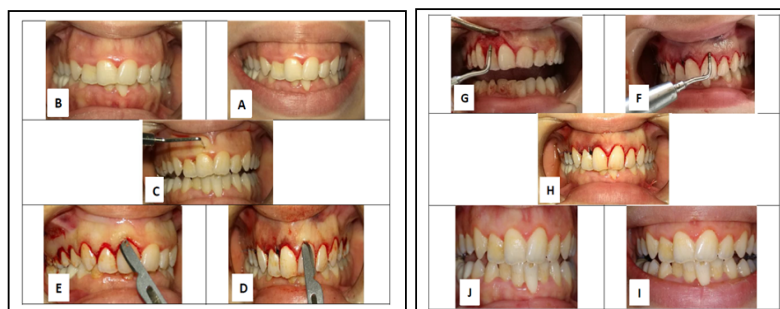


Figure 2. Piezo-Surgical tip CE3 (Satelec®) intended for accurate osteotomies.



Figure 3. Vacuum stent made to standardize the location during measurements with periodontal probe.



Figure 4. The mean of the visual pain values in the samples according to the time and the method of treatment On the: X-axis, the time periods. *On the Y-axis, the pain values.



- Immediately after the surgery (T0), the mean of the RBL was higher compared at the baseline for both groups ($P < .05$), without any significant statistical difference between those groups ($P > .05$), and there is a Significant difference between baseline and immediately after surgery (T0) for both groups (FL/OF) ($P < .05$).

- At baseline, the mean of the RGM measurements was 2.79 ± 0.44 and 2.85 ± 0.45 for the FL group and OF group respectively, without any significant statistical difference between those values ($P > .05$). After 7 days of healing (T1), the mean of the RGM was 4.30 ± 0.64 and 4.36 ± 0.61 in the FL group and the OF group respectively, without any significant statistical difference between those values ($P > .05$). After 3 months of healing (T2), the mean of the RGM was 4.08 ± 0.57 and 4.10 ± 0.55 mm in the FL group and the OF group respectively, without any significant statistical difference between those values ($P > .05$), and there is a Significant difference between baseline and 3 months after surgery for both groups (FL/OF) ($P < .05$), and a significant difference between 7 days and 3 months after surgery for both groups (FL/OF) ($P < .05$).

- At baseline, the mean of the WKT measurements was 5.68 ± 0.75 and 5.61 ± 0.66 mm for the FL group and OF group respectively, without any significant statistical difference between those values ($P > .05$). After 7 days of healing (T1), the mean of the WKT was 3.75 ± 0.63 and 3.74 ± 0.71 mm in the FL group and the OF group respectively, without any significant statistical difference between those values ($P > .05$). After 3 months of healing (T2), the mean of the WKT was 4.02 ± 1.03 and 4.11 ± 0.88 mm in the FL group and the OF group respectively, without any significant statistical difference between those values ($P > .05$), and there is a significant difference between baseline and 3 months after surgery for both groups (FL/OF) ($P < .05$), and a significant difference between 7 days and 3 months after surgery for both groups (FL/OF) ($P < .05$).

- Postoperative Pain Associated with FL and OF Technique: This study evaluated patient pain sensation using a scale from 0 (absence of pain) to 100 (most severe pain). Each patient was asked

to rate the values of pain score from 24 hours and 48 hours after the surgery and All the values from 24 hours and 48 hours after the surgery were significantly higher in the control group ($P < .05$), and there was a significant decrease in mean pain values after 48 hours compared to 24 hours in both groups ($p < 0.05$).

Discussion

A gingival smile can be an Inappropriate condition and areal problem issue for some individuals, particularly the individuals who experience an unaesthetic gingival smile [15], in spite of the fact that the expanding interest for improving aesthetics is turning into a significant piece of the current act of periodontal procedure, the clinical research in connection with gummy smile is still not enough, unclear. Aesthetic crown lengthening should intend to diminish the exaggerated gingival appearance and accomplish full display of the anatomical crowns while restoring an appropriate distance for the biological width [16].

The median age of the patients in the current research was 26.5 ± 1.3 years, which is going along with numerous comparative researches [1, 5, 17]. This is clarified by the way that the exaggerated gingival appearance diminishes with age, and the esthetic corrective requirements are higher among youngsters.

The results of the research after 3 months showed that both surgical techniques are efficient in Aesthetic crown lengthening. Using Aesthetic piezo-surgery crown lengthening served to effectively perform bone reduction, the outcomes showed big increases in the average of Relative Bone level (RBL) instantly after surgery for both test and control groups. also, we had the option to create a new biological width, after 3 months of procedures.

The steadiness of the gingival margin during the healing period after the surgeries is uncertain, furthermore, there was an acceptance that major tissue rebound after Aesthetic crown lengthening is regularly connected with thick phenotype and the brief distance between the gingival margin and the bone crest [18].

The outcomes showed a significant decrease in the Width of

Keratinized tissue (WKT) and Pocket depth (PD), and a significant increase in Relative clinical attachment level (RCAL) and Relative Gingival Margin (RGM) after 3 months compared with the baseline, which implies that both test (FL) and control (OF) groups made a significant reduction in the exaggerated gingival appearance.

From the result of the research, we were able to get immediate enhancements in the length of the clinical crown following the procedures by 1.99 mm/1.96 mm for control and test group respectively. and that gain still constant for the following 3 months. the tissue rebound happens as a result of the periodontium endeavor to reshape in past form during the maturing and development periods [7], this rebound was a little higher in the control group ($P > .05$). Also, all surgical procedures including flap raise and osteotomy have been found to cause more rebound for gingival tissue [7]. The rebound of the tissue in this research can be clarified by that all patients had thick phenotype as indicated by the inclusion criteria, and the thick phenotype shows more tissue regrowth than thin one [19].

The mean values of Gingival index (GI) and Bleeding on probing (BOP) for the test group (FL) were lesser than control group (OF), and the little variance noted especially in control group (OF) could be because of flap raise and flap suturing, trauma and increased healing time.

The results of this study about flapless permits rapid healing and decreased tissue inflammation compared with the open-flap, and by this, we agreed with a previous study [11]. in general, most of the patient showed low mean values of pain for both test (FL) and control (OF) groups, but the test group (FL) offer less pain values than (OF) ($P < .05$); and the reason for this result it is up to flap elevation and injury of the blood vessels in the periosteum [20] for control group (OF), figure (4).

The minimally invasive surgical method (Flapless Piezo-surgery) offers a really encouraging alternative technique and showed critical advantages compared with the conventional technique which using instruments for bone resection in esthetic crown lengthening. However, this technique (Flapless Piezo-surgery) must be used within certain indications mentioned previously, Flapless approach has various weaknesses like difficult perform osteotomy on the buccal side of the alveolar bone Because of the inability to see the alveolar bone and other structures [21].

Conclusion

Within the limitations of this study, it can be concluded that flapless aesthetic crown lengthening can decreased the pain and bleeding and there is no need for surgical sutures so flapless technique can be predictable procedure with worthy clinical advantages.

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