



## Evaluation of Ice Cream Cone Technique as a Flapless Guided Bone Regenerative Method with Immediate Implant Placement in Management of Patients with Labial Plate Dehiscence: A Case Series

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### Abstract

The study was aimed to assess the changes in the facial plate thickness after using ice cream cone technique with immediate implant placement in treatment of type II sockets. The present study was conducted on 10 participants who were recruited from the outpatient Diagnostic center, Faculty of Dentistry, Cairo University. Ten participants with a non-restorable tooth in esthetic zone with facial bone dehiscence received immediate implant with ice cream cone technique. Horizontal bone change, labial plate thickness, pink esthetic score, gingival thickness, implant stability, post-operative pain and patient satisfaction were all measured, 6 months following implant restoration. All these parameters were subjected to statistical analysis. All participants were available for analysis at the 6 months follow up. The mean horizontal bone resorption was 1.3( $\pm$ 0.86) mm after 6 months with statistical significance reduction from the baseline. The mean( $\pm$ SD) labial plate thickness was 2.12( $\pm$ 0.69) mm. Gingival

thickness assessment showed statistical significance increase after 6 months of  $0.55(\pm 0.28)$  mm. The mean pink esthetic score was  $11.9 (\pm 0.99)$ . Post-operative pain reported by the patients' revealed reduction at 14 days compared with 7 days. The mean overall satisfaction on VAS was  $5.5 (\pm 1.7)/7$ . The ice cream cone technique at the time of flapless tooth extraction at esthetic zone and immediate implant placement in sockets with facial plate dehiscence might be considered as a promising intervention to reconstitute the compromised facial bone plate.

**Key words:** Immediate implant, alveolar bone remodeling, xenograft, patient satisfaction.

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## **Introduction**

Immediate implant placement is an effective treatment modality with the main advantage of reducing treatment time, increasing patient comfort and enhancing esthetics<sup>1</sup>. Moreover, it allows for preserving the soft and hard tissues surrounding the implant<sup>2</sup>. Nevertheless, immediate implants are associated with mucosal recession  $> 1$ mm as a consequence of post-extraction dimensional changes and buccal plate resorption which was observed after 3-9 years<sup>3</sup>. The integrity of the buccal plate is another major factor affecting the bone remodeling following immediate implant placement. Presence of

dehiscence and fenestration defects of the buccal plate may affect long term mucosal stability and esthetic outcomes. Dehiscence and fenestration may result from periapical pathosis, tooth malposition, cracking or fracture of endodontic treated teeth, removal of facial bone during extraction, removal of teeth with curved or ankylosed roots<sup>4</sup>.

Elian et al.<sup>5</sup> introduced a simplified classification of alveolar socket after extraction in the esthetic zone that was classified into three categories. Extraction socket type I; where the facial soft tissue and buccal plate of bone are at normal levels in relation to the cemento-enamel

junction (CEJ) of the pre-extracted tooth and remain intact postextraction. Extraction socket type II; with presence of facial tissues but the facial plate of bone is partially or completely missing. While in extraction socket type III, the facial soft tissue and buccal plate are reduced after extraction.

Type II sockets represent the most difficult to diagnose and treat as it may be mistaken as type I socket due to the presence of soft tissue covering the defect making placement of immediate implant more challenging. However, it does not appear to decrease the implants survival rate and success rate <sup>6</sup>. Consequently, alveolar ridge preservation techniques were widely used to preserve the remaining soft and hard tissue aiming to eliminate or reduce the post-extraction horizontal and vertical ridge alterations.

Several techniques have been advocated to develop a simple, repeatable, minimal invasive and promising technique to reconstruct the missing labial bone plate. With no standard

guidelines for treating compromised sockets, the present case series study aimed for reconstruction of the labial plate dehiscence in patients with extraction socket type II along with placement of immediate implant placement simultaneously with guided bone regeneration using resorbable collagen membrane in the shape of an ice cream cone and bone grafting material.

## **Materials and methods**

The present case series was registered with the Identifier: ID: NCT04679766 at ClinicalTrials.gov and was accepted by the Ethics Committee for Scientific Research at Cairo University (December 2020) (Reference code: 71020). The purpose of this study was described to all subjects who signed a written consent and committed to participate in this work. The current case series included ten patients with a non-restorable tooth having labial plate dehiscence who received immediate implants with ice cream cone technique using xenograft and collagen membrane. All patients

presented to the Department of Oral Medicine and Periodontology, Faculty of Dentistry, Cairo University. This study was conducted from January 2021 till June 2022 and recruiting of patients was carried out through screening of the patients until the target sample was achieved. Identifying and recruiting potential subjects was achieved through patients' database.

Patients were selected with a single non-restorable tooth in the maxillary inter-bicuspid region with socket type II after extraction and adequate bone volume apical and palatal for placement of immediate implant. While smokers, patients with any systemic diseases that may affect healing dynamics and pregnant females were excluded from the current case series.

Flapless atraumatic extraction started with supracrestal fibrotomy using blade no. 15c<sup>1</sup> then a periostome<sup>2</sup> was inserted along the root surface

with apical pressure and rocking motion to cut periodontal ligaments circumferentially. Luxation of the tooth then atraumatic removal of the tooth without trauma to the remaining labial plate was done. The size of the defect was measured with a UNC periodontal probe<sup>3</sup>. Implant<sup>4</sup> placement was performed according to manufactures instructions in the ideal 3D position in anterior teeth. Regarding bucco-palatal position, implants were placed in slight palatal direction to avoid the remaining facial plate and to allow adequate space so facilitate guided bone regeneration and facial plate regeneration. This position provided adequate blood clot thickness facially to support bone during the remodeling and modeling phases. Also, the bucco-palatal position of the implant was placed in accordance with the adjacent tooth cingulum to optimize esthetics.

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<sup>1</sup> Swann-Morton, No.15C Stainless Steel Scalpel Blades, England.

<sup>2</sup> Periostome no. 7756 Medizintechnik GmbH & Kohler Co., Germany

<sup>3</sup> Martin™ graduated periodontal probe KLS martin Group, Germany.

<sup>4</sup> IS II, Neobiotech Co., Seoul, South Korea.

In addition, implants were placed to engage at least 2mm apical and palatal bone and to obtain adequate primary stability not less than 35Ncm<sup>7</sup>. After fixture placement, a template was made from tin foil of the exact size and shape of the labial bone dehiscence defect. Then a resorbable collagen membrane<sup>5</sup> was cut confirming the shape of the defect. The membrane was then placed against the internal surface of the socket against the remaining buccal plate of the extraction socket. The gap between the collagen membrane and the implant was filled with xenograft particulates<sup>6</sup>. Then the membrane was folded in a palatal direction to seal the socket in an ice cream cone shape. The membrane was tucked in a palatal pouch to prevent dislodgement of the graft particulate and secure the blood clot then sutured in a palatal direction with 5-0 sutures<sup>7</sup>.

Bucco-palatal ridge dimensional changes and labial plate thickness were recorded at the

baseline, immediately post-operative and after 6 months using cone beam computed tomography (CBCT) at level of implant platform as a standardized reference point. The CBCT images were imported using OnDemand 3D<sup>8</sup> software in a DICOM format. Gingival thickness (GT) was recorded before implant placement and after 6 months using a UNC probe<sup>4</sup>. Pink esthetic score (PES)<sup>8</sup> was recorded based on seven variables: mesial papilla, distal papilla, soft-tissue level, soft-tissue contour, alveolar process deficiency, soft tissue color and soft tissue texture. For patient reported outcomes; Visual Analogue Scale (VAS) with numbers from 0 to 10 ('no pain' to 'the most painful) were used to record post-operative pain measured after 1 week and 2 weeks postoperatively. Discrete data was described as mean  $\pm$  standard deviation. Comparison between follow up periods was performed using paired t-test. A P-value less than or equal to 0.05 was considered statistically

<sup>5</sup> Collprotect, botiss dental, Germany

<sup>6</sup> Cerabone, botiss dental, Germany

<sup>7</sup> Assut, 5-0 Polypropyelen non-absorbable monofilament suture, Switzerland.

<sup>8</sup> OnDemand3D software, Cybermed Inc, Korea.

significant and all tests were two tailed. Data was analyzed using MedCalc software, version 19 for windows<sup>9</sup>.

## Results

A total of 10 patients (two males and 8 females with mean age  $36.3 \pm 8.5$  years) received immediate implant with simultaneous ice cream cone technique. All patients completed the follow up period after 6 months with no drop outs with 100% retention rate.

The mean ( $\pm$ SD) bucco-palatal ridge dimension measured at the level of implant platform at baseline was  $7.51 (\pm 1.11)$  mm. While after 6 months the mean ( $\pm$ SD) ridge dimension was  $6.2 (\pm 1.12)$  mm demonstrating a statistically significant reduction in the bucco-palatal ridge dimensional thickness compared to baseline ( $P < 0.001$ ). The mean ( $\pm$ SD) labial plate thickness measured by CBCT at implant platform was  $2.12 (\pm 0.69)$  mm compared with absent labial plate pre-operatively. Mean ( $\pm$ SD) scores of PES

were  $11.9 (\pm 0.99)$  after 6 months. Post-operative pain reported by the patients revealed reduction at 14 days compared with 7 days. The mean ( $\pm$ SD) VAS score recorded at 7 days were  $6 (\pm 1.4)$  while at 14 days it was  $1.3 (\pm 1.15)$ . Statistical analysis revealed a statistically significant reduction of postoperative pain in day 14 compared with days 7 ( $P = 0.002$ ). The mean overall satisfaction on a VAS was  $5.5 (\pm 1.7)/7$ .

## Discussion:

Tooth extraction results in hard and soft tissue loss especially at the buccal side<sup>9</sup>. The buccal plate integrity is considered a crucial factor in case selection of immediate implants in the esthetic zone<sup>10</sup>. Hence, the treatment of type II extraction sockets with immediate implants remains challenging due to the presence of bone dehiscence together with soft tissue covering the defect. Ice cream cone technique was proposed by Elian et al.<sup>5</sup> as a socket preservation approach in treatment of type II sockets.

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<sup>9</sup> MedCalc Software Ltd, Ostend, Belgium

Radiographic bone changes around immediate implants is considered an important factor for long term implant success and peri-implant soft tissue stability<sup>11</sup>. Intact and thick facial plate of bone were an ideal condition for immediate implant placement and less mid-facial mucosal recession<sup>12</sup>. Accordingly, facial plate thickness was considered the primary outcome in this investigation together with bucco-palatal horizontal bone changes. These outcomes were assessed to evaluate the regenerative potential of the ice cream cone technique regarding regenerating the lost facial plate and minimizing the amount of alveolar ridge dimensional changes following tooth extraction besides maintaining the soft tissue contour.

This case series showed that the use of immediate implant along with ice cream cone technique demonstrated reconstruction of the facial bone plate height and thickness in all cases after 6 months. These results were in accordance with other studies reported regeneration of facial plate dehiscence following the use of collagen

membrane with bony particulates for treating type II extraction sockets<sup>13-15</sup>. In addition, the current investigation demonstrated that the crest of the facial plate coincided or was at a higher level from all implant platforms showing vertical regeneration of the labial plate. The current results demonstrated that the mean bucco-lingual (horizontal) dimensional change at implant crest was 1.3 mm, which denotes that the present treatment protocol could not prevent horizontal dimension reduction at 6 months. Similar results were shown by Tan-Chu et al.<sup>16</sup> in a case series using ice cream cone technique as a socket preservation method in the anterior maxilla reporting mean bucco-lingual dimensional reduction of 1.28 mm after 6 months.

Regarding the esthetic outcomes, the results of the present study showed a mean PES of 11.9. These results were comparable to the findings reported by Noelken et al.<sup>17</sup> who found similar results with immediate implant placed in extraction sockets with and without bone

dehiscence in the esthetic zone. The authors reported PES of 11.9 at 1 year which was stable after 5 years showing PES of 11.7. Similarly, Elaskary et al.<sup>18</sup> used immediate implants in defective sockets along with vestibular socket therapy and reported PES of 11.33 after 13 months.

## **Conclusion**

This case series shows reconstruction of labial plate dehiscence with simultaneous implant placement. The use of ice cream cone technique along with immediate implant might be considered an effective method for treating patients with facial bone dehiscence and clinically enhanced reconstruction of the missed facial plate after 6 months in a flapless and less invasive approach. The current technique requires surgical skills during atraumatic tooth extraction, implant placement in proper 3D position with enough implant stability and bone augmentation. The absence of immediate temporization resulted in less esthetic outcomes as well as the short term follow up. Further

randomized clinical trials with an adequate sample size are required to compare the ice cream cone technique to other treatment modalities for management of socket type II defects with immediate implants. Studies with longer follow up periods are recommended to assess hard and soft tissue stability around the implant.

## **Abbreviations**

CEJ: Cemento-enamel junction.

CBCT: Cone beam computed tomography.

GT: Gingival thickness.

PRS: Pink esthetic score.

VAS: Visual Analogue Scale.

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## **Tables**

Case	Age (years)	Sex	Tooth number
1	33	F	5
2	24	F	7
3	39	F	10
4	35	F	12
5	56	M	13
6	37	F	7
7	41	F	5
8	37	M	10
9	29	F	12
10	32	F	5
Mean±SD	36.3±8.5		

Table

(1):

Demographic data of the study participants

*Evaluation of Ice Cream Cone Technique as a Flapless Guided Bone Regenerative Method with Immediate Implant*

Case	Buccopalatal dimension at baseline (mm)	Buccopalatal dimension at 6 months (mm)	Labial plate thickness at 6 months at implant platform (mm)	Pink Esthetic Score (PES)	Gingival Thickness at baseline (mm)	Gingival Thickness at 6 months (mm)
1	9.94	7.46	3.23	12	1	1.5
2	6.24	6.06	1.95	12	0.5	1.5
3	6.66	4.21	1.33	12	2	2
4	8.17	6.35	2.03	13	1	1.5
5	6.75	6.17	1.35	13	2	2.5
6	7.54	6.05	2.05	11	1	2
7	7.32	5.05	1.21	13	1	1.5
8	6.09	5.58	2.1	10	1.5	2
9	8.21	8.02	3.42	11	2	2.5
10	8.64	7.12	1.83	12	1	1.5
Mean±SD	7.51 ±1.11	6.2± 1.12	2.12± 0.69	11.9 ± 0.99	1.3 ±0.53	1.85± 0.41

**Table (2): Mean descriptive parameters at various points.**

## Figures

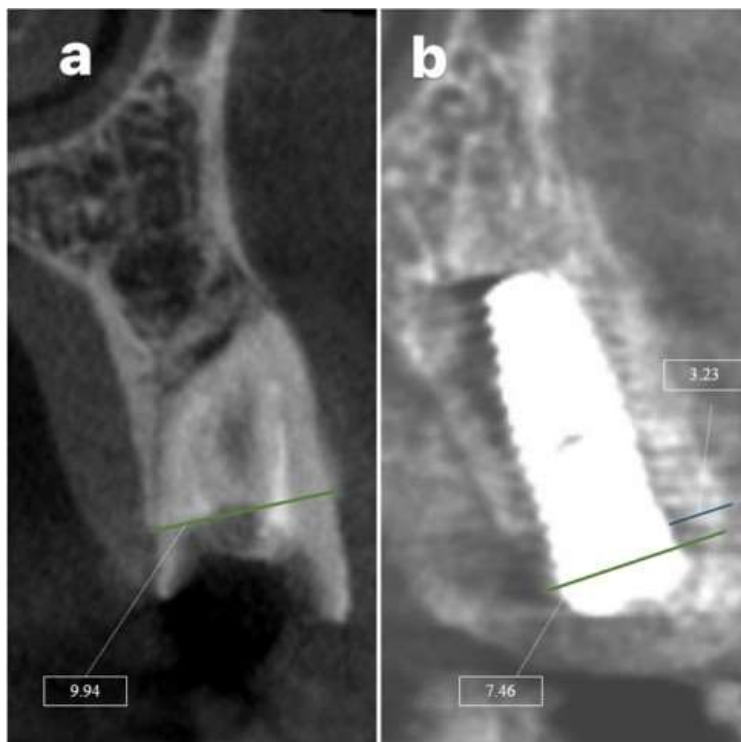


Figure (1)

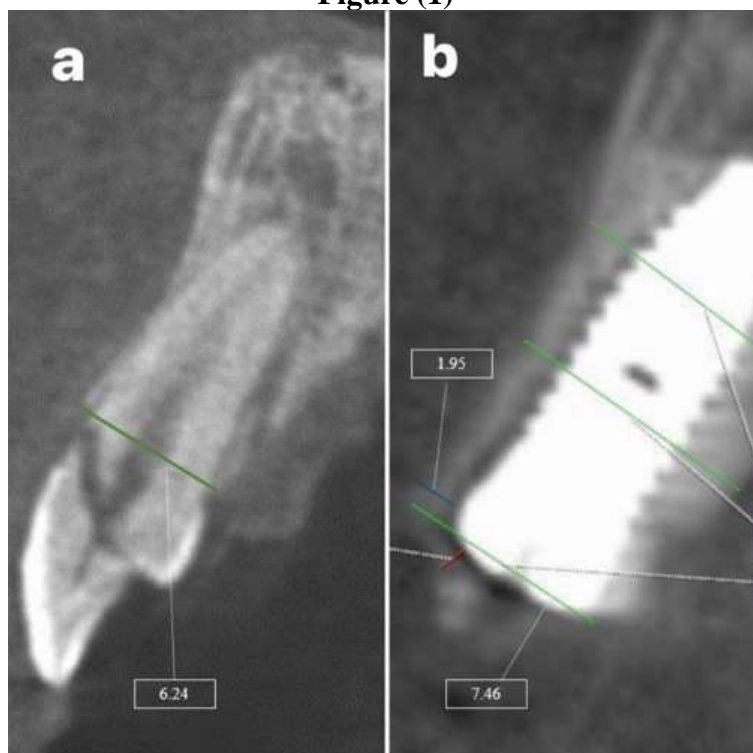


Figure (2)



**Figure (3)**



**Figure (4)**



**Figure (5)**



**Figure (6)**



**Figure (7)**



**Figure (8)**

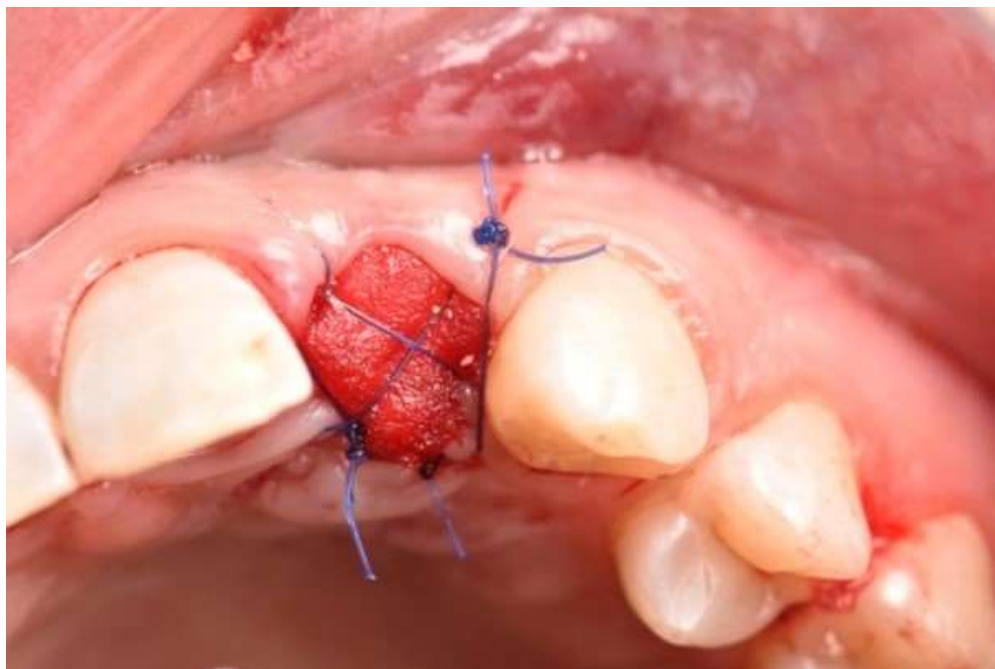




**Figure (9)**



**Figure (10)**



**Figure (11)**



**Figure (12)**



**Figure (13)**

## **Captions to figures**

**Figure 1** Case 1 CBCT cuts in the mid-labial of the implant showing the linear measurements of bucco-palatal dimension and labial plate thickness. Green line showing bucco-palatal dimension and implant platform level. Blue line showing labial plate thickness at implant platform level. 1a. Baseline CBCT showing labial plate dehiscence 2a. CBCT taken 6 months after implant placement.

**Figure 2** Case 2 CBCT cuts in the mid-labial of the implant showing the linear measurements of bucco-palatal dimension and labial plate thickness. Green line showing bucco-palatal dimension and implant platform level. Blue line showing labial plate thickness at implant platform level. 1a. Baseline CBCT showing labial plate dehiscence 2a. CBCT taken 6 months after implant placement.

**Figure 3** Baseline frontal photo.

**Figure 4** Baseline occlusal photo showing vertical crown fracture at subcrestal level.

**Figure 5** 15c Blade used for supra-crestal fibrotomy.

**Figure 6** Atraumatic extraction using periosteal elevator.

**Figure 7** Immediate Implant placement.

**Figure 8** Resorbable collagen membrane was cut to in the form of an ice cream cone.

**Figure 9** Collagen membrane was placed in the internal surface of the socket to cover the dehiscence defect.

**Figure 10** Xenograft placed in gap between the membrane and implant surface.

**Figure 11** Membrane tucked in the palatal side forming an ice cream cone shape & secured using a crisscross suture.

**Figure 12** Six month's post-operative after exposure of the implant using prefabricated healing abutment.

**Figure 13** Delivery of zirconia crown over the titanium abutment.