

A Challenging Approach: Implant Placement in Fresh Extraction Socket with Buccal Plate Defect Using a Novel Technique

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ABSTRACT

As Dental implants have emerged to be one of the best means of rehabilitating a missing tooth, there have been various new advancements taking place in implant dentistry in the recent years. It is extremely important to preserve the facial bone and the soft tissue, especially in the esthetic zone. Various such procedures maintain the width of the soft tissue and underlying bone in the esthetic areas. Conventionally it was advisable to wait for at least 3 months after the implant placement, before prosthetically rehabilitating the patient. However, with recent advances, we can provide the patient with immediate implants. This review aims to discuss a technique, which discusses on how we are able to place dental implants in fresh extraction sockets, with a buccal plate defect incorporating a novel surgical method along with usage of both hard and soft tissue grafts, which will enable us to achieve pleasing esthetics for the patient, without causing future facial bone resorption.

Key Words: Immediate implant placement, Bone shield, Fresh Extraction Socket, Pink Esthetic Score, Novel Surgical Method, Facial Bone Resorption

INTRODUCTION

Providing long-lasting, healthy hard and soft tissue architecture while avoiding intraoperative surgical trauma and post-operative problems and reducing treatment time with reliable aesthetic results is the ultimate goal of implant treatment. A therapeutic option addressing several of these parameters is the immediate implantation of implants in newly created extraction sockets.^{1,2,3}

However, the potential resorption of the face bone plate, as suggested in numerous studies, is a significant risk with immediate implant insertion,^{4,5} therefore several strategies were suggested to prevent facial bone resorption and improve the final aesthetic result, as studied by Hürzeler et al. who introduced the socket shield therapy wherein a small labio-coronal fragment of the root is maintained in place to preserve the blood supply reaching the facial cortical plate from the periodontal ligaments.⁵ A number of studies were conducted by Chu et al, Elian et al., Buser et al. suggesting the use of this technique in order to improve the final esthetic outcome.^{6,7,8}

Abdelsalam Th Elaskary et al.⁸ further introduced a new procedure called vestibular socket therapy (VST), which involves applying a facial bone shield through a vestibular horizontal incision, adding bone graft to the socket, and placing a custom-made healing abutment and allowing for immediate implant placement in sockets with and without deficient facial bone and to assess radiographic and esthetic parameters pre and post healing. In this review, we aim to discuss the technique, challenges faced and the benefits of this novel approach which can offer significant benefits over traditional procedures.

TECHNIQUE

Methodology

A sample size of 12 patients, aged 18 to 50 years with non-salvageable teeth in the maxillary anterior region with sufficient bone apically and palatally and natural teeth on the contralateral site was selected for this study. Extraction sockets that were type III, if there was acute infection in the hopeless tooth, or if the patient was a heavy smoker (> 10 cigarettes

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per day), pregnant, or had received chemotherapy or radiotherapy in the previous year were excluded. Every patient was provided with a consent form for the study. A cone beam computed tomography (CBCT) scan was used for diagnosis and treatment planning.

Descriptive statistics were calculated. The groups were compared using Mann-Whitney U test. Baseline and post-implant values were compared using Wilcoxon signed rank test. Comparison to one group was done using a one-sample Wilcoxon signed-rank test. Significance was set at $P < 0.05$. Data were analyzed using IBM SPSS statistical software.

Grouping

The 12 fresh extraction sockets included in the study were divided into 2 equal groups receiving the same intervention:

- Group 1: Sockets with intact but thin facial plate of the bone and intact soft tissue
- Group 2: Sockets with a deficient facial plate of bone but intact soft tissue

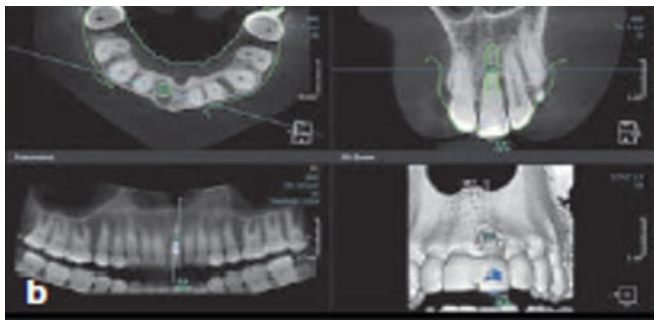


Figure 1: CBCT pre-planning for CAD/CAM surgical guide. Measuring the exact bone shield dimensions on CBCT.

Procedure

Surgeries were conducted by the same experienced periodontist (A.A.) under local anesthesia. Sulcular incisions were made, and then hopeless teeth were extracted traumatically using peristomes. Socket lavage and curettage were done thoroughly; the socket type was assessed, and the presence of adequate interproximal bone level was confirmed.

A vestibular access horizontal incision was made at the socket site, 3 to 4 mm apical to the mucogingival junction and extending 5 to 10 mm horizontally. A submucoperiosteal tunnel was created starting from the facial aspect of the socket orifice and extending apically until the vestibular access incision. A computer-guided surgical template was used to deliver the implant (Megagen implant) in the optimum prosthetically guided position with the implant shoulder placed 3 to 4 mm apical to the labial gingival margin.

A slowly resorbable xenograft cortical membrane shield (Flexible cortical bone sheet, Bioteck) trimmed to fit the facial wall of the socket was introduced through the tunnel

lying over the intact or deficient facial bone plate and stabilized by bone tacks. The facial gap was filled with a mixture of autogenous bone chips and deproteinized bovine bone mineral (DBBM) in a ratio of approximately 3:1.⁵

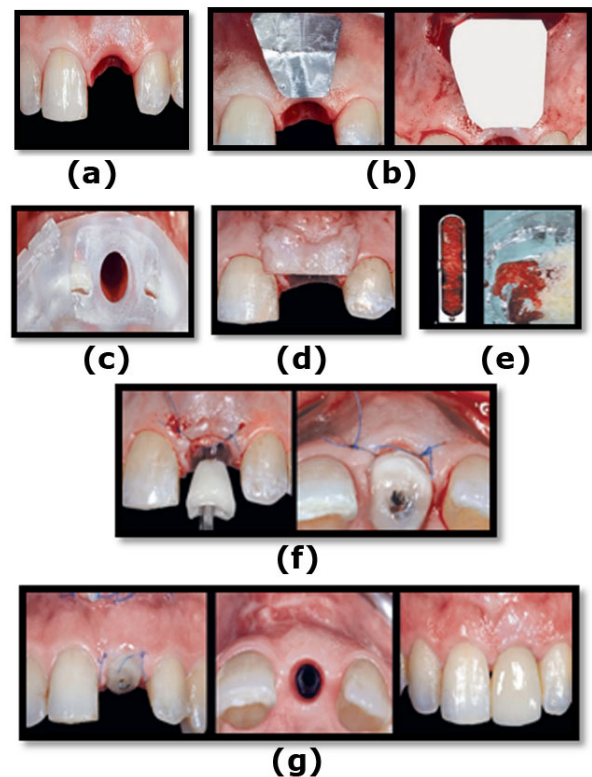


Figure 2: Surgical protocol. (a) Fresh extraction site, b) Surgical guide fabrication done using CBCT and CAD/CAM, c) Template trial for the bone shield and bone shield trial just before placement, d) Bone shield stabilized using Bone tacks, e) Sub epithelial connective tissue graft ready for insertion cortical bone chips harvested, f) Customised healing abutment try in, suturing connective tissue graft, g) One and two-month healing, Prosthesis after 3 months.

The autogenous bone was harvested from the area of the vestibular access incision using a bone scraper. A subepithelial connective tissue graft was harvested from the palate using the single incision technique and secured to the soft tissue wall of the tunnel by sutures. Finally, the socket orifice was sealed using a customized healing abutment screwed to the implant, adequately finished, and polished to ensure a proper soft tissue emergence profile, while the vestibular access horizontal incision was sutured using 5/0 Vicryl sutures.

Facial bone thickness was measured on the 6/13-month images from the implant surface to the outer surface of bone at three points: at the implant platform, at the midpoint of implant length, and at a point located midway between the first two points. Mean bone thickness at these three points was calculated. The three points specified on the superimposed

6/13-month images were projected on the baseline image; facial bone thickness was measured from the root surface to the outer surface of bone at these same points, and the mean was calculated. The esthetic appearance at 6 and 13 months was calculated using the pink esthetic score (PES).

RESULT

Hundred percent implant success rate was observed with this technique, with none of the patients reporting post-operative infection or wound exposure. The results for the mean facial bone thickness in socket with intact and deficient facial bone at 6 and 13 months is summarized in table 1 and 2. The mean facial bone thickness in sockets with intact facial bone was 0.76 ± 0.42 mm at baseline and 1.88 ± 0.73 mm at the 6-month follow-up after implant placement with a statistically significant difference ($P = .046$). On the other hand, sockets with deficient facial bone had a mean facial bone thickness at baseline of 0 mm, which significantly increased to 2.34 ± 0.78 mm at 6 months ($P = .028$). There was no statistically significant difference in facial bone thickness between the two groups at 6 months.

The total mean PES at 6 and 13 months was 11.33 for both groups. Ten out of the 12 cases (83.33%) had a total PES of more than 10. The soft tissue level score was 2 for all cases in both groups (Table 3).

Table 1 Facial Bone Thickness at Baseline, After 6 Months, and After 13 Months Among Extraction Sockets

	Group 1 (n = 6)	Group 2 (n = 6)	Total (n = 12)	P
Bone thickness at baseline				
Mean $\pm$ SD	0.76 ± 0.42	0 ± 0	0.38 ± 0.49	.002*
Median (IQR)	0.61 (0.54, 0.96)	0 (0, 0)	0.19 (0, 0.62)	
Bone thickness after 6 mo				
Mean $\pm$ SD	1.88 ± 0.73	2.34 ± 0.78	2.11 ± 0.76	.394
Median (IQR)	1.85 (1.23, 2.62)	2.08 (1.92, 2.65)	2.01 (1.77, 2.49)	
Bone thickness after 13 mo				
Mean $\pm$ SD	1.84 ± 0.74	2.18 ± 0.73	2.01 ± 0.72	.394
Median (IQR)	1.83 (1.17, 2.60)	1.92 (1.85, 2.42)	1.90 (1.72, 2.41)	
P value				
Baseline–6 mo	.046*	.028*	.003*	–
Baseline–13 mo	.075	.027*	.004*	
6 mo–13 mo	.027*	.028*	.002*	

*Statistically significant at $P < .05$.
IQR = interquartile range.

Table 2 Distance from Platform of Implant to Bone Crest (P/C) at Baseline, After 6 Months, and After 13 Months Among Extraction Sockets

	Group 1 (n = 6)	Group 2 (n = 6)	Total (n = 12)	P
P/C at baseline				
Mean $\pm$ SD	0.07 ± 0.17	7.96 ± 2.55	4.02 ± 4.47	.002*
Median (IQR)	0 (0, 0.11)	7.58 (5.79, 10.45)	2.75 (8.27, 0)	
P/C after 6 mo				
Mean $\pm$ SD	0 ± 0	0 ± 0	0 ± 0	1.00
Median (IQR)	0 (0, 0)	0 (0, 0)	0 (0, 0)	
P/C after 13 mo				
Mean $\pm$ SD	0 ± 0	0.20 ± 0.13	0.10 ± 0.13	.002*
Median (IQR)	0 (0, 0)	0.15 (0.10, 0.33)	0.05 (0, 0.18)	
P value				
Baseline–6 mo	.317	.028*	.018*	–
Baseline–13 mo	.317	.028*	.018*	
6 mo–13 mo	1.00	.026*	.026*	

*Statistically significant at $P < .05$.
IQR = interquartile range.

DISCUSSION

Vestibular Socket therapy (VST) is a surgical procedure for immediate implant placement in sockets with or without deficient facial bone. This novel approach is a minimally invasive technique with the reliable esthetic and radiographic outcome which shows a complete reconstruction of the facial bone plate thickness and height. Facial bone thickness at 6 and 13 months was similar in sockets with and without deficient facial bone. After 13 months, the thickness significantly decreased in sockets of both types and overall. The amount of bone thickness observed in the present study more or less agrees with the results of Sarnachiaro et al.,⁹ where the average facial bone thickness at all the three levels they studied was 2.52 mm after 6 to 9 months postoperatively.

In the present study, the crest of the facial bone plate coincided with the implant platform level in both groups at 6 months, with some loss in vertical bone height after 13 months in sockets with deficient facial bone with statistical but not clinical significance. The mean soft tissue level score after 6 and 13 months was 2, which is the highest possible score, indicating that there was no midfacial mucosal recession in these cases.

Advantages of VST technique:

- The newly proposed VST technique overcame the problem of mucosal recession not only in sockets with intact facial bone but also in sockets exhibiting a large facial wall defect
- Minimally invasive technique
- Good aesthetic and radiographic outcome
- Has a high deficient alveolar process score: 1.92 out of 2

Challenges with this technique:

In the present study, the distal papilla demonstrated the lowest mean score (1.25) in both groups which was similarly reported in other studies.^{10,11,12} The outcomes of the VST can be due to several technical factors-

- Due to the slowly resorbing membrane shield which helped retain the original architecture of the socket and preserve the overlying mucosal level. When the residual facial plate started to resorb, the shield remained until a complete gap fill occurred, resulting in a thicker facial bone plate
- The second factor is the choice of grafting material. The autogenous bone resorbs rapidly but enhances osteogenesis, while the DBBM has a low substitution rate, thus providing further dimensional stability over time
- Lastly, the incision was designed without vertical incisions, thus preserving the vascular network while at the same time being convenient.

Limitations:

- Longer follow-up periods would allow more solid conclusions to be drawn, especially after complete substitution of the membrane shield with natural bone
- Evaluation of the final esthetic outcome using the subjective PES. Objective measurements of the mucosal marginal level and papillae level are strongly recommended.
- Future studies are also needed to assess the treatment outcomes under various clinical conditions including sockets with different defect sizes and those in need of different amounts of bone and/or connective tissue grafts, which would require the inclusion of a greater number of patients representing these various conditions.

CONCLUSION

Immediate implant placement in sockets with and without a deficient facial plate using this technique resulted in facial bone thickness that was greater than that reported by previous similar techniques for immediate implant placement and in line with the recommended 2 mm.

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