

Case Series

Esthetic Buccal Flap for Correction of Buccal Fenestration Defects During Flapless Immediate Implant Surgery

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Background: Clinically, it is a tremendous challenge to create natural gingival esthetics after immediate or delayed implant placement. Hence, flapless immediate implant surgery has been proposed to overcome the shortfalls of these techniques. Nonetheless, one of the major limitations for this technique is its inability to correct localized horizontal/vertical deficiency, dehiscence, or fenestration without jeopardizing esthetic outcomes. Therefore, the aim of this paper was to present a new flap design, the esthetic buccal flap (EBF), aimed at overcoming this potential problem while maintaining the optimal esthetic appearance.

Methods: Five consecutively EBF-treated patients with simultaneous implant placement were included in this pilot case study. Clinical measurements were taken at the time of prosthesis insertion and 6 and 12 months after surgery. These included soft tissue height, papillae appearance, scar appearance, and mid-buccal probing depth.

Results: Data obtained from this pilot case study showed that soft tissue height was preserved, and papillae appearance remained the same as at presurgery. No scar tissue was reported in any cases. Mid-buccal probing depths remained consistent throughout the study.

Conclusion: The results indicate that EBF, together with simultaneously guided bone augmentation, allows clinicians to correct apical buccal fenestration defects while maintaining the supraosseous soft tissue during flapless immediate implant surgery. *J Periodontol* 2006;77:517-522.

KEY WORDS

Bone regeneration; flaps; implants; surgery.

Initially, implant dentistry focused on successful osseointegration of the implant. Today, the clinician is judged mainly by postoperative morbidity and final esthetic outcome. The first and most basic objective is creation of the most natural smile. The attainment of this objective is far less complex if the natural anatomy of the soft tissue is permanently preserved over time.

It is often difficult for surgeons to control the outcome of sophisticated soft tissue healing. Hence, if only the tooth is compromised and not the soft tissue and surrounding osseous structure, a flapless surgery with immediate implant placement can be performed.^{1,2} Nonetheless, when a dehiscence or fenestration is noted in the apical buccal bone, a flap is often needed to correct the problem. However, when soft tissue presents no signs of recession and underlying bone shows limited resorption interproximally, a newly designed flap, the esthetic buccal flap (EBF), would be an ideal approach to correct this defect while maintaining the overall esthetic appearance. This flap approach allows clinicians to correct buccal apical fenestration using guided bone regeneration (GBR) and at the same time preserve the natural supraosseous soft tissue profile. Hence, the overall esthetic profile is protected. A detailed description of this technique is presented in this article.

EBF TECHNIQUE

Profile Assessment

Before extraction of the hopeless tooth, the mesio-distal dimension of the future edentulous segment and its comparison to existing contralateral teeth together with underlying bone are evaluated clinically and radiographically. Then, the surrounding gingival tissues of the hopeless tooth and adjacent teeth are assessed for papilla height, thickness, and scalloping of the gingival line. Evaluations of the tooth form, three-dimensional position, and orientation of the clinical crowns are also important. The periodontal biotype,³ together with the periodontal and endodontic condition of the tooth and the crown-to-root ratio, should also be

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analyzed. The future implant and restorative therapy is then determined by the inclination of the frontal bone volume apical to the remaining extraction site. Additional esthetic parameters such as diastemas, the smile line, and trajectory of the gingival margin should also be examined.

Extraction and Implant Placement

Tooth removal should not compromise the extraction site. After careful extraction with a periosteal elevator (active only mesiodistally and palatally), a thorough examination of the remaining alveolar bone is performed, and the ideal implant position is determined. The ideal position should be slightly toward the palate from the original tooth position to avoid resorption of the buccal plate. The socket is cleaned with curets and rotation instruments. Osteotomy is prepared following the manufacturer's suggested protocol; an undersized osteotomy is often recommended for better primary stability, especially in the soft bone. The implant[§] is placed and torqued down to its final position with respect to the vertical and horizontal dimensions of the interproximal bone using either hand or electronic instrumentation.³ A minimum of 4 mm of bone apical to the extraction socket is often required for primary stabilization of an immediately placed implant.⁴

EBF Design

The best way to preserve the mesial and distal interproximal papillae adjacent to the implant and the facial free gingival margin of the implant is by avoiding surgical intervention in this region. However, an ideal prosthetic implant placement often resulted in perforating the buccal bone at the apex of the implant, especially when a flapless surgery was employed. Bone augmentation was then needed to correct these perforated defects. EBF is a flap design that allows surgeons to maintain the architecture of the coronal soft tissue and gain access to these defects. This flap design involves three incisions, which include two vertically beveled releasing incisions placed in the mucosa along the tension lines and one horizontal incision to connect both vertical incisions (Fig. 1). Depending on the size of the defect, the vertical incisions should be positioned so that there is enough space for GBR. The horizontal incision is performed in the attached gingiva ~1 to 2 mm coronally from the mucogingival junction. In addition, the horizontal incision

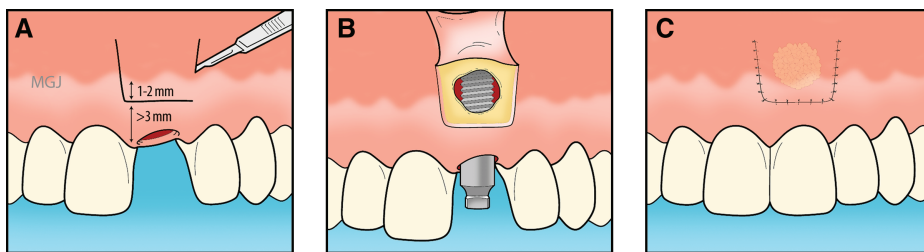


Figure 1.

Diagram to illustrate esthetic buccal flap together with immediate flapless implant surgery. **A)** Flap incision design that includes two vertically beveled releasing incisions placed in the mucosa along the tension lines and one horizontal connected incision (1 to 2 mm below the mucogingival junction [MGJ]) to connect both vertical incisions; in addition, the horizontal incision should be at least 3 mm away from the gingival margin to ensure that the supraosseous soft tissue is not disturbed. **B)** Flap reflected to expose defect. **C)** Flap closure with temporary restoration in place (inside the flap, the defect is corrected with bone graft and collagen membrane).

should be made at least 3 mm away from the gingival margin to ensure that the supraosseous soft tissue is not disturbed. This technique is applicable only when the supporting interproximal osseous crest has not been significantly resorbed. Furthermore, only apical buccal defects can be corrected with EBF.

GBR and EBF Sutures (the EBF sutures)

After properly placing the implant in the final position, GBR is performed to correct any bone deficiencies using bone graft and collagen membrane.⁵ Specifically, a sandwich bone augmentation⁵ that uses layers of different bone grafts and a collagen barrier is often our treatment of choice. After GBR, the flap is slightly released in the apical portion via an inner underlying incision cut to relieve any potential flap tension. After repositioning of the flap to its initial position, the flap is then sutured. The suturing follows a specific sequence to reduce tension in the coronal-apical direction onto the remaining attached gingiva. Tension at this level may lead to future recession of the buccal soft tissue. First, the vertical incisions are sutured in their original position, and the horizontal incision is closed in a tension-free position. Generally, a 5-0 polyglactin 910^{||} suture was used in our cases. After flap closure, a temporary abutment is screwed onto the implant. To support the restorative gingival interface, the following different methods are possible: 1) introducing a healing abutment, 2) introducing composite into the soft-tissue socket around a composite abutment, 3) using an impression and fabrication of a temporary crown for soft tissue support, and 4) repositioning of the natural crown to the initial position after cutting off the root and hollowing it out.

§ Tapered screw vent, Zimmer Dental, Carlsbad, CA.

|| Vicryl, Ethicon, Johnson & Johnson, Somerville, NJ.

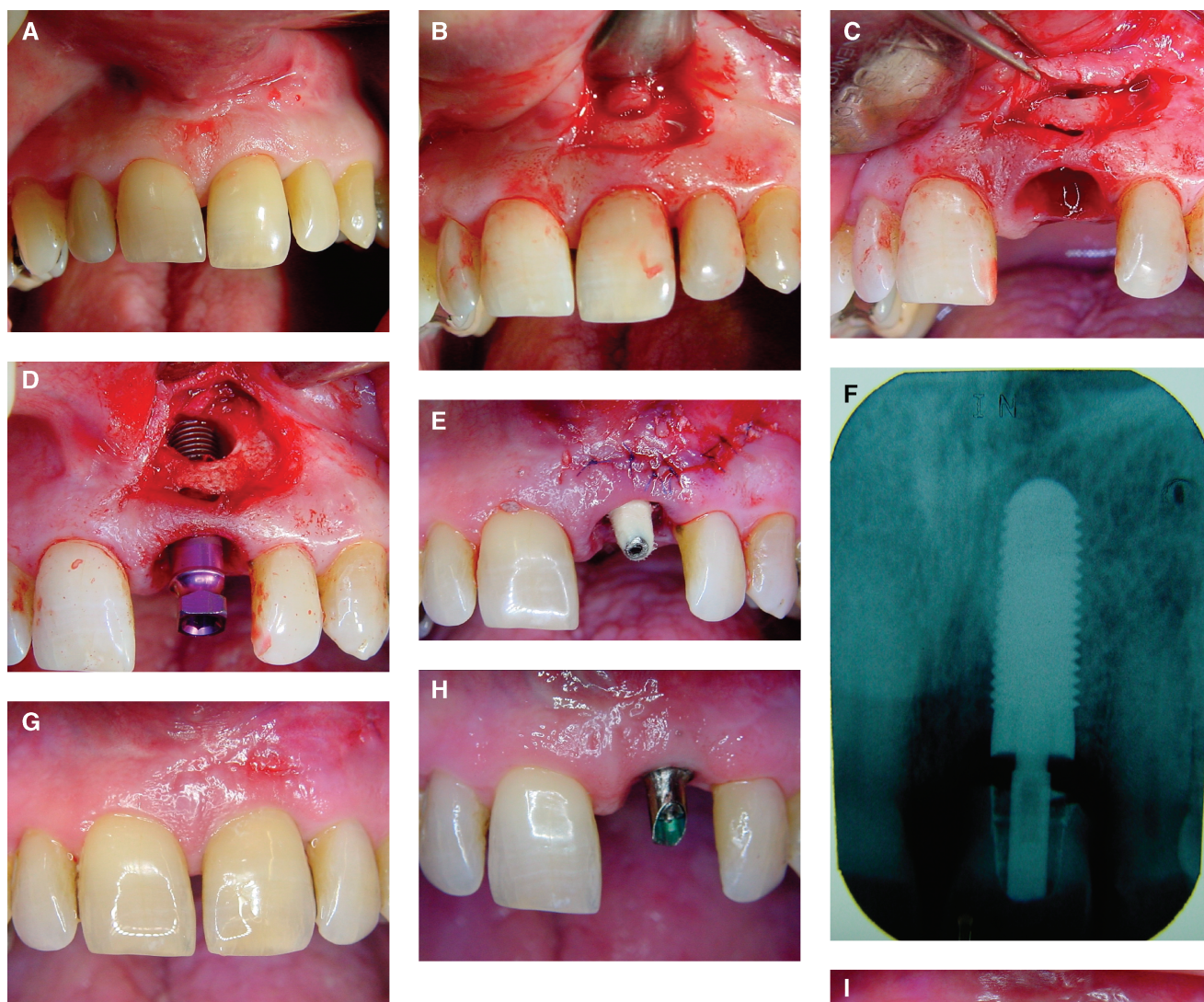


Figure 2.

Patient A treated with EBF technique. **A)** Initial view before tooth was extracted. **B)** EBF incisions and flap reflection. **C)** Atraumatic tooth extraction using a periosteal elevator; flap was examined to make sure it was released of any tension. **D)** Implant placed according to the surgical guide. **E)** Flap closure and final abutment placement with acrylic coping. **F)** Radiograph showed implant placement with natural tooth as temporary crown. **G)** Two-week post-surgery healing. **H)** Four-month post-surgery healing showed excellent soft tissue healing. **I)** Final restoration at 1 year showed an excellent soft tissue profile and esthetic result (e.g., papillae were preserved as presented before natural tooth extraction).

Figures 2 and 3 illustrate outcomes of two subjects (patients A and B, respectively) treated with EBF in conjunction with GBR to correct apical defects while maintaining all supraosseous soft tissue and interproximal bone height. Overall, the EBF technique allows for the preservation of the soft tissue housing form that existed before extraction while achieving bone augmentation in the commonly noted buccal-apical fenestration defects.

MATERIALS AND METHODS

Five systemically healthy patients (mean age \pm SD: 40.2 ± 12.0 years; range: 28 to 55 years), two males

and three females, participated in this pilot case study from March 1, 2002 through November 30, 2004 at a private practice in Heidelberg, Germany. Each patient was in need of a single implant placement in the maxillary central incisors and provided informed consent to have this procedure done and data recorded. Teeth were extracted according to the technique introduced in the preceding paragraphs. Soft tissue height was measured from crestal alveolar bone to the tip of papillae. The appearance of papillae was recorded using the classification described by Nordland and Tarnow:⁶ normal: interdental papilla fills embrasure space to the apical extent of

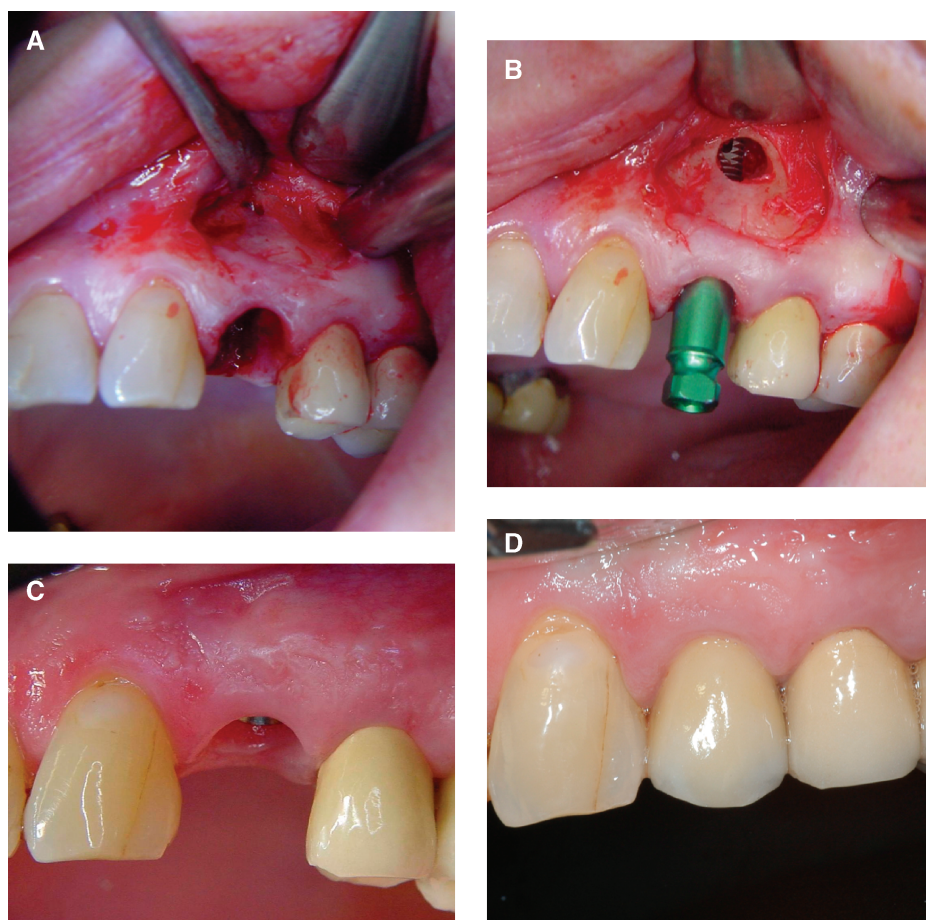


Figure 3.

Patient B treated with EBF technique. **A)** EBF incisions with atraumatic tooth extraction. **B)** Implant placed according to the surgical guide. **C)** Four-week post-surgery healing. **D)** Final restoration at 1 year showed excellent soft tissue profile and Class I papillae appearance according to Nordland and Tarnow.⁶

the contact point/area; Class I: the tip of the interdental papilla lies between the interdental contact point and the most coronal extent of the interproximal cemento-enamel junction (CEJ; space present, but interproximal CEJ is not visible); Class II: the tip of the interdental papilla lies at or apical to the interproximal CEJ but coronal to the apical extent of the facial CEJ (interproximal CEJ is visible); and Class III: the tip of the interdental papilla lies level with or apical to the facial CEJ. Scar appearance was marked either “appear” or “disappear”. Mid-buccal probing depths were measured from the gingival margin to the implant sulcus depth. Measurements were taken at the time of prosthesis insertion and 6 and 12 months after surgery.

RESULTS

Table 1 shows changes in soft tissue height and mid-buccal probing depths over time. Soft tissue heights remained stable overall with no or minimal recession. A

similar trend was also noted in the mid-buccal probing depths; no changes in probing depths before or after surgery were noted. In addition, no additional scarring was noted in any treated case.

Table 2 lists loss of papillae according to Nordland and Tarnow’s classification.⁶ Overall, all patients maintained their original papillae appearance, which was similar to their original papillae shape prior to tooth extraction. Briefly, three patients achieved normal papillae appearance, whereas the remaining two individuals had Class I papillae appearance.

DISCUSSION

The key to an esthetically pleasing smile in implant restorations is based largely upon proper management of the soft tissues surrounding implants. The basic parameters related to implant esthetics in the maxillary anterior segment are well documented in the dental literature.⁷⁻¹⁴ An important concern lies in the fact that, under normal conditions, a maxillary anterior tooth extraction leads, on average, to an approximately 2-mm loss in vertical tissue

height.^{8,9,15} For this reason, many authors have described methods attempting to maintain the soft tissue profile.^{15,16} Furthermore, to minimize the possibility of postoperative peri-implant tissue loss and to overcome the challenge in soft tissue management during or after surgery, the concept of flapless implant surgery has been introduced and applied clinically to both delayed and immediate loading cases.¹⁷⁻¹⁹ This treatment should be limited to the cases in which only the tooth is compromised and not the adjacent osseous and soft tissue structures. Immediate implant placement has been shown to be feasible,²⁰ leading to a combination of immediate implant placement together with a flapless surgery approach. The EBF makes preservation of the soft tissue housing possible in cases with localized buccal apical bone deficiencies.

Data obtained from this pilot case study showed soft tissue height was preserved, and papillae appearance (either normal or Class I according to Nordland and Tarnow⁶) remained the same as at presurgery.

Table 1.**Soft Tissue Height and Mid-Buccal Probing Depths (mean \pm SD)**

	Soft Tissue Height (mm)		Mid-Buccal Probing Depth (mm)
	Mesial	Distal	
Baseline	4.6 \pm 0.6	4.1 \pm 0.6	4.0 \pm 0.7
6 months	4.6 \pm 0.7	4.1 \pm 0.6	4.2 \pm 0.8
12 months	4.6 \pm 0.7	4.1 \pm 0.6	4.2 \pm 1.3

Table 2.**Papillae Loss Using the Classification of Nordland and Tarnow^{6*}**

	Baseline		6 Months		12 Months	
	Mesial	Distal	Mesial	Distal	Mesial	Distal
Normal	3	3	3	3	3	3
Class I	2	2	2	2	2	2
Class II	0	0	0	0	0	0
Class III	0	0	0	0	0	0

* Data represent the number of cases occurring in each classification category.

This implies that an EBF design would allow surgeons to place an implant according to prosthetic-driven guidelines rather than bone-driven. However, one of the concerns for this approach is a fenestration-type defect in the apical area of the implant. Coronal flap access is required to manage this type of defect. This classic flap approach may lead to soft tissue manipulation with the potential of a negative esthetic outcome. With EBF, this potential problem could be reduced while permitting a simultaneous lateral bone augmentation. Furthermore, data from this study showed no mid-buccal probing depth change throughout the study. This suggests that the bone level was protected; hence, the soft tissue profile surrounding the implant could be maintained. This is a great improvement from the conventional coronal flap access approach.

The EBF offers an alternative in these cases by preserving the soft tissue housing and making bone augmentation possible at the same time, especially in a flapless implant surgery. This type of flap design should be attempted in areas that are sensitive to esthetics, in particular, the upper anterior region. Nonetheless, future studies are encouraged to include larger sample sizes and longer follow-up times.

CONCLUSIONS

This article describes a unique flap technique for cases of immediate implant placement in the esthetic zone with a need for immediate soft tissue support and bone augmentation. The EBF presented in this article offers a flap design that maintained the supraosseous soft tissue and allowed simultaneous guided bone augmentation to correct buccal implant fenestration defects while maintaining optimal implant esthetics.

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REFERENCES

1. Tarnow DP, Magner AW, Fletcher P. The effect of distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. *J Periodontol* 1992;63:995-996.
2. Garber D, Salama M, Salama H. Immediate total tooth replacement. *Compend Contin Educ Dent* 2001;22:210-218.
3. Wöhrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization: Fourteen consecutive case reports. *Pract Periodontics Aesthet Dent* 1998;10:1107-1114.
4. Schwartz-Arad D, Chaushu G. The ways and wherefores of immediate placement of implants into fresh extraction sites: A literature review. *J Periodontol* 1997;68:915-923.
5. Wang H-L, Misch C, Neiva RF. Sandwich bone augmentation technique: Rationale and report of pilot cases. *Int J Periodontics Restorative Dent* 2004;24:232-245.
6. Nordland WP, Tarnow DP. A classification system for loss of papillary height. *J Periodontol* 1998;69:1124-1126.
7. Belser UC. Esthetic implant restorations. In: Lang NP, Karring T, Lindhe J, eds. *Proceedings of the 3rd European Workshop on Periodontology*. Berlin: Quintessence; 1999:304-332.
8. Atwood DA. Postextraction changes in the adult mandible as illustrated by microradiographs of midsagittal sections and serial cephalometric roentgenographs. *J Prosthet Dent* 1963;13:810-825.
9. Atwood DA. Some clinical factors related to rate of resorption of residual ridges. *J Prosthet Dent* 2001;86:119-125.
10. Salama H, Salama MA, Garber D, et al. The interproximal height of bone: A guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. *Pract Periodontics Aesthet Dent* 1998;10:1131-1141.
11. Wang H-L, Itose T, Neiva RF, et al. Multidisciplinary treatment approach for enhancement of implant esthetics. *Implant Dent* 2005;14:21-29.
12. Bichacho N, Landsberg CJ. Single implant restorations: Prosthetically induced soft tissue topography. *Pract Periodontics Aesthet Dent* 1997;9:745-754.
13. Steigmann M, Daum O. Diagnosis in implant esthetics (in German). *Implantologie Journal* 2004;3:50-52.
14. Steigmann M. Aspects of implant esthetics (in German). *Cosmetic Dentistry* 2004;2:30-32.

15. Iasella JM, Greenwell H, Miller RL, et al. Ridge preservation with freeze-dried bone allograft and a collagen membrane compared to extraction alone for implant site development: A clinical and histological study in humans. *J Periodontol* 2003;74:990-999.
16. Wang H-L, Kiyonobu K, Neiva RF. Socket augmentation: Rationale and technique. *Implant Dent* 2004;13:286-296.
17. Hahn J. Single-stage, immediate loading, and flapless surgery. *J Oral Implantol* 2000;26:193-198.
18. Campelo LD, Camara JRD. Flapless implant surgery: A 10-year clinical retrospective analysis. *Int J Oral Maxillofac Implants* 2002;17:271-276.
19. Rocci A, Martignoni M, Gottlow J. Immediate loading in the maxilla using flapless surgery, implants placed in predetermined positions, and prefabricated provisional restorations: A retrospective 3-year clinical study. *Clin Implant Dent Relat Res* 2003;5(Suppl. 1):29-36.
20. Gapski R, Wang H-L, Mascarenhas P, et al. Critical review of immediate implant loading. *Clin Oral Implants Res* 2003;14:515-527.

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