Soft Tissue Healing Around Implants Placed Immediately After Tooth Extraction Without Incision: A Clinical Report

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Purpose: *The purposes of the present study were to evaluate implants placed immediately after tooth extraction without incision or primary flap closure and to observe the peri-implant soft tissue healing.* ***Materials and Methods:*** *Fifteen patients (9 men and 6 women) aged 31 to 54 years were included in this study. Each patient had a tooth that required extraction, and each had at least 4 mm of bone beyond the root apex. Teeth with multiple roots were excluded from this study. After tooth extraction, the implants were immediately placed without incision or flap elevation. Implant sites showing bone fenestrations, bone dehiscences, or peri-implant bone defects exceeding 2 mm were excluded from this study. In these cases, a standard guided bone regeneration procedure with a surgical flap elevation was used. The second-stage surgical procedure was performed 6 months after the first procedure. The following clinical parameters were evaluated at the time of implant placement and at second-stage surgery: levels of mesial and distal papillae, width of keratinized mucosa, position of mucogingival junction relating to the surrounding tissues, and peri-implant radiolucency and marginal bone loss, which were evaluated radiographically.* ***Results:*** *The postsurgical healing period was uneventful for all patients. Soft tissue closure over the implant sites was achieved in 1 to 3 weeks after surgery at all sites. At second-stage surgery, no peri-implant bone defects were observed or detected by probing around all the experimental implants. The soft tissue anatomy was considered clinically acceptable in all patients.* ***Discussion and Conclusion:*** *Successful osseointegration and complete bone healing were observed for all patients. The soft tissue healing and morphology were satisfactory; additional mucogingival surgery was not required before definitive prosthetic rehabilitation.* INT J ORAL MAXILLOFAC IMPLANTS 2004;19:549–553

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The placement of implants immediately or shortly after tooth extraction has proven to be a predictable treatment strategy with a very high rate of success.[1–3] Immediate implant placement has several advantages, such as reduction of the number of surgical treatments, reduction of the time between tooth extraction and placement of the definitive prosthetic restoration, prevention of bone resorption, and preservation of the alveolar ridge in terms of height and width, which in turn has esthetic and functional benefits.[4] The use of guided bone regeneration (GBR) techniques has been suggested for the treatment of peri-implant bone defects after immediate implantation.[5]

Bone regeneration procedures in the presence of large bony defects usually require the use of barrier membranes, either with or without bone grafting material.[6,7] Complete soft tissue closure has been considered necessary in GBR to cover the membranes and to avoid early exposure of the treated sites to the oral cavity. Several flap designs have been proposed to achieve the primary closure, such as the coronally positioned flap, the laterally positioned flap, and the rotated split-thickness palatal flap. The coronal repositioning of the flap could modify the implant's normal relationship with the adjacent soft tissues and it could change the mucogingival junction position and reduce vestibular depth. The lateral repositioning of the flap to achieve primary wound closure could cause gingival recession at the level of the donor site. The rotated split-thickness palatal flap could avoid all the disadvantages of the other techniques and offer a predictable treatment to obtain primary flap closure, but it requires palatal gingival tissue thicker than 4 mm.

Several authors have reported high rates of membrane dehiscence after immediate implant placement.[8–10] Because the membrane is exposed to the oral cavity, it is at risk for bacterial colonization and infection, which can lead to complications that require membrane removal. Membrane removal, in turn, compromises bone regeneration and bone healing.[8,9]

On the basis of these considerations, it has been recently observed that the use of a barrier membrane is not always necessary, especially for small bone defects such as small circumferential defects not exceeding 2 mm, which could heal spontaneously.[11,12] Schwartz-Arad and Chaushu[13] reported a successful clinical outcome for 9 single implants placed immediately after tooth extraction without incisions or primary flap closure. Complete bone healing was achieved with papilla preservation and minimal gingival recession. Clinical cases with extensive bone loss were excluded from the study.

The purposes of the present study were to evaluate implants placed immediately after tooth extraction without incision or primary flap closure and to observe the peri-implant soft tissue healing.

MATERIALS AND METHODS

Fifteen partially edentulous patients (9 men and 6 women) aged 31 to 54 years who were in need of tooth extraction were included in this study. All patients willing to participate in the study demonstrated good general health. Heavy smokers (more than 10 cigarettes per day) were excluded. All procedures to be performed were explained, and all patients signed an informed consent form. Inclusion criteria for the study were *(1)* the presence of at least 4 mm of bone beyond the root apex, *(2)* the absence of acute signs of infection or inflammation in the treatment area, and *(3)* the absence of systemic pathologies that would contraindicate bone healing around implants.

In each patient, the intra-arch relationship was evaluated using diagnostic casts. Periapical and panoramic radiographs and computerized tomography scans were also obtained if necessary. Fifteen hopeless teeth in the 15 patients were selected for replacement by an implant to be placed immediately after extraction. Teeth with multiple roots were excluded from this study. After initial treatment planning procedures, all patients underwent scaling and received oral hygiene instructions and periodontal treatment as necessary to provide an oral environment more favorable to wound healing.

Immediately before surgery, the patients rinsed for 1 minute with chlorhexidine and were instructed to use this mouthwash twice daily for 4 weeks. Under local anesthesia (2% mepivacaine), the teeth were carefully removed and the sockets debrided. No flaps were raised, and no incisions were made. The implant sites were prepared with standard drills using the bony walls as a guide; no countersinking was carried out. After implant site preparation a periodontal probe was used to explore and estimate the integrity of the bony walls of the alveolus. The longest and widest possible implants were placed at the buccal-palatal level of bone crest without considering the bone height at the mesial and distal levels. All implants placed showed good primary stability.

Implant sites showing bone fenestrations, bone dehiscences, or peri-implant bone defects exceeding 2 mm were excluded from this study. In these cases, a standard GBR procedure with surgical flap elevation was followed.

All implants used had a microtextured surface (Premium; Sweden & Martina, Padova, Italy). Implant length ranged from 13 to 15 mm; diameter, from 3.75 to 5.0 mm.

After implant placement, the surgical sites were protected with a patch of benzyl ester of hyaluronic acid (Hyaff; TISSUEtech Laboratory, Abano Terme, Italy). Soft tissue edges were then sutured to protect the implant sites. Antibiotics (500 mg amoxicillin 4 times daily for 4 days), anti-inflammatory medication, and chlorhexidine mouthwash were prescribed for all patients. Removable prostheses were worn for the first 3 weeks only for esthetic reasons. Sutures were removed after 7 days. The patients were seen monthly for prophylaxis.

Implant placement according to tooth position is reported in Table 1. An individualized acrylic resin template was fabricated for each patient. Each template had vertical grooves at the levels of the mesial and distal papillae to obtain a consistent periodontal probe position and to guarantee radiographic reproducibility for the follow-up period. The second-stage surgical procedure was performed 6 months after the first procedure for all experimental sites. A minimal incision was made at the crestal level to remove the surgical screw and place a healing abutment. After varying intervals of time, all implants were restored with a single-crown prosthesis. All patients participated in a individually tailored recall schedule ranging from 2 to 4 months. The total follow-up period was 6 months from delivery of the definitive prosthetic restoration. A typical patient treatment can be seen in Figs 1 to 4.

The following clinical parameters were evaluated at the time of implant placement and at second-stage surgery:

- Presence or absence of implant mobility
- Level of mesial and distal papillae, measured as distance from the occlusal template to the most coronal point of the mesial and distal papillae (ie, the interproximal papilla [IP])
- Width of keratinized mucosa, measured at the buccal side
- Position of mucogingival junction in relation to the surrounding tissues
- Peri-implant radiolucency and marginal bone loss

To evaluate the last 2 parameters, a periapical radiographic examination was conducted using the individualized occlusal template. All measurements were obtained with a standardized periodontal probe and rounded up to the nearest millimeter. All measurements were made by a single examiner (AB). Clinical measurements were calculated for each patient by averaging the readings for each clinical parameter for implants for each patient, since the intrasubject variation was much lower than the intersubject variation. Subsequently, the means and medians were calculated from the means per patient for each clinical measurement.

Table 1 Implant Location According to Tooth Position

	Maxilla	Mandible	Total
Incisor	3	–	3
Canine	2	1	3
Premolar	5	4	9
Total	10	5	15

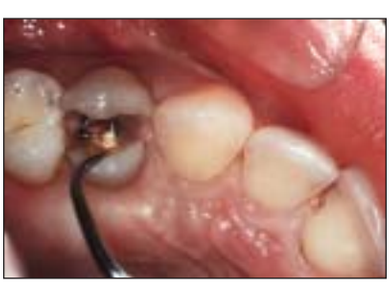

Fig 1a Preoperative occlusal view of a fractured maxillary first premolar.

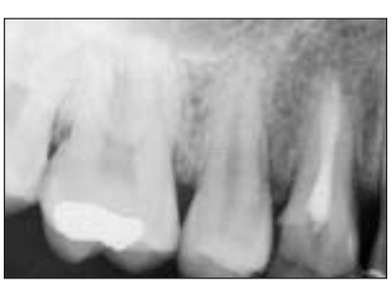

Fig 1b Preoperative periapical radiograph of the fractured maxillary first premolar.

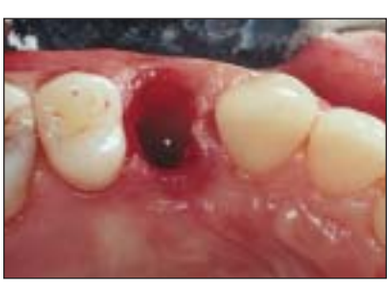

Fig 2 Fresh extraction site without flap reflection.

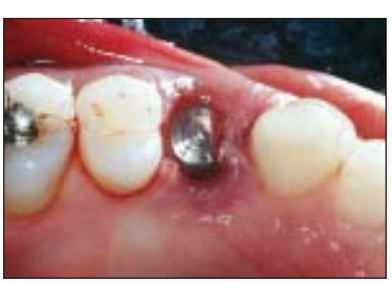

Fig 3a An implant is placed and primary stability achieved. No surgical flap was raised.

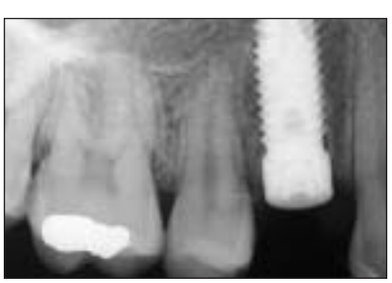

Fig 3b Periapical radiograph taken 6 months after implant placement.

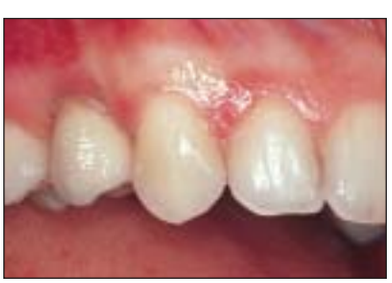

Fig 4 Final prosthetic restoration in place.

Table 2 Level (in mm) of Interproximal Papilla and Keratinized Tissue*

Examination	IP	WK
Baseline	6.24 ± 0.28	3.57 ± 0.26
Second-stage surgery	6.79 ± 0.30	3.54 ± 0.28

*For 15 immediate implants.
IP = mean distances from the reference template to the interproximal papilla; WK = mean width of the keratinized tissue at the buccal level from the gingival margin to the mucogingival junction.

RESULTS

The surgical implant site preparation and implant placement proceeded uneventfully. The use of the bony walls as a guide and the placement of a finger over the buccal mucosa prevented bone perforation during bone drilling. The postsurgical complaints from the patients were minimal; pain and swelling were the most frequently mentioned symptoms. The postsurgical healing period was uneventful for all patients. Soft tissue closure over the implant sites was achieved within 1 to 3 weeks of surgery for all sites. In 2 cases, exposure of the cover screw occurred late (3 to 4 months after implant placement), but no further treatment was needed. At second-stage surgery all implants were asymptomatic, immobile, and osseointegrated. No peri-implant bone defects were observed or detected by probing around the experimental implants. Four of 15 implants had excessive bone growth over the implant head. The excess bone was removed with a periodontal curette so that the healing abutments could be connected.

The soft tissue anatomy was clinically acceptable in all patients; additional mucogingival surgery to improve the soft tissue morphology was considered unnecessary. The mean distance from the template to the IP at implant placement and at second-stage surgery is reported in Table 2. All implant sites showed a slight apical displacement of the IP from the time of implant placement to the time of second-stage surgery. The mean displacement was 0.55 ± 0.24 mm, which demonstrates the preservation of the soft tissue level at the interproximal sites. The mucogingival junction did not show any change with respect to the adjacent teeth, and the width of keratinized mucosa was stable throughout the study.

The radiographic examination did not show any peri-implant radiolucency. All implants were deemed successful at 6 months after prosthetic rehabilitation on the basis of the clinical criteria of Albrektsson and associates.[14]

DISCUSSION

The present study was carried out with 15 patients, each of whom needed a single tooth to be extracted and replaced with an immediate implant. The purpose of this study was to evaluate the treatment outcome of implants placed immediately after tooth extraction without incisions and to observe the peri-implant soft tissue healing.

The placement of an implant immediately after tooth extraction could result in a defect between the implant surface and the surrounding bone walls. The use of barrier membranes with or without graft materials has been recommended to obtain bone regeneration and to prevent soft tissue growth at the bone-implant interface.[5,8,15] However, the use of barrier membranes may be associated with clinical complications such as bacterial colonization, infection, and impaired bone healing. Several authors have reported high rates of membrane exposure with immediate placement of implants in extraction sockets. Gelb[1] found that 39% of treated sites showed membrane exposure and required premature removal of the membrane. Becker and coworkers[8] had to remove 41% of membranes used because of premature oral exposure. Moreover, other authors[16] evaluating the effects of GBR procedures in experimental animals found the greatest bone gain in sites not protected by membranes. This was probably related to the reduced risk of oral exposure and the associated detrimental effects on bone healing. The need for barrier membranes should therefore be carefully evaluated. More recently, some authors[17] have demonstrated through a histologic analysis that implants placed immediately after extraction without any regenerative procedures could heal like implants placed in healed or mature bone. All peri-implant bone defects included in this histologic evaluation[17] were circumferential bone defects with a small discrepancy between the implant and the socket bone walls.

The complete soft tissue coverage of implants placed immediately after tooth extraction was considered an important criterion for clinical success.[18] Several surgical techniques have been proposed to obtain soft tissue closure. Unfortunately, none of the techniques published in the literature seems to be superior to the others. The techniques that employ coronal repositioning of the buccal flap could alter the level of the mucogingival junction, the vestibular depth, and the width of keratinized tissue and thereby require additional mucogingival surgery. Lateral repositioning of the buccal flap could potentially cause gingival recession at the level of donor sites. All techniques that involve the

rotation and/or the splitting of a palatal flap to achieve the soft tissue primary closure are considered time-consuming and sensitive and require gingival tissue to be at least 4 mm thick.[11]

In the present study, in which incisions and the displacement of flaps were avoided, osseointegration was achieved for all 15 implants with stability of the soft tissues. These results were determined based on clinical measurements such as width of keratinized tissue, level of mucogingival junction, and IP level. In the present study, the reproducibility and repeatability of clinical measurements were assured by the use of a single examiner and use of reference templates. These reference templates provided reproducible measuring sites.

The technique used in this study could be used in the presence of peri-implant bone defects capable of spontaneous healing, such as 4-wall bone defects with a bone-to-implant gap not exceeding 2 mm. Careful consideration should be given to the bone defects before placing an implant without incisions and flap elevation. In this study, a manual periodontal probe was invaluable in checking the residual sockets. The clinical findings from this and previous studies[11,12,17] showed that 100% of peri-implant bone defects with a bone-to-implant gap not exceeding 2 mm and without fenestration or dehiscence had complete bone healing without the application of any regenerative procedures. This finding suggests that the application of bone reconstructive procedures should be considered for bone defects wider than 2 mm.

Another interesting observation from this study was the excellent soft tissue healing around the immediate implants with a stable mucogingival junction with respect to the adjacent teeth, the stable width of keratinized tissue, and the preservation of IP. These clinical results reduced the need for further mucogingival surgery during prosthetic rehabilitation.

More extensive controlled and prospective clinical studies are needed to evaluate this clinical protocol.

REFERENCES

1. Gelb DA. Immediate implant surgery: Three years retrospective evaluation of 50 consecutive cases. Int J Oral Maxillofac Implants 1993;8:388–399.
2. Becker BE, Becker W, Ricci A, Geurs N. A prospective clinical trial of endosseous screw-shaped implants placed at the time of tooth extraction without augmentation. J Periodontol 1998;69:920–926.
3. 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.
4. Werbitt MJ, Goldberg PV. The immediate implant: Bone preservation and bone regeneration. Int J Periodontics Restorative Dent 1992;12:207–217.
5. Lazzara R. Immediate implant placement into extraction sites: Surgical and restoration advantages. Int J Periodontics Restorative Dent 1989;9:333–343.
6. Becker W, Becker BE, Polizzi G, Bergstrom C. Autogenous bone grafting of bone defects adjacent to implants placed into immediate extraction sockets in patients: A prospective study. Int J Periodontics Restorative Dent 1994;14:389–396.
7. Gher ME, Quintero G, Assad D, Monaco E, Richardson AE. Bone grafting and guided bone regeneration for immediate dental implants in humans. J Periodontol 1994;65:881–891.
8. Becker W, Dahlin C, Becker BE, et al. The use of e-PTFE barrier membranes for bone promotion around titanium implants placed into extraction sockets: A prospective multicenter study. Int J Oral Maxillofac Implants 1994;9:31–40.
9. Augthun M, Yildirim M, Spiekermann H, Biesterfeld S. Healing of bone defects in combination with immediate implants using the membrane technique. Int J Oral Maxillofac Implants 1995;10:421–428.
10. Wachtel HC, Langford A, Bernimoulin JP, Reichart P. Guided bone regeneration next to osseointegrated implants in humans. Int J Oral Maxillofac Implants 1991;6:127–135.
11. Nemcovsky CE, Artzi Z, Moses O. Rotated split palatal flap for tissue primary coverage over extraction sites with immediate implant placement. Description of the surgical procedure and clinical results. J Periodontol 1999;70:926–934.
12. Covani U, Cornellini R, Barone A. Bucco-lingual bone remodeling around implants placed into immediate extraction sockets: A case series. J Periodontol 2003;74:268–273.
13. Schwartz-Arad D, Chaushu G. Immediate implant placement: A procedure without incisions. J Periodontol 1998;69:743–750.
14. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants 1986;1:11–25.
15. Wilson TG, Schenk R, Buser D, Cochran D. Implants placed in immediate extraction sites: A report of histological and histometric analysis of human biopsies. Int J Oral Maxillofac Implants 1998;13:333–341.
16. Celletti R, Davarpanah M, Etienne D, et al. Guided tissue regeneration around dental implants in immediate exaction sockets: Comparision of e-PTFE and a new titanium membrane. Int J Periodontics Restorative Dent 1994;14:243–253.
17. Paolantonio M, Dolci M, Scarano A, et al. Immediate implantation in fresh extraction sockets. A controlled clinical and histological study in man. J Periodontol 2001;72:1560–1571.
18. Gher ME, Quintero G, Assad D, Monaco E, Richardson AE. Bone grafting and guided bone regeneration for immediate implants in humans. J Periodontol 1994;65:881–891.