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Clinical Paper
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Alveolar ridge preservation with a free gingival graft in the anterior maxilla: volumetric evaluation in a randomized clinical trial

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Abstract. The aim of this study was to evaluate and compare the dimensional changes in maxillary extraction sockets that have healed spontaneously and those treated with free gingival grafts. Ten subjects with at least two maxillary anterior teeth scheduled for extraction were selected for this study. Two maxillary teeth were allocated randomly to either the test group or the control group. In the test group, the extraction socket was covered with a free gingival graft harvested from the palate, while in the control group the sockets healed spontaneously. Cone beam computed tomography (CBCT) scans were taken on the day of extraction and at 3 months postoperative. Soft tissue healing of the extraction sockets was assessed visually by clinical inspection. Hard tissue measurements were obtained from the CBCT scans. After 3 months of healing, the control sockets had lost height in the buccal and lingual crestal bones (−1.03 and −0.56 mm, respectively); however, the height in the buccal and lingual crestal bones was preserved at the test sites (+0.06 and +0.25 mm, respectively). This difference between the two groups was statistically significant ($P < 0.05$). In contrast, both the control and test groups lost width in the buccal and lingual crestal bones; the difference between the control and test groups was not statistically significant ($P > 0.05$). The authors propose that covering the orifice of the extraction socket with a free gingival graft can result in preservation of the alveolar bone height.

Key words: Extraction socket healing; Alveolar ridge dimension; Socket preservation; Alveolar ridge preservation; Free gingival graft; Punch technique; Cone beam computed tomography.

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Alveolar ridge resorption is a complicated process that includes structural, functional, and physiological components. Periodontal disease, peri-apical pathologies, and mechanical trauma cause loss of the bone surrounding the teeth. Age, gender, systemic conditions, facial morphology, traumatic dental extractions, and functional stress on the extraction wound are also predisposing factors that affect alveolar bone loss following tooth extraction.[1]

The rate of alveolar ridge resorption following tooth removal is rapid in the first 6 months[2,3] and continues at a mean 0.5–1% a year for life.[4] Lekovic et al.[5] emphasized that 40% of alveolar bone height and 60% of alveolar bone width are lost within the first 6 months after tooth extraction. Schropp et al.[6] reported that approximately 50% of the original alveolar bone width is reduced within the first 12 months after tooth extraction, and two-thirds of this resorption occurs in the first 3 months. This resorption can significantly affect the position, angulation, and prognosis of a dental implant, as well as the hard and soft tissue aesthetics.

Alveolar ridge preservation techniques have recently been applied to eliminate or decrease bone loss after tooth extraction. Several studies have proposed various ridge preservation techniques, including the placement of mineralized or non-mineralized graft materials, the use of membranes or soft tissue grafts to cover the extraction socket entrance, immediate implant placement, buccal overbuilding, and tissue engineering techniques.[7] Demineralized bovine bone material has frequently been utilized as a graft material to preserve the alveolar ridge width and height. Although this has been shown to be effective for protecting bone volume, graft material residue has been observed in the socket even after 7–9 months.[8,9] In a recent study by Lindhe et al., the authors emphasized that the tissue modelling and remodelling process in the augmented sockets is delayed with the use of Bio-Oss Collagen.[10] Similar results have been presented in other studies in which different graft materials have been used to preserve ridge dimensions.[11,12] The free gingival graft has also been used for alveolar ridge preservation in animal and human studies. This graft is preferred as it eliminates the need to elevate a full thickness mucoperiosteal flap and compensates for soft tissue deficiencies when immediate implant placement or a socket augmentation procedure is required.[11,13–15] However, in some of the human studies that used the free gingival graft to cover the extraction socket, dimensional changes in the alveolar ridge were investigated using study casts or the master casts.[16,17]

The aim of this study was to determine the dimensional changes in the maxillary anterior extraction socket after 3 months of healing in humans, comparing sockets covered with a free gingival graft to those left to heal spontaneously using cone beam computed tomography (CBCT) scans. This study is reported in accordance with the CONSORT guidelines.

Table 1. Data for the patients included in the study.

Patient	Gender	Age, years	Total number and positions of extracted teeth	Control group	Test group
1	Male	36	3 (11, 12, 13)	12	13
2	Male	38	4 (11, 12, 21, 22)	22	12
3	Male	57	3 (11, 21, 13)	11	21
4	Female	48	2 (12, 21)	12	21
5	Female	46	4 (11, 21, 22, 23)	21	11
6	Female	39	2 (13, 23)	13	23
7	Female	48	2 (21, 11)	21	11
8	Male	40	4 (11, 12, 21, 22)	12	11
9	Female	55	4 (11, 12, 21, 22)	12	22
10	Male	60	3 (21, 22, 23)	21	23

Materials and methods

This split-mouth, unblinded, randomized controlled clinical study was performed in accordance with the Declaration of Helsinki and was approved by the institutional ethics committee. Written informed consent was obtained from all patients.

Study population

Ten adult patients (five females, five males) ranging in age from 36 to 60 years (mean 46.7 years) participated in this study between September 2011 and November 2012. Each patient had at least two maxillary anterior teeth that required extraction. Seven patients underwent multiple extractions in the anterior maxilla; the remaining three patients had two maxillary anterior teeth removed. However, only two extraction sockets per patient were included in the study. The 20 extraction sockets in these 10 patients were allocated randomly to one of two groups using a random number table: (1) a test group, in which the socket was covered with a free gingival graft and treated with the socket seal technique; (2) a control group, in which the extraction socket was allowed to heal spontaneously ($n = 10$ per group). The randomized codes were enclosed in sequentially sealed envelopes. Following the tooth extractions, the envelopes were opened and it was determined whether each extraction socket was to be used as a test site or control site.

Patient demographic data and information on the teeth included in this study are presented in Table 1. The indications for extraction were advanced periodontal disease and/or prosthetic reasons. Exclusion criteria were the presence of uncontrolled systemic disease, any systemic condition compromising wound healing, and acute periodontal and/or odontogenic infection.

Surgical procedure

All patients were treated with scaling and root planing prior to the study and demonstrated good oral hygiene and compliance. On the day of extraction, following the administration of local anaesthesia (Maxicaine; Vem Medicine, Turkey), the teeth were carefully extracted without the elevation of a mucoperiosteal flap or compromising the marginal gingiva (Fig. 1). Care was taken to perform an atraumatic extraction to protect the periosteum and alveolar bone. The sockets were curetted to remove granulation tissue. The extraction sockets were assigned randomly to be a control site or a test site.

In the control group, blood clots were allowed to form in the extraction socket and they were left to heal spontaneously. In the test group, the internal marginal gingiva of the extraction socket was de-epithelialized with a number 15 scalpel to encourage vascularization of the free gingival graft. A trephine bur with a diameter corresponding to that of the socket orifice was chosen. A free gingival graft of approximately 2–3 mm in thickness was cut from the palate with this selected trephine bur and gently dissected using a sharp periosteal elevator, in accordance with the technique of Jung et al.[18] (Fig. 2). The flap was adapted to the site and sutured to the marginal gingiva with six to eight interrupted sutures (4–0 Vicryl; Ethicon, Johnson & Johnson, USA). The donor site was covered with a Xeroform sponge to allow for secondary healing (Fig. 3).

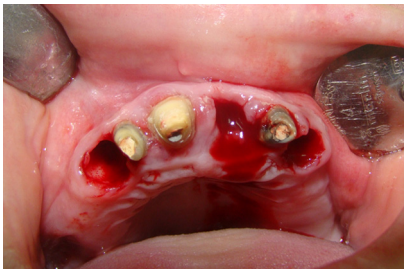

Fig. 1. Intraoral appearance following tooth extractions.