Posttraumatic Use of Dental Implants Immediately After Tooth Extraction: Clinical Study

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Purpose: Root fracture is a combined injury of cementum, dentin, and pulp. Many of these traumas remain untreated, mistreated, or over-treated. It leads to a more complicated treatment in case of tooth loss. Many different treatment procedures, with a very changeable success rate, have been proposed for years to treat teeth with root fractures. The objective of the following clinical studies was to evaluate the clinical effectiveness of implants placed in fresh extraction sites to treat teeth with horizontal root fracture.

Methods: The study group included 25 patients (15 men and 10 women) between the ages of 20 and 65 years. After an initial examination and a treatment planning, all of the patients underwent periodontal treatment, which was deemed necessary to favor wound healing.

All the 25 teeth were extracted because of horizontal root fracture located at the level of the middle third. The second-stage surgery was performed 6 months after the initial procedure. The following clinical parameters, presence or absence of mobility, presence or absence of pain, and presence or absence of suppuration, were evaluated in each patient at 6 and 12 months after implant placement. Radiographs were taken using the standard method to evaluate the marginal bone loss.

Results: The healing period was uneventful for all patients. All implants had osseointegrated. After 12 months, patients were asymptomatic and showed no signs of infection or bleeding when probed.

Conclusions: On the basis of this study, implants placed right after tooth extraction are a valid treatment procedure, which induces predictable results as treatment of fractured teeth.

Key Words: Immediate implants, horizontal root fracture, osseointegration

In the last decade, advances in implant surface technology and continuous clinical research have provided the clinicians with innovative and efficient operative protocols to properly treat more and more demanding clinical situations.1 Some of the original prerequisites of osseointegration have been rediscussed to satisfy the increasing patients' demand for reduced treatment time, improve aesthetic treatment outcomes, and increase comfort during healing.2

The placement of implants immediately after tooth extraction has proven to be a predictable treatment strategy with a very high success rate.3–12 Immediate implant placement has several advantages, such as reduction of the number of surgical treatments and reduction of the time between the tooth extraction and the placement of the definitive prosthesis.4

Most of these traumas remain untreated, mistreated, or over-treated, leading to a more complicated treatment in case of tooth loss.5 Nowadays, there are several methods to treat severely injured teeth, but the long-term success rates obtained with these operative protocols are still low, and those teeth often need later extraction.6–10 Ozbek11 suggested a conservative treatment of root fractures below the alveolar crest; Pilleggi and Dumsha12 suggested root fractures can heal spontaneously, if immediately treated with an adequate therapy; Ferrari et al13 pointed out that the prognosis of a root fracture is strictly connected to its location and in particular if close to the gingival sulcus. On the basis of these considerations, it has been recently observed that the use of an immediate implant could be a valid treatment procedure for the replacement of traumatized teeth. The aim of the present clinical study has been to evaluate the clinical effectiveness of implants placed in fresh extraction sites to treat teeth with horizontal root fracture.

PATIENTS AND METHODS

Twenty-five patients (15 men and 10 women) aged 20 to 65 years were referred to academic and private practices of the authors between 2006 and 2012 and included in this study. All the patients were scheduled for at least 1 single-rooted tooth extraction and an immediate implant placement. Inclusion criteria for the study were as follows: indication for a tooth extraction (intra-alveolar root fracture located at the level of the middle third), presence of at least 4 mm of bone beyond the root apex, absence of acute signs of infection or inflammation in the treatment area, and absence of systemic pathologies that would contraindicate bone healing around implants. No tobacco abuse (maximum 10 cigarettes per day) and no alcohol or drug dependency were accepted. All patients admitted into the study group were required to sign a standard model of informed consent to treatment. Each case was carefully evaluated by analyzing diagnostic casts for intra-arch and interarch relationship. Periapical and panoramic radiographs (Fig. 1) were taken as well as computed tomography scans if needed. All the selected clinical cases required tooth extraction because of a horizontal fracture. Chlorhexidine mouthwash was used immediately before surgery.

Every tooth extraction was performed with extreme care to preserve the alveolar bone integrity (Fig. 2) by using thin syndesmome, and the implant was placed with a flapless technique.14

When an atraumatic technique was not possible during the extraction, a mucoperiosteal flap elevation was applied by performing intrasulcular and vertical incisions extended over the mucogingival...
juncture. The implant site was prepared with standard drills under copious saline irrigation. The longest possible implants were placed at the buccal/palatal level of the bone crest without considering the bone height at the mesial and distal level (Fig. 3). All the implants placed showed very good primary implant stability. Twenty-four implants were placed in the maxilla and 1 in the mandible; all the implants used had a microtextured implant surface (Premium; Sweden & Martina, Padova, Italy). Implant length ranged from 13 to 15 mm with 3.75- to 5-mm diameter. All of the implants showed clinical primary stability. After implant placement, the peri-implant bone defect that had occurred between bone walls and implant surface was characterized by absence of fenestration or dehiscence. Therefore, no augmentation procedures were performed. In case of flap elevation, the flap was replaced in the original position and sutured with interrupted sutures around a healing screw as proposed by Lang et al.15 Antibiotics (amoxicillin 500 mg 4 times daily for 4 days), anti-inflammatory agents (100 mg nimesulide 2 times per day for 4 days), and chlorhexidine mouthwash were prescribed during the postoperative period. A removable prosthesis was worn during the healing process only for aesthetic reasons. During the healing process, patients underwent scaling, oral hygiene instructions, and periodontal treatment if needed, to provide an oral environment, which would be more favorable to wound healing. The temporary prosthesis was healing-screw bearing with occlusal rests and was relined with soft lining material. Sutures were removed after 7 days. An individualized occlusal template was made to guarantee radiographic reproducibility for the follow-up period. Patients were followed up monthly.

The final follow-up was at 12 months. The following clinical and radiographic parameters: presence or absence of mobility, presence or absence of pain, presence or absence of suppuration, were evaluated for each patient at 6 and 12 months after surgery. The radiographic technique used was the parallel cone, which allows a minimal distortion of images. Radiographs were taken using an individualized occlusal stent to evaluate the presence of peri-implant radiolucencies and marginal bone loss. An implant was considered a success when it fulfilled the criteria defined by Albrektsson et al.16

RESULTS

The surgical protocol, which combines the extraction of a fractured tooth and the placement of immediate implants, proceeded smoothly. All the patients included in the current study were followed up carefully during 12 months. They were followed up weekly during the first postoperative month and monthly during the rest of the follow-up period.

The postsurgical healing phase was uneventful for all patients. Pain and swelling were the most frequently mentioned complaints. At the time of definitive prosthesis placement, no signs of infection or bleeding were detected, and no pockets were found (Figs. 4 and 5). Periapical radiographs were taken just after the implant placement and at the end of the follow-up period. The total mean distance from implant shoulder to bone crest at baseline was 0.3 mm. At 6 months after placement, the mean value was 0.5 mm (Table 1). There was no fracture of abutments and/or loss of prosthetic screws. No prostheses needed to be replaced. The only prosthetic complication that occurred (regarding 2 implants) was the loss of the screws that connected the
abutment to the implant. The implants were deemed successful at 6 months following prosthetic rehabilitation, according to clinical criteria suggested by Albrightsson et al.16

### DISCUSSION

The reliability of dental implants has greatly improved in the last 20 years, providing clinicians with new therapeutic devices for dental rehabilitation that previously were considered unrealistic. Nowadays, implants placement right after tooth extraction has proven to be a predictable treatment strategy with a very high success rate, and they present the first therapeutic option in the case of a single untreated tooth.1,3 All the implants placed in this study were clinically stable and asymptomatic and did not show any significant bone defects at the end of the follow-up period. The definitive prosthetic restoration took place 4 to 6 months after the first surgery. The current study concentrated on patients with single tooth loss, which made prosthetic rehabilitation easier. Immediate implant placed in fresh extraction sockets could result in a defect between the implant surface and the surrounding bone walls. When the gap between alveolar bone and implant is bigger than 2 mm, the use of barrier membranes is recommended to obtain bone regeneration and to prevent soft tissue growth at the bone implant interface. However, there are several clinical complications that might occur using barrier membranes, such as bacterial colonization, which can lead to an infection and even to implant failure. Several authors have reported high rates of membranes exposure with implants placed immediately after tooth extraction.1,18 Kohal et al18 found a very high frequency of membrane exposure during the healing period. The researchers assumed that in the sites with exposed membranes, the amount of regenerated bone was less than that in the sites with retained membrane.

The use of barrier membranes should be therefore carefully evaluated. In their study on immediate implants, Covani et al19 reported a low frequency of complications during the healing period and a very high survival rate without using barrier membranes.20 On the basis of these findings, grafting material and/or barrier membranes were not used in the current study, showing that small circumferential defects could heal spontaneously. Therefore, within the limits of the study, our clinical results totally agree with those previously reported by the same authors, thus supporting the hypothesis that implant primary stability, integrity of bone walls, maintenance of a firm blood clot, and primary flap closure are sufficient factors to induce spontaneous bone healing in circumferential peri-implant bone defects of less than 2 mm.21 The pattern of bone rearrangement could be induced by new bone apposition to fill the peri-implant defect and, at the same time, by buccal and lingual bone resorption, leading to a width reduction of the alveolar ridge.22

### CONCLUSIONS

Implant placement in fresh extraction site has proved to be a valid treatment procedure. It induces predictable results in fractured untreated teeth treatment. Moreover, our results seem to suggest that implants placed in fresh extraction sockets, delimiting small circumferential defects not more than 2 mm, could heal with good predictability without any regenerative procedures. No clinical parameters were used to evaluate the stability and health of soft tissues. However, at the end of the follow-up period, none of the patients showed a negative aesthetic outcome. Additional more extensive, long-term, and well-matched studies are needed to support our hypothesis and to suggest this technique as a routine in the treatment of untreated intra-alveolar root fracture located at the level of the middle third.

### REFERENCES

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### TABLE 1. Mean (SD) Vertical Distance (Marginal Bone Loss) Between Implant Shoulder and Marginal Bone Crest at Baseline and 6 Months Later

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