Immediate Implant Placement in Single-Tooth Molar Extraction Sockets: A 1- to 6-Year Retrospective Clinical Study

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The aim of this study was to investigate the survival rate of implants immediately placed in fresh extraction sockets of molars in the maxilla and mandible with a single-stage procedure. A total of 102 patients were treated, and 107 implants (53 in the maxilla and 54 in the mandible) were placed in a fresh molar extraction socket and connected to a healing abutment. After a mean follow-up of 3 years (range: 1 to 6 years) 1 implant failed, for a cumulative success rate of 99.06% (98.11% for the mandible and 100% for the maxilla). The results of this study support placement of an implant immediately after the extraction of a molar, applying a single-stage procedure. Int J Periodontics Restorative Dent 2018;38:495–501. doi: 10.11607/prd.3179

The use of dental implants to replace single teeth has been well documented and shows high survival rates and predictable results. The protocol for the standard staged approach recommends 2 to 3 months of alveolar ridge healing after the extraction prior to implant insertion; this results in an increased treatment time and more discomfort for the patient.1 The immediate extraction placement procedure provides similar results with minimal discomfort and shorter treatment time.2

One criterion for the success of immediate placement is the possibility of achieving primary stability. The clinical application was initially limited to anterior teeth. The shape of the alveolus of a single-rooted tooth allows the conical implant to engage the alveolar walls, leading to good adaptation.3,4 Immediate replacement of an anterior tooth has the main advantages of maintaining the soft tissue architecture and reducing volumetric tissue changes due to postextraction alveolar bone resorption, thus fulfilling the patient’s esthetic expectation.5–7 In recent years, immediate placement has been extended to molar sites to maintain the tissue morphology, reducing the invasiveness, discomfort, and treatment time.6 In addition, immediate implant placement in fresh extraction sockets may limit the extent of bone remodeling and
reduce the need for augmentation procedures. Adequate primary stability during implant insertion in single-rooted fresh extraction sites can be achieved by selecting an implant of an appropriate diameter and length to engage the alveolar walls or extending the osteotomy preparation to the bone beyond the apex of the tooth.

Achieving optimal primary stability in fresh molar extraction sites represents a more difficult challenge for the operator because of the morphology of the molar alveoli and because it usually is not possible to extend the site preparation beyond the root apices due to the presence of anatomical structures such as the inferior alveolar canal in the mandible or the sinus floor in the maxilla. To achieve primary stability in a molar site, it is crucial to maintain the integrity of the interradicular bone septum. Thus, a gentle extraction, separating the roots, and an atraumatic site preparation to the bone beyond the apex of the tooth is necessary.

The aim of this retrospective clinical study is to evaluate the survival rates of implants placed in fresh molar extraction sockets, preparing the osteotomy with the use of a combined piezoelectric osteotomes/drills sequence and immediately inserting a healing abutment in a single-stage procedure.

Materials and Methods

Between January 2009 and June 2015, patients needing extraction and replacement of a single mandibular or maxillary first or second molar were consecutively recruited to participate in this prospective clinical study. Reasons for extraction included decay, fracture, or endodontic failure. All included teeth had to be in good periodontal condition. Smoking was not considered a contraindication to surgery; or presence of any pathology involving the adjacent teeth.

All subjects were thoroughly informed about the risks associated with the procedure and signed a consent form. A complete intraoral examination was given to each patient, impressions were taken, and study casts were mounted on an articulator. Computed tomographic (CT) or cone-beam CT scans were obtained and used for preoperative three-dimensional analysis of the alveolar site. Based on the obtained information, diagnostic wax-ups were made and surgical templates were fabricated.

Antibiotic prophylaxis (1 g amoxicillin twice a day for 6 days) was started 24 hours before surgery. Local anesthesia was induced with articaine 4% with adrenaline 1:100,000 in the vestibular and lingual area. No flap was raised at any of the sites, and each tooth was extracted atraumatically using a diamond burr and designing an odontotomy to separate the roots, taking care to preserve the interradicular septum and all the alveolar walls. After roots extraction, thorough debridement of the alveolus was carried out with an alveolar curette. The osteotomy preparation was performed using piezosurgical tips up to 3 mm diameter and thereafter the standard drilling sequence following the implant manufacturer’s protocol, using conical drills for the mandible and osteotomes for the maxilla. To achieve high insertion torque (> 50 Ncm) and improve the primary stability, the osteotomes were undersized using a final drill or osteotome of the same diameter as the implant but one size shorter than the implant length. The implants used in the study were 5 mm in diameter tapered implants with lengths of 10, 11.5, and 13 mm (Biomet 3i) (Fig 1).

All implants were inserted using a motor unit, and the final seating was obtained with a calibrated torque hand ratchet (Biomet 3i) to evaluate and record the final insertion torque value. In all the cases where a buccal gap was present between the implant and the buccal wall, a collagen
sponge (Gingistat, Gaba) was inserted to fill the void. Horizontal mattress sutures were used to stabilize the collagen sponges.

For all the implants, a healing abutment with a 4-mm platform (platform switching) and expanded to a 6.0- or 7.5-mm-wide body (EP One-Piece, Biomet 3i) were used. The healing abutment screw was immediately inserted and torqued to 10 Ncm using a calibrated hand torque driver.

After the surgery, patients were instructed to consume a liquid diet for the first week and to refrain from chewing at the implant site for the following 6 to 8 weeks. They also were instructed to use a 0.20% chlorhexidine mouthrinse three times a day. Patients were recalled for follow-up visit at 1-week intervals for the first month and once a month thereafter for the first 3 months.

Prosthetic Procedure

A final impression was made 4 to 6 months after implant placement using a custom tray, a pick-up coping (Biomet 3i), and low-viscosity polyether impression material (Impregum Penta, 3M ESPE). Definitive gold universal clearance limited abutments (Biomet 3i) were connected to all the implants. All the definitive restorations were screw-retained. Once inserted, the gold screw abutment was torqued to 20 Ncm for internal connection implants and 32 Ncm for external connection implants, using a calibrated torque driver as recommended by the manufacturer.

Patients were recalled every 6 months thereafter to monitor the implant condition. At each recall appointment, periapical radiographs were taken to detect any bone loss. Implants were considered well integrated if no mobility was present and < 3 mm of bone loss was detected. They were considered healthy if no signs or symptoms of inflammation were present. Restorations were considered successful if < 1 mm of recession developed.

Figures 2 and 3 demonstrate two typical treatments administered to the study subjects in a maxillary and a mandibular case.

Results

A total of 102 patients (50 men and 52 women) participated in the study. Of these, 62 were nonsmokers and 40 were smokers. They required replacement of a total of 107 molars, 59 of which presented with periapical lesions. In 99 patients, one site required extraction, 2 patients had two sites, and 1 patient had three. None of the study sites were adjacent.

The implant distribution was as follows: 53 in the maxilla (41 first molars; 12 second molars) and 54 in the mandible (49 first molars; 5 second molars). Implant distribution by site is shown in Fig 4. Implant distribution by diameter and length is shown in Fig 1. Table 1 presents the insertion torque values recorded for all the implants placed.

The mean follow-up time was 3 years (range: 1 to 6 years): 20 implants with a 1-year follow-up; 70 with a 2- to 5-year follow-up; and 17 with more than 5 years of follow-up. During that time, 1 implant failed in the mandible (4 weeks after placement) for a cumulative success rate of 99.06%. The failed implant was removed and replaced 3 months later, and the replaced implant subsequently osseointegrated.

Discussion

Immediate implant placement in fresh extraction sockets represents a diffused approach to reduce the duration and invasiveness of the implant therapy. Immediate provisionalization, initially used for full-arch implant rehabilitation, has since been applied with highly predictable results for the replacement of a single tooth in the esthetic area showing survival rates comparable to a standard staged approach.

While many studies showed favorable implant survival rates in the immediate replacement of a single-rooted tooth, a reduced survival rate was observed in the posterior area. These results are negatively affected by anatomical limitations, such as poor bone quality.
and the presence of anatomical structures such as the maxillary sinus or the mandibular canal that reduce the amount of bone apical to the roots to engage with the implant. Biomechanical condition also appears to be unfavorable in the posterior area. The presence of the highest peak of forces during chewing and the discrepancy between the diameter of the crown occlusal table and the implant diameter can also result in an off-axis force, creating a buccolingual and distomesial cantilever effect.\textsuperscript{21}

In 2008, Fugazzotto\textsuperscript{10} reported placing a total of 341 implants in mandibular molar sites to replace

Fig 2 Case involving a hopeless maxillary molar. (a) Presurgical occlusal view. (b) Occlusal view after extraction. (c) Osteotomy preparation with Piezosurgery. (d) Osteotomy enlargement with osteotomes. (e) Occlusal view of the osteotomy. (f) Implant inserted. (g) Collagen sponges to fill up the alveolar gap. (h) Postoperative radiograph. (i) Buccal view at 5 years of follow-up. (j) Radiograph at 5 years of follow-up.
hopeless teeth. After raising a flap, tooth hemisection and single-root atraumatic extraction were performed. The implant was placed in the interradicular septum. Implants were followed in function for 72 months (mean time of 30.8 months), showing high survival rates (99.1%) and a high predictably of the technique if the protocol was strictly followed.

The author conducted a similar study on the replacement of single maxillary molars and obtained comparable survival rates (99.5%).

Peñarrocha-Diago et al., in a 2012 study, compared the survival rates of 542 implants placed in mature bone with 480 implants placed in fresh extraction sockets and found similar implant survival values. In this study, the survival rates were 99.5% and 99.1%, respectively.
study, a statistically lower survival rate was found for implants immediately inserted in the posterior maxilla.18

It has been demonstrated an optimal primary stability at the time of implant insertion that can reduce the risk of micromovements at the implant-bone interface.22 The insertion torque value is one of the main parameters to easily evaluate implant primary fixation. In 2005, Ottoni et al23 evaluated the relationship between single-tooth implant survival and placement torque. In this study, a low insertion torque value was associated with high risk potential for biomechanical failures of immediately inserted implants. Khayat et al,24 in a 2013 study, showed that high insertion torque (up to 176 Ncm) can avoid the risks of implant failure, maintaining similar marginal bone resorption with the implant inserted with a lower torque.

A human histologic study demonstrated that high insertion torque for an immediately loaded implant in the molar area does not negatively interfere with osseointegration, ensuring an optimal primary stability and contributing to successful osseointegration with high bone-to-implant contact and without disturbance of the local bone microcirculation early in healing.25

Several studies have demonstrated that maintaining the periostium attached to the crestal bone can dramatically reduce bone resorption after tooth extraction.26 The use of a flapless technique allows reduction in discomfort for patients, surgical steps needed, and treatment time, allowing for immediate conditioning of the soft tissue and development of the correct profile during the first phase of healing.27

In molar extraction sites, achieving primary stability at implant insertion is challenging due to the shape of the alveolus and the presence of the anatomical structures beyond the apex of the molar.28 In most cases, the interradicular septum represents the ideal area for an optimal implant position.10,20 Drilling the osteotomies directly through the teeth’s initially retained root complexes could help with precise positioning and angulation of the implant bed preparation, enabling ideal implant positioning during immediate placement at multirooted extraction sites.29

A classification of the surgical sites for immediate implant insertion in the molar area was presented by Smith and Tarnow in 2013.28 In this study, a surgical protocol was proposed based on socket classification. Primary stability and presence of the buccal plate are required when immediate implant placement is planned; otherwise, a delayed approach is recommended.10

Sometimes hopeless molars present with periapical lesions, which have been considered a contraindication to immediate implant placement due to possible implant contamination.30 Several recent studies have shown that implants can be immediately placed in infected sites with predictable results if proper decontamination of the site has been performed.31 Blus et al,32 in a 2015 study, showed that the survival rates of immediate implants placed in infected and non-infected fresh extraction sockets were not influenced by the presence of an acute or chronic infection. In this study, the osteotomy was performed with a Piezosurgery device simultaneously accomplishing an atraumatic extraction and a bactericidal effect on the cavitation.

Piezoelectric devices were developed in response to the need for greater precision and safety of use and were applied in oral surgery to design the lateral window for the sinus lift and for the osteotomy in the split-crest technique.12,33 More recently, new piezoeurgical tips have been introduced for preparation of the implant osteotomy.11 The main advantages are the ability to obtain a precise osteotomy and reduced risk of damage to critical anatomical structures.34

Conclusions

Immediate placement of implants in molar extraction sites may be a viable alternative to the conventional staged protocol. However, several clinical parameters must be considered if this treatment option is to succeed. Along with careful case selection, the surgical and prosthetic protocols must be closely followed. Additional studies with larger sample size are needed for further validation.

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References


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