Immediate Placement of Ultrawide-Diameter Implants in Molar Sockets: Description of a Recommended Technique

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Immediate implant placement is performed less frequently in molar extraction sockets than in single root sockets. This is mainly due to the tripodal anatomical configuration of molar roots, which is perceived as complex and therefore unsuitable. The mechanical burden of molar sites, combined with much larger socket dimensions, make it amenable to the use of ultrawide-diameter dental implants. This article describes a practical, sequenced technique that can be used predictably for immediate implant placement in maxillary and mandibular first molar sockets, using a dry skull model for clarification. This detailed description is based on the experience of more than 580 clinical cases over a 10-year period.
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Although it may have been controversial in the past, immediate implant placement into extraction sockets has become a generally accepted treatment approach. This protocol probably has its origin in the anterior socket region, where the need for immediate tooth replacement has always been esthetically driven.[1] The added advantages of a single surgical procedure, control over bone and soft tissue volume, and shortened treatment times are now well recognized.[2,3] Studies have demonstrated excellent short-term treatment outcomes in relation to implant survival, as well as limited soft and hard tissue variations in the esthetic zone.[4] Studies comparing immediate and delayed implant placement found no differences between the two treatment approaches in terms of implant survival.[5–7] However, some studies have reported significantly less bone loss when implants were placed immediately after tooth removal.[6,8]

Primary stability is essential for successful immediate implant placement,[9] but achieving primary stability in molar extraction sockets is more challenging due to the complex anatomy of the alveolar socket, larger socket voids, and presence of the maxillary sinus or inferior alveolar nerve.[10] Primary stability can be achieved when placing a conventional implant in one of the three molar root sockets, but this could lead to significant prosthetic and maintenance complications due to a compromised emergence profile, noncentric loading of the implant, and the cantilever effect that is inevitably created.[11,12]

Placing the implant into the interradicular septum could idealize the prosthetic design and improve the long-term maintenance possibilities, but engaging the septum of the socket can lead to inaccurate implant site preparation.[13] Placing a regular-diameter implant into the septum may require a bone substitute to augment the residual socket spaces.[14]

An ultrawide-diameter implant (UWDI) could be used to overcome these obstacles and achieve accurate implant placement in molar sockets. Immediately placed wide-diameter implants have demonstrated excellent outcomes under immediate and delayed loading conditions,[15,16] but according to a recent systematic review UWDIs demonstrate an increased risk for complications and implant failures.[17] This may be due to challenging site preparation and implant insertion factors that could compromise the integrity of the buccal bone wall. Surgical experience and technical skill must be combined with a sequenced surgical protocol to achieve predictable success in these cases.

The aim of this study is to demonstrate a surgical protocol for the predictable use of UWDIs in molar extraction sockets. Two examples (Figs 1 and 4) are discussed to demonstrate this concept.

Mandibular Technique

Mandibular Left First Molar

A dry skull was used to maximize the demonstration detail of this technique, and a mandibular left first molar was selected as an example (Figs 1 to 3). A clear clinical and radiographic assessment of the molar planned for replacement is essential (Fig 1a).

Periodontal biotype selection is an important consideration and is based on recommendations described by De Rouck et al.[18] Thin periodontal biotypes were generally excluded in clinical case selections.

The tooth was carefully loosened with conventional molar extraction forceps but without attempting to remove it from the socket. Rotational movements were combined with moderate apical pressure. Once minimal mobilization of the roots was accomplished, the tooth was decoronized at the cervical level using a carbide burr in a high-speed handpiece (Fig 1b).

Site preparation was initiated by drilling a pilot hole through the base of the pulp chamber and into the interradicular bone septum (Figs 1c, 1d, 2b, and 3b). The pilot hole was intentionally positioned slightly to the lingual side of the buccolingual dimension (Fig 1d) to ensure that the final implant position would not engage the inner aspect of the buccal socket wall. Preparation depth is established from the outset according to planning based on the preoperative radiograph (Figs 1a and 1c). The preparation was incrementally widened using a sequence of tapered drills up to 5 to 6 mm in diameter. The roots were then separated and removed by mobilization into the central drilling void that was created (Fig 1e). This technique ensures that no further bone is removed to facilitate extraction. Elevation of the roots was accomplished using fine pointed elevators. The bony socket was inspected to confirm that the bony walls were sufficiently intact and to ensure the absence of residual pathology or fenestrations (Fig 1e). The sockets were then carefully debrided as necessary.

The osteotomy was finalized with specially designed wide-diameter drills and taps to the required width of the planned implant. A custom-designed osteotome was placed into the osteotomy site, and a periapical radiograph was taken to verify the position and depth of the osteotomy preparation (Fig 3c). To accommodate bone remodeling postextraction, the depth of the implant preparation site must allow the implant to be seated 2 mm below the margin of the most apical bony crest, commonly the buccal bone crest (Fig 1g).

In this example, an UWDI (MAX Implant, Southern Implants) 7 mm in diameter and 9 mm in length was placed. Care was taken to ensure that the implant shoulder was seated 2 mm below the margin of the most apical bony crest and at least 2 to 3 mm away from the inner aspect of the buccal socket wall (Figs 1f to 1i).

A wide-profile healing abutment was connected to the implant, and any residual space between

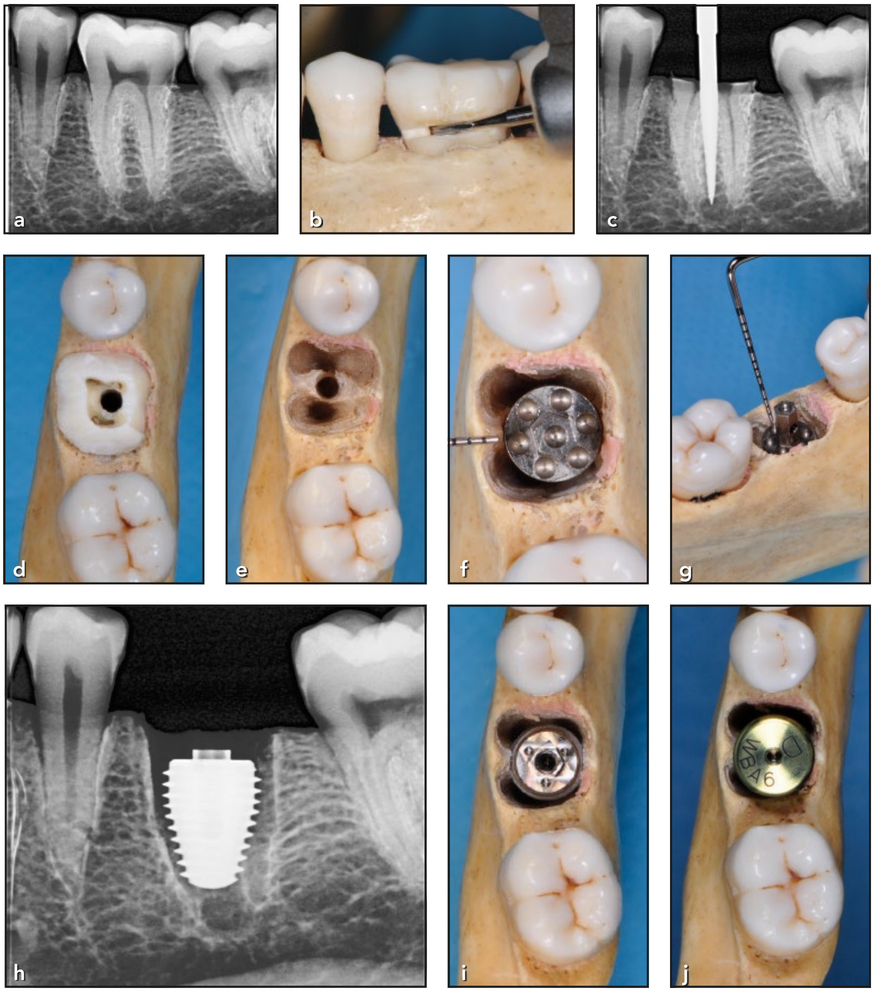

Fig 1 (a) *Mandibular left first molar to be removed.* (b) *Coronectomy at cervical level.* (c) *Pilot hole preparation through pulpal floor of tooth to correct depth.* (d) *Clinical view of pilot hole preparation—offset to the lingual side.* (e) *Pilot hole in interradicular septum following root removal.* (f) *Clinical verification of 2 mm distance from buccal wall using profile gauge.* (g) *Clinical verification of 2 mm depth from lowest point of buccal wall using profile gauge.* (h) *Radiographic view of implant in situ.* (i) *Clinical view of ideal implant positioning.* (j) *Wide-diameter healing abutment connected to implant.*

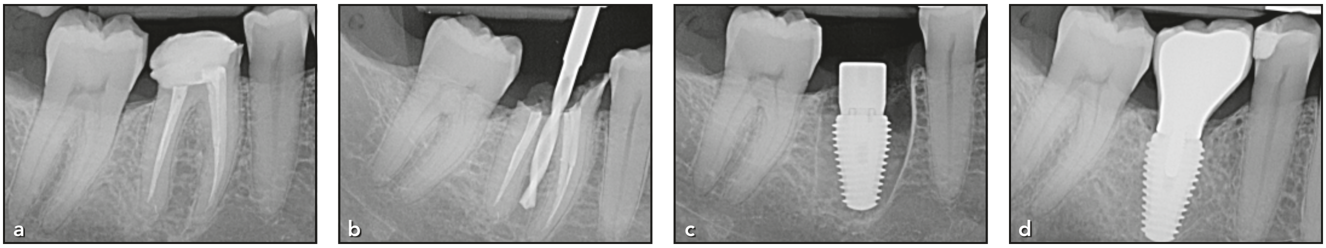

Fig 2 *Clinical case 1.* (a) *Mandibular right first molar to be removed.* (b) *Pilot hole preparation through pulp chamber of tooth.* (c) *Radiographic view of implant in situ on day of surgery.* (d) *Restored implant 4 years later.*

the healing abutment and the soft tissue margin was carefully closed with hemostatic collagen (Fig 1j). The collagen was placed only at abutment level, and no attempts were made to fill any bony voids with grafting materials. Sutures were used to adapt the soft tissue around the healing abutment and eliminate voids.

Patients were instructed not to rinse/swish for a week and were given a course of antibiotics, analgesics (paracetamol/ibuprofen), and chlorhexidine mouthrinse (only to be held over the surgical area from the third day postoperative, twice a day). Mechanical cleaning of the surgical site was discouraged.

Patients were seen 2 weeks after the surgical procedure. Reverse torque testing was carried out to 32 Ncm after 4 months of integration. Impressions were taken, and an all-ceramic screw-retained molar crown was connected to the implant 2 weeks later (Figs 3d and 5d).

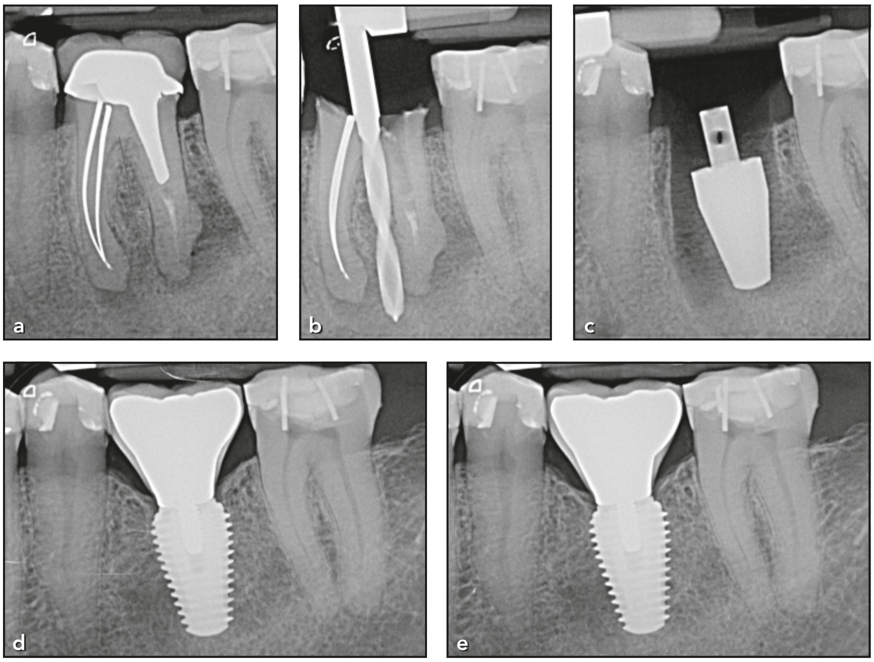

Fig 3 *Clinical case 2.* (a) *Mandibular left first molar to be removed.* (b) *Pilot hole preparation through pulpal floor to correct depth.* (c) *Radiographic assessment of preparation using using an osteotome of a corresponding size as a profile gauge.* (d) *Restored implant at 4 months.* (e) *Restored implant 3 years later.*

Maxillary Technique

Maxillary Right First Molar

A dry skull was used to maximize the demonstration detail of this technique, and a maxillary first molar was selected as an example (Figs 4 to 6). The same principles apply to the initial sequence of the technique as that described for mandibular first molars.

Coronectomy at the cervical level (Fig 4b) was followed by osteotomy preparation. Initial site preparation was performed according to the aforementioned protocol (Figs 4b to 4d). The pilot hole for the osteotomy was placed slightly toward the mesial aspect of the site to avoid proximity of the UWDI to the mesial root surface of the second molar (Figs 4b and 4d). The roots were similarly separated and elevated to the center of the drill site. The implant site was finalized with a dedicated wide-diameter tap. After confirmation of preparation depth and position, an UWDI (MAX Implant, Southern Implants) 7 mm in diameter and 11 mm in length

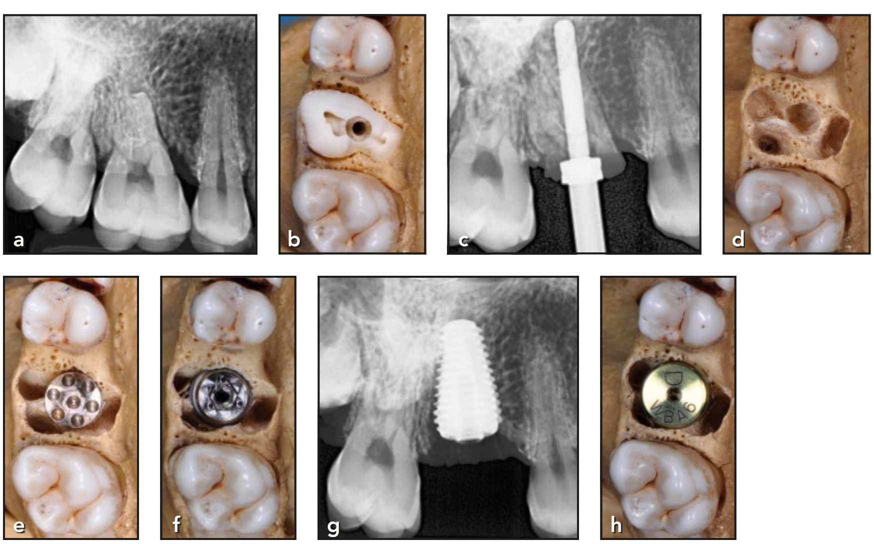

Fig 4 (a) *Radiograph of maxillary right first molar to be removed.* (b) *Pilot hole preparation through pulpal floor of tooth, often directed toward the mesial aspect if there is more bone between the first molar and second premolar than between the first and second molars.* (c) *Radiographic verification of pilot hole position.* (d) *Pilot hole in interradicular septum following removal of roots.* (e) *Clinical verification of 2 mm distance from buccal wall and 2 mm depth from lowest point of buccal wall.* (f) *Clinical view of ideal implant positioning.* (g) *Radiographic view of implant in situ.* (h) *Wide-diameter healing abutment connected to implant.*

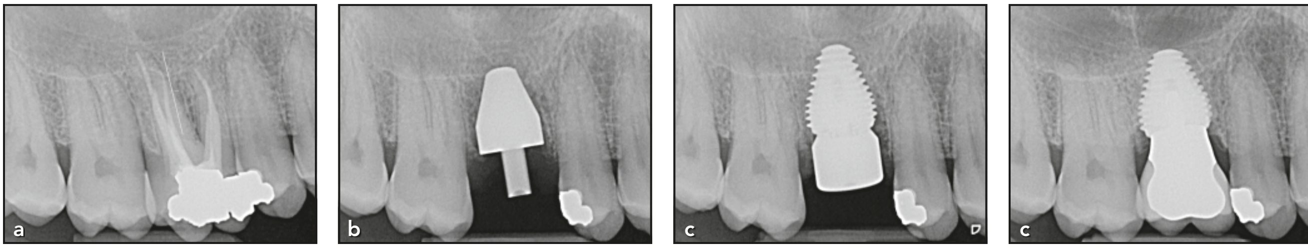

Fig 5 *Clinical case 3.* (a) *Maxillary right first molar to be removed.* (b) *Radiographic assessment of preparation using an osteotome of a corresponding size as a profile gauge.* (c) *Radiographic view of implant in situ on day of surgery.* (d) *Restored implant 4 years later.*

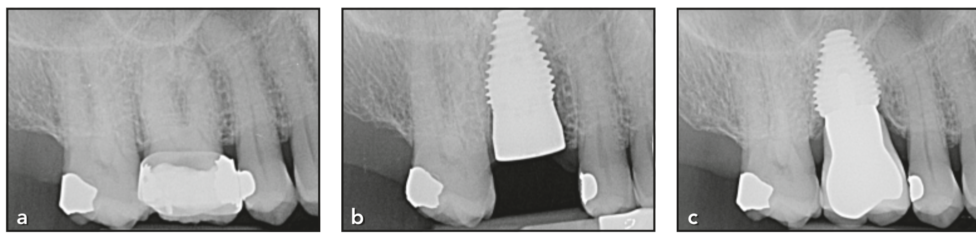

Fig 6 *Clinical case 4.* (a) *Maxillary right first molar to be removed.* (b) *Radiographic view of implant in situ on day of surgery.* (c) *Restored implant 5 years later.*

was placed into the prepared site. The technique as described for the mandible was applied for closure of the soft tissue apertures. The same postoperative regime was followed, and the implant was allowed to integrate for 4 months in a nonsubmerged state.

Integration was confirmed at 4 months, when the prosthetic phase of treatment was completed. The implant was restored with an all-ceramic screw-retained crown (Figs 5d and 6c).

Discussion

Molars are the first permanent teeth to erupt and the most common teeth to be lost, often at an early age.[19] This confirms a distinct need for molar replacement options.

After tooth removal, bone remodeling and pneumatization of the maxillary sinus often result in insufficient residual bone volume for successful implant placement, leading to a need for complex bone augmentations. Immediate implant placement could be considered a predictable and viable protocol to overcome these problems, provided that the recommended guidelines are observed. A critical aspect of this protocol relates to correct three-dimensional implant positioning, which requires a certain level of surgical skill and experience. The highly varied anatomy of molar sockets is a further challenge, which is made more predictable by the recommended protocol of using the tooth as a drill guide.

Case selection should be strictly guided by the patient's periodontal biotype and confirmation that the bony walls are sufficiently intact. Medium and thick biotypes are suitable for this method, but thin biotypes should be managed with more conventional techniques. Thin biotypes are associated with a higher rate of bone resorption and an increased risk of recession, which may result in an unsatisfactory outcome.[20]

Careful tooth removal and bone preservation, combined with accurate site preparation, are vital to the success of this treatment method. Pilot hole positioning for the osteotomy site (as described in the above demonstrations) is crucial to ensure correct implant placement (see Figs 1c, 1d, 4b, and 4c). Drilling through the floor of the pulp chamber greatly increases visual access and the accuracy with which the operator can prepare the pilot osteotomy in a multirooted site.[13,21] This allows for a level of operative predictability that is otherwise difficult to achieve in variable multirooted sites.

The preparation depth should be planned and well established in the initial stages of site preparation, since it cannot be altered in the final stages of the osteotomy, primarily due to the wide diameter of the final drills. Incrementally sequenced drills allow for careful and accurate widening of the osteotomy site. This particular implant design produces a high degree of primary stability due to the strongly tapered macrogeometry of the implant and needs to be considered during preparation of the site depth. The implant should never engage the inner aspect of the buccal socket wall, and the implant platform should be at least 2 mm deeper than the most apical crest of the socket wall (Figs 1f, 1g, 1j, 4e, 4f, and 4h).

It has been shown that 3 mm could be the optimal gap distance for bone fill to take place, provided the buccal bone plate thickness is > 1 mm.[22] Buccal plate thickness usually increases from anterior to posterior,[23,24] and this may enhance the capacity for bone fill in molar sites. The author does not place biomaterials in the voids around the implants, instead using hemostatic collagen to close the residual soft tissue space and stabilize the socket coagulum. This is only performed at the healing abutment level.

Some studies suggest that wide-diameter implants tolerate occlusal forces better than standard- and narrow-diameter implants and that an increase in diameter reduces the risk of implant fracture.[25] This is especially important in molar sites, where occlusal forces are greatest.

UWDIs allow for increased primary stability, greater bone contact, and reduction of the residual space in a molar socket. However, incorrect preparation can easily lead to malposition of the implant, which may compromise the integrity of the buccal socket wall. This relates more to the application of the technique than to the implant design. As with immediate placement in the anterior maxilla, specific protocol guidelines should be followed.

The author's experience with this molar extraction and immediate implant placement protocol is based on 580 clinical cases over a 10-year period. For these cases, the calculated total survival rate is 95.17%, of which 3.62% were early failures and 1.20% were late failures.

Although this innovative technique allows for greater predictability in placing UWDIs in molar extraction sockets, this treatment modality requires clinical experience and careful case selection.

Conclusions

By following this technique, immediate implant placement in molar extraction sites using UWDIs can be performed in a predictable and accurate manner, achieving optimal implant positioning and primary stability.

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