

# Single Tooth Restoration in the Maxilla with an Ultra-wide Diameter Implant: A Clinical Report

Nicholas Egbert<sup>1</sup>, Swati Ahuja<sup>2</sup>, Audrey Selecman<sup>2</sup>, Russell Wicks<sup>2</sup>

<sup>1</sup>Private Practice, Salt Lake City, Utah, USA, <sup>2</sup>Department of Prosthodontics, University of Tennessee Health Science Center, College of Dentistry, Memphis, Tennessee, USA

## ABSTRACT

Immediate implant placement in the molar region is challenging due to complicated socket morphology, residual inter-radicular bone, and concurrence of the mandibular canal or maxillary sinus. These challenges may impede the placement of implants 10 mm or longer. Placing regular diameter implants <10 mm in length may result in poor primary stability, non-axial loading, increased functional overload, implant failure, compromised emergence profile, creation of a cantilever effect, difficulty in maintaining adequate hygiene around the restoration and the implant, and abutment screw loosening. Implant diameters >6 mm (“ultra-wide”) have been advocated to circumvent the disadvantages of regular diameter implants <10 mm in length in the molar regions. The purpose of this article is to report a case utilizing an ultra-wide diameter implant (Max Dental Implant System, Keystone Dental, Burlington, MA) to replace an extracted molar tooth.

**Keywords:** Immediate, posterior maxilla, single tooth, wide diameter

## INTRODUCTION

Immediate placement of implants has several advantages including reduced number of surgical interventions, decreased treatment time, and improved esthetics due to the maintenance of gingival and crestal bone architecture.<sup>[1-3]</sup> However, immediate implant placement in the molar region is challenging due to complicated socket morphology, residual inter-radicular bone,<sup>[4]</sup> and limited available bone because of proximity to structures such as the mandibular canal and pneumatized maxillary sinus.<sup>[5-7]</sup> These challenges may impede the placement of implants 10 mm or longer.

The use of short implants (length <10 mm) in areas of reduced bone height may provide several clinical advantages, such as protection of vital anatomic

structures, lowering of the need and risks of bone augmentation procedures, decreased treatment period and cost, and better patient acceptance of the treatment.<sup>[7,8]</sup> However, immediate placement of regular diameter short implants in molar extraction sockets may result in poor primary stability, non-axial loading, increased functional overload, implant failure, compromised emergence profile, creation of a cantilever effect, difficulty in maintaining adequate hygiene around the restoration and the implant, and abutment screw loosening.<sup>[9,10]</sup> Wide (5-6 mm) and ultra-wide diameter implants (>6 mm) have been advocated to circumvent the disadvantages of regular diameter (diameter 4 mm) short implants in the molar regions. The use of these implants for immediate implantation in the molar sockets aids in decreasing the space between the implant body and the surrounding alveolar bone,<sup>[9]</sup> increasing the available surface area for osseointegration, and improving the primary stability, stress distribution, and emergence profile.<sup>[7,9]</sup> Improved surgical procedures, new implant designs, and new microsurfaces have resulted in significant improvement in the success and survival rate of wide diameter implants for immediate implantation in the molar root sockets.<sup>[9]</sup>

Access this article online	
Quick Response Code:	Website: www.joaor.org
	DOI: ***

**Address for correspondence:** Dr. Swati Ahuja, Department of Prosthodontics, 875 Union Ave, University of Tennessee Health Science Center, Memphis, TN 38163, Tennessee, USA. Fax: 901-448-1294. E-mail: sahuja@uthsc.edu

Received: 10-22-16

Revised: 11-28-16

Accepted: 12-09-16

Limited ultra-wide diameter implant options are now available to facilitate immediate implant placement in the posterior (molar) regions of the jaw. These implants may be a good alternative to regular and wide diameter implants in the molar area owing to their enlarged implant surface area, thread geometry, moderately rough surface, primary stability, and bicortical anchorage.<sup>[7]</sup>

The purpose of this article is to report a case utilizing the ultra-wide diameter implant (Max Dental Implant System, Keystone Dental, Burlington, MA) to replace an extracted molar tooth.

## CASE REPORT

A 22-year-old Caucasian woman with a non-contributory medical history came to the author's clinic with a chief complaint of pain and discomfort in the region of tooth #14. Tooth #14 was treated endodontically and restored, 6 years ago. It was retreated endodontically, 2 years ago, due to pain and discomfort. Clinical and radiographic examination indicated the presence of chronic apical periodontitis and vertical fracture of the mesiobuccal root of tooth #14, rendering the tooth non-restorable, Figure 1. The patient had a good oral hygiene and was esthetically conscious. The following treatment plan was presented to the patient after a thorough consideration of her age, clinical condition, and her preferences:

- Atraumatic extraction of tooth #14
- Immediate placement of a wide or an ultra-wide diameter implant
- Placement of a definitive crown.

The treatment was initiated on receipt of the patient consent. The procedural steps are described below:

A cone-beam computed tomography (CBCT) scan (CBCT, ProMax 3D, Planmeca USA, Inc. Roselle, IL) was obtained to aid in implant planning. It revealed that tooth #14 had divergent roots with adequate inter-radicular bone which measured 12 mm in the mesiodistal and buccolingual dimension and had a vertical bone height of 9 mm. To optimize primary stability, stress distribution, and emergence profile for esthetics and hygiene within the limitations of the existing anatomy, an ultra-wide diameter implant (diameter = 8 mm, length = 9 mm) was planned in the region of tooth #14.

### Tooth extraction

On the day of surgery, intravenous (IV) sedation, pre-operative antibiotics (clindamycin 600 mg IV), and

local anesthetic were administered to the patient. It is important to note that immediate placement of the implant is possible only when all bony walls of the socket have been preserved. The crown of the tooth #14 was cut off horizontally, and the roots were separated and then carefully elevated and removed one at a time without removal or fracture of any bony plate, Figure 2. Following the complete tooth removal, the bony socket walls were examined to confirm the presence of intact buccal and palatal walls and interradicular bone [Figure 3]. The socket was curetted and profusely irrigated with saline to remove a minor amount of granulation tissue.

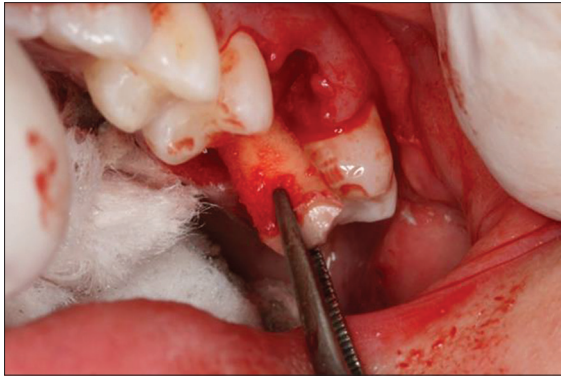
### Implant placement

A side-cutting Lindemann drill (Salvin Dental Specialities, Charlotte, NC) was positioned on the interradicular bone and used to create the initial osteotomy vector. The side-cutting design of this drill permits lateral cutting of bone and aids in resisting the cortical deflection of the inter-radicular bone. Once the correct osteotomy vector was established, the osteotomies were prepared as per the recommended manufacturer's protocol starting with the 1.2 mm diameter twist drill (at the desired length), progressing to the 7 mm diameter tapered spade drills. Care was taken to ensure that the implant was not being placed too close to tooth #15. The osteotomies were prepared 2 mm subcrestal and 2-3 mm lingual to the buccal bone to compensate for future recession. A periapical radiograph was taken with the direction indicator to evaluate the depth and position of the osteotomy. Next, surgical taps (7 × 9 mm and 8 × 9 mm) were used to complete the preparation of the site and evaluate the potential primary stability of the proposed implant size. If the tap encounters appropriate resistance, an implant with the same diameter as the surgical tap is used. If appropriate resistance is not felt with the tap, an implant of larger diameter may be used to optimize primary stability.

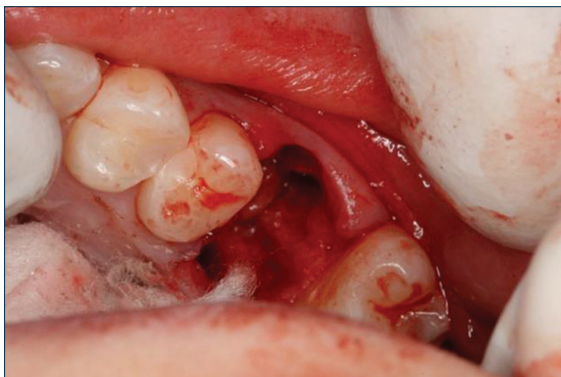
The sinus membrane was indirectly lifted on implant placement. The osteotome-like, blunt tip design of the ultra-wide diameter implant (Max, Keystone dental, Burlington, MA) allows for predictable, safe placement near the sinus floor as opposed to an aggressive self-tapping implant tip design. A collagen plug (Collaplug, Zimmer Dental) was placed to prevent bone graft perforation of the sinus membrane. Coarse particulate 50/50 corticocancellous graft material (OsteOss, Mendit



**Figure 1:** Pre-operative panoramic radiograph of the patient depicting large periapical lesion associated with tooth #14



**Figure 2:** Atraumatic extraction of tooth #15

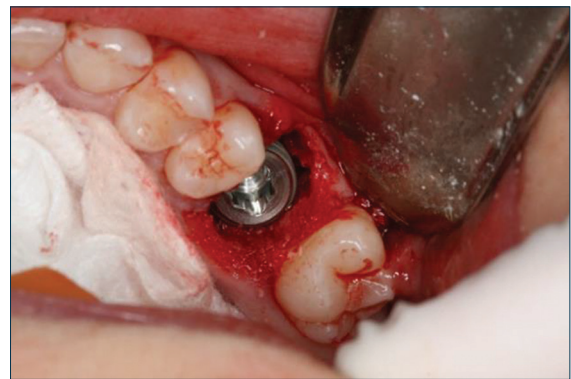


**Figure 3:** All socket walls intact and interradicular bone preserved

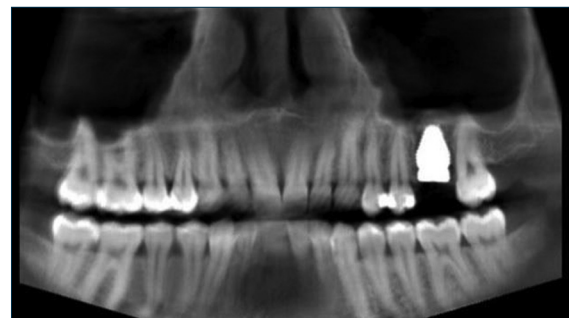
Medical, Salt Lake City Utah) was placed below the plug. Next, the implant (Max Dental Implant, 8 mm × 9 mm) [Figure 4] was carefully placed (at 50 Ncm) with the implant surgical unit and then seated by hand with an implant insertion wrench [Figure 5]. A periapical and panoramic radiograph was taken to ensure proper positioning and depth of the implant [Figure 6]. The space between the implant and the buccal alveolar wall was packed with 50-50 corticocancellous graft material (OsteOss, Mendit Medical, Salt Lake City Utah). The healing abutment was attached to the implant, and the soft tissues were sutured with vicryl sutures. The implant was allowed to heal for 4 months.



**Figure 4:** Implant mount with extra-wide diameter short implant



**Figure 5:** Implant placed in the region of tooth #14. Note there is 2 mm of bone buccal and lingual to the implant platform



**Figure 6:** Panoramic radiograph depicting the placement of implant in location of tooth #14

### **Fabrication and delivery of cement-retained crown**

Open tray impression [Figure 7] and maxillomandibular jaw relation records were registered for the patient using current best prosthodontic procedures. A custom zirconia abutment and a cement-retained zirconia crown were fabricated for the patient as she did not desire a hole in her restoration. The rhomboidal shape of the healing abutment permitted easy seating of the custom zirconia abutment (verified with a radiograph and torqued as per the manufacturer's recommendations)

[Figure 8], the crown was tried and evaluated for fit, form, and function. It was adjusted as needed and cemented to the abutment with resin cement (Relyx™ Unicem, self-adhesive resin cement, 3M Dental, St Paul, MN) [Figures 9 and 10].

## DISCUSSION

Osseous anatomy and morphology are principal factors to be considered when selecting an appropriate implant dimension for prosthetic replacement of the missing dentition. The emergence of wider, shorter implant designs may be a simple, cost-effective, predictable solution for compromised bony morphology.

The inherent risks and benefits of immediate placement of implants are well documented.<sup>[1-3]</sup> A systematic review published by Ketabi *et al.*, reveals the importance of recognizing the optimal implant diameter for immediate molar implant placement.<sup>[11]</sup> Authors concluded that the implant diameter was a significant factor ( $P = 5.048$ ) and reported implant failures being higher (3.67 vs. 1.45%) for ultra-wide (>6-9 mm) versus wide (4-6 mm) implants. They suggested inadequate buccal and lingual/palatal bone thickness (<1.8 mm retained on the buccal

and/or lingual aspect of the implant after osteotomy preparation) and poor surgical technique as reasons for implant failure.<sup>[11]</sup> However, advances and availability in CBCT imaging, treatment planning software, and precision surgical guides permit digital measurement of bone volume, selection of the appropriate implant dimension, and direct placement with a high level of accuracy. Thus, failures can be avoided by appropriate treatment planning and using ultra-wide diameter implants for immediate implantation only when the crestal width is >11 mm (ensuring at least 1.8 mm of bone is retained, both buccal and lingual to the osteotomy) and length <10 mm.

Ku *et al.*, studied 58 implants (6-7 mm in diameter, 7-12 mm in length) which were placed in 53 patients and reported a mean survival rate of 98.28%.<sup>[12]</sup> The average marginal bone loss was 0.018 and 0.045 mm at 12 and 24 months, respectively, after the loading and 0.14 mm at final follow-up date. No statistically significant difference between 6 and 7 mm diameter implants was reported for survival or success rate, primary or secondary stability, or marginal bone loss in 12 and 24 months, suggesting 7 mm implants to be a reasonable choice, especially for previously failed surgical sites.

Implants in the molar region are subjected to increased compressive, tensile, and shear loads.<sup>[12]</sup> Previously reported failure of implants >6 mm in diameter and <10 mm in length has been associated with lack of



**Figure 7:** Vinyl polysiloxane impression made with an open tray impression coping. Implant analog attached to the impression coping



**Figure 8:** Zirconia custom abutment attached to the implant



**Figure 9:** Zirconia crown cemented to the zirconia abutment



**Figure 10:** Patients smile with definitive prosthesis

experience with wider implants, improper surgical technique, poor implant design and bone-implant contact area and/or off-axis loading of the implant.<sup>[11,13]</sup> Modifications of implant design, implant surfaces, and surgical protocols have helped improve the success and survival rates of wide diameter implants.<sup>[9]</sup> Oswal *et al.*, reported minimum Von Mises stresses at the cortical bone level with a reverse buttress thread design (compared to V-shaped and buttress thread designs) signifying bone preservation in a three-dimensional finite element analysis of an implant placed in the mandibular molar region.<sup>[14]</sup> The implant placed in this study has 0.8 mm pitch and reverse buttress thread shape enhancing surface area and load distribution.

Wide diameter implants create a wider restorative platform and are beneficial in the long-term maintenance of various implant-supported prostheses.<sup>[15]</sup> However, published literature lacks double-blind, randomized, controlled clinical trials on ultra-wide diameter implants to guide the development of implant design modifications and surgical protocols. Evaluation of clinical outcomes and the long-term success of design modifications of ultra-wide implants is as important as identifying a broader population that would benefit from implant therapy.

## CONCLUSION

Increasing survival rate, success rate, primary and secondary stability, and limiting marginal bone loss of immediately placed molar implants can be achieved by careful consideration of the implant surgical site morphology and implant design. This case study illustrates the use of an ultra-wide implant in conjunction with compromised residual bone without compromised results.

## REFERENCES

1. Altintas NY, Taskesen F, Bagis B, Baltacioglu E, Cezairli B, Senel FC. Immediate implant placement in fresh sockets versus implant placement in healed bone for full-arch fixed prostheses with conventional loading. *Int J Oral Maxillofac Surg* 2016;45:226-31.

2. Esposito M, Barausse C, Pistilli R, Jacotti M, Grandi G, Tucco L, *et al.* Immediate loading of post-extractive versus delayed placed single implants in the anterior maxilla: Outcome of a pragmatic multicenter randomised controlled trial 1-year after loading. *Eur J Oral Implantol* 2015;8:347-58.
3. Chen ST, Buser D. Esthetic outcomes following immediate and early implant placement in the anterior maxilla--a systematic review. *Int J Oral Maxillofac Implants* 2014;29 Suppl:186-215.
4. Fugazzotto PA. Sinus floor augmentation at the time of maxillary molar extraction: Technique and report of preliminary results. *Int J Oral Maxillofac Implants* 1999;14:536-42.
5. Muftu A, Chapman RJ. Replacing posterior teeth with freestanding implants: Four-year prosthodontic results of a prospective study. *J Am Dent Assoc* 1998;129:1097-102.
6. Truhlar RS, Orenstein IH, Morris HF, Ochi S. Distribution of bone quality in patients receiving endosseous dental implants. *J Oral Maxillofac Surg* 1997;55 12 Suppl 5:38-45.
7. Vandeweghe S, De Ferrer R, Tschakaloff A, De Bruyn H. A wide-body implant as an alternative for sinus lift or bone grafting. *J Oral Maxillofac Surg* 2011;69:e67-74.
8. Morand M, Irinakis T. The challenge of implant therapy in the posterior maxilla: Providing a rationale for the use of short implants. *J Oral Implantol* 2007;33:257-66.
9. Prosper L, Crespi R, Valenti E, Capparé P, Gherlone E. Five-year follow-up of wide-diameter implants placed in fresh molar extraction sockets in the mandible: Immediate versus delayed loading. *Int J Oral Maxillofac Implants* 2010;25:607-12.
10. Bergendal T, Engquist B. Implant-supported overdentures: A longitudinal prospective study. *Int J Oral Maxillofac Implants* 1998;13:253-62.
11. Ketabi M, Deporter D, Atenafu EG. A systematic review of outcomes following immediate molar implant placement based on recently published studies. *Clin Implant Dent Relat Res* 2016;18:1084-94.
12. Ku JK, Yi YJ, Yun PY, Kim YK. Retrospective clinical study of ultra-wide implants more than 6 mm in diameter. *Maxillofac Plast Reconstr Surg* 2016;38:30.
13. Eckert SE, Meraw SJ, Weaver AL, Lohse CM. Early experience with wide-platform Mk II implants. Part I: Implant survival. Part II: Evaluation of risk factors involving implant survival. *Int J Oral Maxillofac Implants* 2001;16:208-16.
14. Oswal MM, Amasi UN, Oswal MS, Bhagat AS. Influence of three different implant thread designs on stress distribution: A three-dimensional finite element analysis. *J Indian Prosthodont Soc* 2016;16:359-65.
15. Degidi M, Piattelli A, Iezzi G, Carinci F. Wide-diameter implants: Analysis of clinical outcome of 304 fixtures. *J Periodontol* 2007;78:52-8.

**How to cite the article:** Egbert N, Ahuja S, Selegman A, Wicks R. Single tooth restoration in the maxilla with an ultra-wide diameter implant: A clinical report. *J Adv Oral Res* 2016;7(3):41-45.

**Source of Support:** Nil. **Conflict of Interest:** None declared.