

# Clinical research on a flapless surgical technique application of narrow implants

Li Xu, MD, Yihan Liu, MM, Yuanyuan Wang, MM, Jiangang Chen, MD\*

## Abstract

The aim of the present study was to investigate the role of Axiom (implant diameter)  $\varnothing$ 2.8 mm narrow body implant in the clinical effect of minimally invasive implants in edentulous space.

This study included 10 patients with 10 edentulous spaces less than 5 mm and received minimally invasive surgery with 10 Axiom  $\varnothing$ 2.8 mm narrow implants. Re-stabilization of all implants began 6 months after surgery to fix the partial denture. All cases were followed up for clinical and panoramic X-ray examinations.

Imaging examination on these 10 pieces of narrow implants after 6 months showed that implant alveolar bone crest average absorption amount was 0.20 mm and no implant peripheral inflammation mucositis and denture with adjacent teeth gingival papilla between the fillings. All patients felt strong mastication and the reparation effect was more than up to expectation. No implant loosening and shedding were observed.

Hence, <5 mm edentulous space by Axiom  $\varnothing$ 2.8 mm implant minimally invasive reparation can be used for aesthetic purposes.

**Abbreviation:** GBR = guided bone regeneration.

**Keywords:** Flapless surgery, narrow body implant, narrow edentulous gap

## 1. Introduction

In implant applications, we often encounter a variety of reasons leading to dentition defects. Reasons in most patients are from long-term missing teeth causing adjacent teeth to have an edentulous tilt, narrow dentures, and conventional implants ( $\varnothing$ 3–6 mm in diameter).<sup>[1,2]</sup> If the implants are too large, it can easily damage the adjacent teeth. In clinic, due to narrow dentures, it is difficult to obtain ideal aesthetic effects and dentures with <5.5 mm are planting denture contraindications.<sup>[3–5]</sup> Therefore, a single denture with <5.5 mm is not suitable for implants and we often chose traditional removable partial dentures or fixed denture reparation procedures. Since 2012, our hospital dental clinic has started to implement the Axiom  $\varnothing$ 2.8 mm narrow implants in <5 mm denture space for minimally invasive purposes, and has achieved satisfactory short-term clinical outcomes.

## 2. Methods

### 2.1. Materials

Axiom REG/PX implants (www.anthogyr.com. Anthogyr, Sallanches, France), the implant's diameter which is 2.8 mm,

narrow body has a special design with a length of 10 to 12 mm specifications, especially suitable for the repair of a single denture. It possesses grade 5 titanium material with high resistance and "small in diameter" characteristics. The base station of Moss (Morse taper) taper lock design principle is that the repair body is connected to implant to obtain a better aesthetic effect. In the special cases, it is sometimes easier to produce the effect of false teeth, and precautions, such as excessive pressure leading to soft-tissue atrophy and aesthetic failure, should be aware.

### 2.2. Patients

Research subjects who underwent minimally invasive implant treatments were recruited into this study. As a mature implant technique, flapless implantation does not harm the safety and health of patients, so there is no ethical problem involved in this study. Written informed consent was obtained. A total of 10 patients (2 males, 2 females) with narrow dentures, including 1 case with maxillary canine denture and 4 cases with maxillary premolar defect, 2 cases with maxillary molars missing, 1 case with loss of mandibular anterior teeth, and 2 cases with mandibular molar denture. Inclusion criteria were the gap between missing teeth should be <5.5 mm and the average gap was 4.24 mm. Patients with the gap >5.5 mm were excluded from the study. The patients' age was ranged from 25 to 55 years with an average age of 40.3 years old. The health status and oral hygiene of all patients were normal. The perimucosal area of the implant area was also normal without infections.

### 2.3. Preoperative assessment

**Hard-tissue considerations:** Using panoramic X-ray and linear tomography imaging technology (SIRONA panoramic machine, Germany), with clinical measurements of the alveolar bone's width, height, thickness, and bone defect, as well as the mucosa thickness of the implant area.

**Soft-tissue considerations:** Thick biotype gingival is ideal, and the horn of the epithelium should be sufficient, so the aesthetics after the minimally invasive procedure can be expected.

Editor: Li Wu Zheng.

The authors have no funding and conflicts of interest to disclose.

Department of Stomatology, Zhongnan Hospital of Wuhan University, Wuhan, Hubei, China.

\* Correspondence: Jiangang Chen, Department of Stomatology, Zhongnan Hospital of Wuhan University, No 169, Donghu Rd, Wuchang District, Wuhan, Hubei 430071, China (e-mail: jiangangche@126.com).

Copyright © 2018 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Medicine (2018) 97:44(e12646)

Received: 26 March 2018 / Accepted: 26 August 2018

<http://dx.doi.org/10.1097/MD.00000000000012646>

To assess the results of combined intra-oral soft and hard tissue, we formulated an individualized implant treatment scheme, to assess alveolar bone mass, height, thickness, and width, as well as determine the direction of implant, diameter and its length.

#### 2.4. Minimally invasive surgical implant procedures

Using minimally invasive techniques with the conventional disinfection shop towel, local anesthesia, collocation use of new patented instruments, replaceable mark gum scale probe planting area mucoperiosteum, measuring mucoperiosteal tissue thickness, relating to the panoramic X-ray image to approximately measure bone height, drill or use periosteum ring drill directly into the mucoperiosteum implant area, then use the Axiom tool box for preparation of implant socket which was required for drilling depth of mucoperiosteal thickness would be implant length, followed by reaming, but make sure to pay attention to the implant side of patients, cheek and tongue (palatine) lateral direction and insertion depth, to avoid damages to adjacent teeth in maxillary posterior region. In addition, make sure to avoid penetrating the maxillary sinus membrane. Meanwhile, damages to the mandibular posterior region should also be avoided. Intraoperative use of gentamicin and saline to rinse the cavity, implant special wrench-like instrument manually which is 2.8 mm, these will narrow the implant screw connection to put in place. Erythromycin ointment paint was for soft-tissue wound healing without requirement of sutures. Oral antibiotics was administrated 1 to 3 days, 1 month after operation, 3 months of follow-up. Six months later, the implant level of the model (closed) was performed to compare the colors and there will be production of permanent fixed partial dentures.

#### 2.5. Effect evaluation

Implants were 6 months into the completion of fixed upper part of the crown, follow-up of patients during and clinical examinations of tissues surrounding the implant body, X-ray imaging was for evaluation of plant body alveolar bone. To implant stability quotient score as patients after clinical judgment, postoperative scores, from 1 month, 3 months, 6 months, were calculated to evaluate the implant stability.

Meanwhile, attention should be paid to see whether there were periodontal gingivitis, implant loosening, abscess formation, and any other complications.

### 3. Results

From 2014 to 2015, a total of 10 patients with 10 edentulous spaces were recruited in this study and received implant of 10 pieces of Axiom  $\varnothing$ 2.8 mm narrow implant with length specifications being 10 to 12 mm. All implants were restabilized with permanently fixed partial dentures 6 months after procedures. Follow-up criteria: Patients with implant denture retention, stability, chewing efficiency and appearance if satisfactory, gingival atrophy surrounding area of implant, formation of black triangles, inflammatory manifestations, no implant peripheral inflammations and planting around mucositis, etc, complications. At 6-month time point for evaluation, with the usage of panoramic X-ray imaging, we assessed the average absorption of alveolar bone crest to see whether it was amounted to 0.20 mm and found narrow axiom  $\varnothing$ 2.8 mm planting and bone growth combination was very good, and alveolar ridge crest was not absorbed.

Typical cases: female, 40 years old, no special dental or internal medicine history. In 2015, patient with long-time missing teeth, hoping to repair with treatment of minimally invasive implant technique. Clinical examinations were performed to exclude operational risks, and panoramic X-ray imaging showed the gap in the 26 adjacent to the tooth was 3.20 mm; minimum root spacing was 5.68 mm; the alveolar bone height was 8.39 mm; 36, 46, 47 spaces were  $>$ 5 mm, and the alveolar bone height was  $>$ 10 mm (Fig. 1). Treatment process: Because of the lack of dental area due to patient conditions, we chosen conventional implant minimally invasive surgery to treat this patient. The 26 edentulous spaces were all too narrow. If the residual alveolar bone height (residual bone high, RBH) had insufficient volume, we used the flapless minimally invasive technique or maxillary sinus floor elevation about 1 mm in length, with using the standard for socket preparation. The narrow axiom of implant was: 10 mm (implant length specification), the  $\varnothing$ 2.8 mm (implant diameter), operation in direct implementation of maxillary sinus elevation without the usage of bone grafting material. Postoperative panoramic X-ray imaging examination showed that the



Figure 1. Panoramic X-ray imaging of the tooth before surgery.

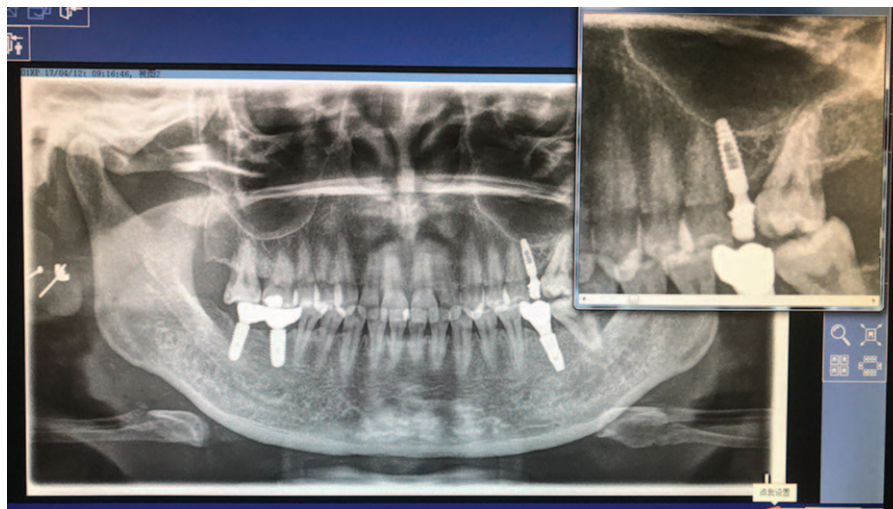


Figure 2. Postoperative panoramic X-ray imaging.

planting body was in position and maintained a distance of about 1 mm to the adjacent teeth. The maxillary sinus floor was intact in the surrounding tissue of the cortical bone which was raised about 2.0 mm (Fig. 2), no other complications were observed and a good initial stability was obtained. Six months after completion of the application of permanent fixed partial denture, there was no obvious absorption of alveolar bone around the implant, the implant denture was repaired with the adjacent gingival margin curves, the gingival papilla was filled, and aesthetics were improved a lot (Figs. 3 and 4).

#### 4. Discussion

Minimally invasive implant is the direct preparation of implants on the gingival and alveolar bone of the missing teeth region without incision of the gums and the alveolar bone. Compared with traditional double valve implantation, minimally invasive plant can obtain ideal reparation with a higher success rate.<sup>[6-8]</sup> In addition, the minimally invasive operation can also reduce the

incidence of trauma, to maintain or cure the disease. However, our goal is no longer just the pursuit of implant bone integration successfully. Whether the tooth has support and if the cavity presents a harmonious appearance of soft and hard tissue in the mouth, even in edentulous area with (<5.5 mm) narrow clearance can affect aesthetic results from the procedure.

The pursuit of beautiful or aesthetically ideal results can be expected in the narrow gap single implant treatment, during the treatment, physicians need to consider all affecting factors for the outcome of the possibility, compared with the traditional method of implants. Moreover, they also should pay attention to the protection of the lesion and surrounding tissue, to avoid or minimize the systemic reactions, reduce complications, shorten the treatment periods, so that patients can recover quickly.<sup>[3,5]</sup> In addition, implant surgery must be performed precisely in the soft tissue of the treatment or implant position and if there is an error and whether the soft tissue or bone mass is sufficient, all can lead to the failure of aesthetic product. Domestic and foreign scholars believe there are several benefits by using this method of implant, such as plenty of bone volume around implant area, no

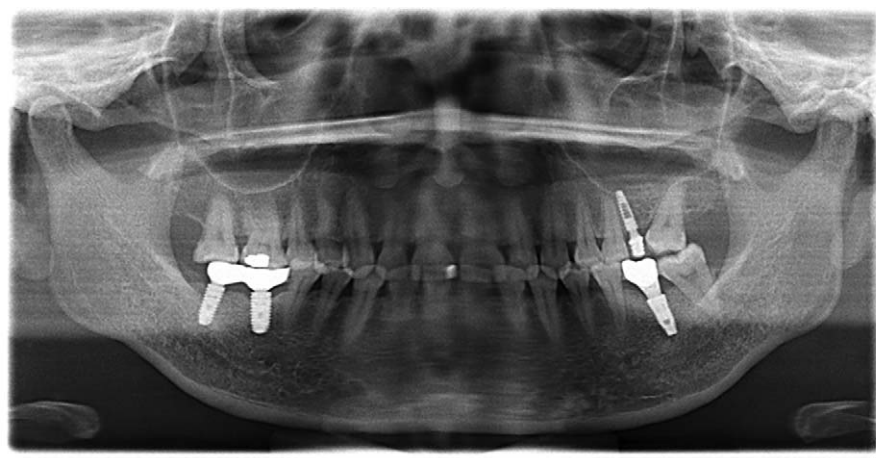


Figure 3. X-ray imaging 6 months after surgery.



**Figure 4.** The repaired dental crown in the oral cavity after surgery. (A) Upper arch. (B) Lower arch. (C) Left arch. (D) Right arch.

penetration of alveolar mucoperiosteal. Therefore, it has the potential to become a growing conventional surgical method.<sup>[1,6–8]</sup>

This typical case of using special design of narrow implant (Axiom  $\phi 2.8$  mm), below are the points and tips to be aware, as long as the technique is in adherence to the principle of operation, they can more simply overcome the posterior area because of the edentulous space is too small and the height of alveolar bone deficiency is not eligible for the procedure, to achieve the functional demand as well as to be in accordance with the appearance of patients expectations. Maxillary sinus augmentation uses implants diameter  $>4$  mm, the reason is that the diameter is larger, resulting in lower incidence of maxillary sinus perforation risk. In this study, we used the  $\phi 2.8$  mm implants for maxillary sinus lift with few articles on it.<sup>[9–11]</sup> This operation needs calculatedly precise measurement of the area of the soft and hard tissue, familiar with the operation skills. In this study, the utility model patent instrument was used,<sup>[12]</sup> for example, changing needle gingival graduated probe, pioneer, sticky periosteal ring drill in the narrow edentulous space with gingival flapless minimally invasive implant,<sup>[6]</sup> the successful completion of the maxillary sinus lift operation. In addition, the maxillary sinus lifting operation without guiding bone regeneration (guided bone regeneration GBR) technique, the reduction of maxillary sinus in intraoperative and postoperative complications. Our results state that without the use of bone grafting material, intraoperative top up sinus membrane is able to access a patient's own bone tissue extrusion and obtains better initial stability.<sup>[9–11]</sup>

In clinical application, the length of implant diameter is generally 3 to 6 mm, and usually implant diameters are  $\phi 3.75$  mm which is the standard diameter of an implant. If it is  $<\phi 3.5$  mm; it is called as small diameter planting body narrow implant. Implant procedure application of implant diameter is generally  $>\phi 3.5$  mm, and the main reason is to obtain sufficient mechanical strength and can bear larger masticatory forces. In the edentulous space  $<5.5$  mm with a diameter is 3.5 mm, implant does not only have a surgical high risk, it may also cause injuries to the adjacent

teeth/tooth crown and root. The majority of small diameter plant body is only available in the anterior area missing tooth gap rare cases, this is used to recover the patients demands for aesthetic restoration of anterior teeth, which is rarely used in posterior teeth loss column planting.<sup>[3–6]</sup>

For patients with long-term missing teeth leading to a left posterior edentulous space narrow, regular review after implant crown restoration performed, the 2 adjacent teeth gap distance was only 3.2 mm and implanted with conventional implant comes with a certain degree of difficulty and risk, the use of a commercially available special design  $\phi 2.8$  mm implant repair therapy were followed up 6 months after the later narrow implant planting area of bone integration and other conventional implant effect of maxillary sinus lift operation is also visible implant in the sinus floor with a small amount of new bone formation after permanent fixed partial denture, the patient has masticatory functions and the symptoms of the patient were improved.

## 5. Conclusion

Application of axiom  $\phi 2.8$  mm narrow planting body without cutting the alveolar ridge mucoperiosteal parallel of maxillary sinus can enhance the operation without the use of bone grafting material. The planting repair treatment can greatly shorten the operation time, cause less bleeding intraoperative, improve narrow gap dentition and alveolar bone height lack of planting indications, provide more comfort for patients' experience, shorten the patients with minimal hindrance. It is a new advancement in technique, which is proved to be more effective than traditional methods and also can obtain satisfactory short-term clinical effects.

## Author contributions

**Conceptualization:** Jiangang Chen.

**Data curation:** Yihan Liu.

**Formal analysis:** Li Xu, Yihan Liu, Yuanyuan Wang.

**Investigation:** Li Xu.

**Methodology:** Li Xu.

**Project administration:** Jiangan Chen.

**Writing – original draft:** Li Xu.

**Writing – review & editing:** Li Xu, Jiangan Chen.

## References

- [1] Mittal Y, Jindal G, Garg S. Bone manipulation procedures in dental implants. *Indian J Dent* 2016;7:86–94.
- [2] Borgonovo AE, Berardinelli FV, Favale M, et al. Surgical options in oroantral fistula treatment. *Open Dent J* 2012;6:94–8.
- [3] Vigolo P, Givani A, Majzoub Z, et al. Clinical evaluation of small-diameter implants in single-tooth and multiple-implant restorations: a 7-year retrospective study. *Int J Oral Maxillofac Implants* 2004;19:703–9.
- [4] Jackson BJ. Small-diameter implants: a 7-year retrospective study. *J Oral Implantol* 2017;43:125–9.
- [5] Klein MO, Schiegnitz E, Al-Nawas B. Systematic review on success of narrow-diameter dental implants. *Int J Oral Maxillofac Implants* 2014;29:43–54.
- [6] Becker W, Goldstein M, Becker BE, et al. Minimally invasive flapless implant surgery: a prospective multicenter study. *Clin Implant Dent Relat Res* 2005;7:S21–7.
- [7] Halpern KL, Halpern EB, Ruggiero S. Minimally invasive implant and sinus lift surgery with immediate loading. *J Oral Maxillofac Surg* 2006;64:1635–8.
- [8] Berdugo M, Fortin T, Blanchet E, et al. Flapless implant surgery using an image-guided system. A 1- to 4-year retrospective multicenter comparative clinical study. *Clin Implant Dent Relat Res* 2010;12:142–52.
- [9] Si MS, Zhuang LF, Gu YX, et al. Osteotome sinus floor elevation with or without grafting: a 3-year randomized controlled clinical trial. *J Clin Periodontol* 2013;40:396–403.
- [10] Nedir R, Nurdin N, Vazquez L, et al. Osteotome sinus floor elevation without grafting: a 10-year prospective study. *Clin Implant Dent Relat Res* 2016;18:609–17.
- [11] Jungner M, Cricchio G, Salata LA, et al. On the early mechanisms of bone formation after maxillary sinus membrane elevation: an experimental histological and immunohistochemical study. *Clin Implant Dent Relat Res* 2015;17:1092–102.
- [12] Chen J, Wang Y, Xu L. The application of new implant surgical instruments in non-flap maxillary sinus surgery. *Medical Bulletin of Wuhan University* 2016;37:1–4.