Int. J. Oral Maxillofac. Surg. 2017; xxx: xxx–xxx
http://dx.doi.org/10.1016/j.ijom.2017.05.025, available online at http://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Pre-Implant Surgery

The application of a delayed expansion technique for horizontal alveolar ridge augmentation in dental implantation

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X. Li, P. Xu, X. Xu, S. Liu: The application of a delayed expansion technique for horizontal alveolar ridge augmentation in dental implantation. Int. J. Oral Maxillofac. Surg. 2017; xxx: xxx–xxx.

Abstract. The aim of this study was to evaluate the application of delayed expansion of the alveolar ridge in dental implantation. This method avoids the need to harvest autogenous bone and the requirement to fix a block with screws, and could help prevent the uncontrolled fracture and avascular necrosis that may result from the traditional alveolar split. Eighteen patients and 43 implants were included in this retrospective study. The width of the alveolar ridge was measured before implantation, immediately after implantation, and after the final restoration. The width increased significantly after the insertion of implants and decreased slightly after bone remodelling. Overall, the width of the alveolar ridge increased by 2.37 ± 1.44 mm on average, ranging from -0.20 mm to 5.75 mm. The results suggest the use of delayed expansion for horizontal alveolar bone augmentation; however, the maxillary premolar area may not be a suitable site.

Key words: horizontal alveolar ridge augmentation; delayed expansion; dental implantation; piezoelectric surgery.

Accepted for publication 26 May 2017

It has now become common practice to restore maxillary and mandibular edentulous areas with implants[1–3]. To obtain ideal osseointegration and a favourable restoration, the maintenance of at least 1 mm of alveolar bone width in the buccal and palatal plane is required[4]. Due to trauma, atrophy, or surgeries, there is often a lack of supporting alveolar bone, and in such cases bone augmentation represents an effective treatment option[5–7].

One of the most effective augmentation techniques is the alveolar ridge split, which has high reported success rates and good long-term outcomes[8,9]. However, it may result in uncontrolled fracture or avascular necrosis, especially in areas with a thick cortex[10]. Scarano et al. introduced a practical technique – delayed expansion of the atrophic mandible by ultrasonic surgery – which was shown to have a success rate of 96.88% at 3 months and to provide a mean increase in ridge width of 5.17 ± 0.86 mm[11]. This study retrospected the application of the delayed expansion technique in dental implantation and evaluated its restorative effects.

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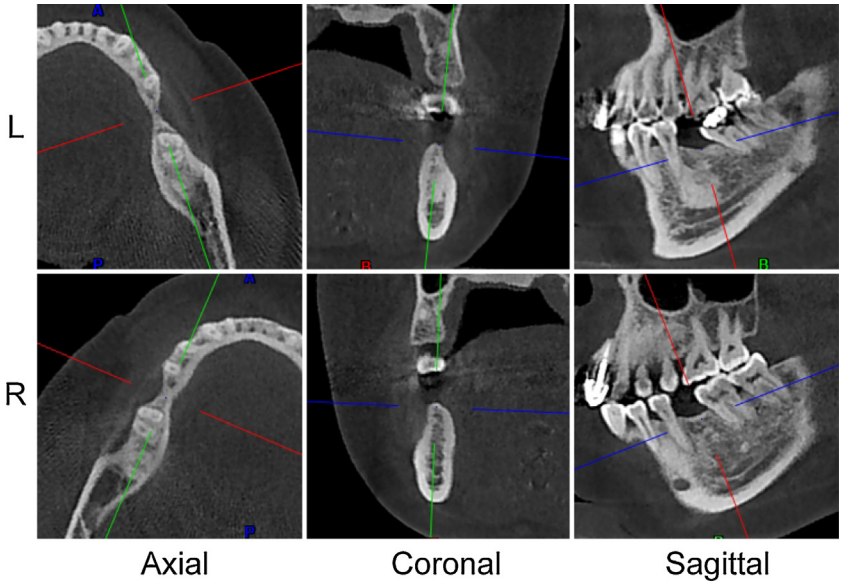

Fig. 1. Preoperative CBCT scan.

Materials and methods

Study design

Eighteen patients (age range 17–70 years) who needed dental implantation and had narrow alveolar ridges were included in this study. Forty-three implants were inserted with the performance of delayed expansion of the alveolar ridge, and the width of the alveolar ridge was measured before and after the surgery for each implant.

Surgical procedure

A representative case is illustrated in the figures. Clinical and radiological examinations of the patient revealed that both mandibular first molars were missing and the alveolar ridge was too narrow for the placement of dental implants (Fig. 1). Therefore the delayed expansion technique was chosen for alveolar ridge augmentation.

This procedure was divided into two surgeries. Before the first surgery, the patient rinsed with chlorhexidine solution for 1 min. After routine disinfection, both inferior alveolar nerves were blocked for pain control. A mucoperiosteal flap was raised with a paracrestal to palatal incision, followed by vertical releasing incisions. The alveolar ridge was extremely narrow. A trapezoid bone block was designed and shaped using an ultrasonic flat chisel. For this technique, the incision should penetrate the cortex of the alveolar bone and part of the cancellous bone. The wound was then closed to await revascularization between the bone block and mucoperiosteum (Fig. 2).

Four weeks later, the second surgery was performed (Fig. 3). After routine disinfection and anaesthesia, a small part of the mucoperiosteum was separated, and the designed trapezoid bone block was pushed to the buccal side along with the buccal mucoperiosteum, without damaging the new blood supply. Two implants (4.3 × 10 mm, NobelActive) were inserted separately and the residual space was filled with particulate bone and autologous bone, which was collected during drilling. A platelet-rich fibrin membrane (PRF) was used to cover the incision.

Seven months later, two healing abutments were inserted separately into the implants to facilitate the formation of soft tissue sulci. Finally, two permanent teeth, smaller than normal molars, were placed in the limited space (Fig. 4). The patient's postoperative recovery was uneventful.

Measurement of alveolar ridge width

The width of the alveolar ridge was measured before implantation (T1), immediately after implantation (T2), and after the final restoration (T3). At T1, the width was measured at 1 mm below the alveolar ridge. All implants were inserted 1 mm below the alveolar ridge, and the width (T2) was measured at the top of the implant. After the final crown had been mounted, the width (T3) was measured at the top of the implant again. Measurement of the alveolar width is illustrated in Fig. 5. In the axial plane (Fig. 5a), one of the cross lines is parallel to the long axis of

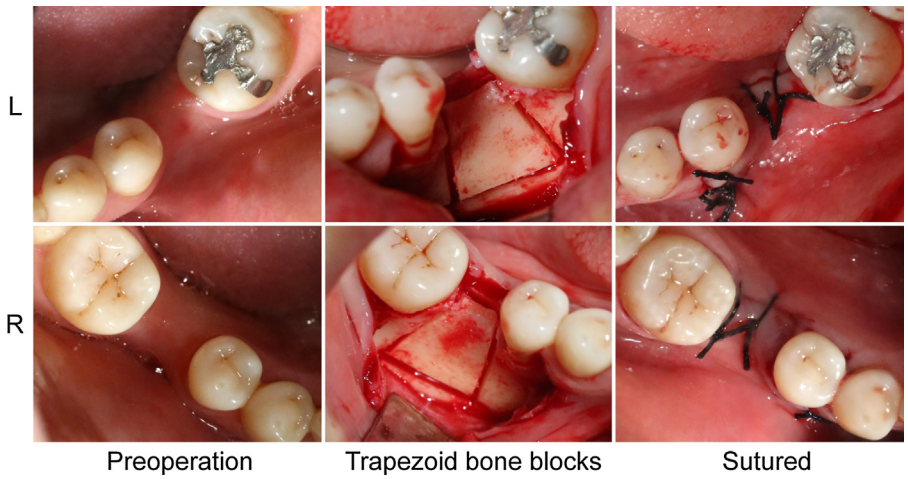

Fig. 2. Trapezoid bone blocks were designed.

Please cite this article in press as: Li X, et al. The application of a delayed expansion technique for horizontal alveolar ridge augmentation in dental implantation, *Int J Oral Maxillofac Surg* (2017), http://dx.doi.org/10.1016/j.ijom.2017.05.025