Bone expansion in one surgical step

Author_Prof Sergio Alexandre Gehrke, Bruno Konig Jr., Brazil, & Giovanni Wiel Marin, Italy

Fig. 1a


Fig. 1b


Fig. 2a

Fig. 2b

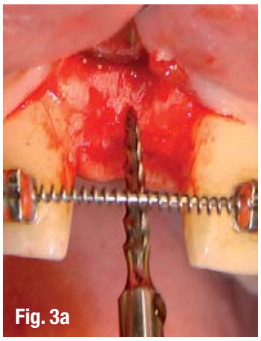


Fig. 3a


Fig. 3b

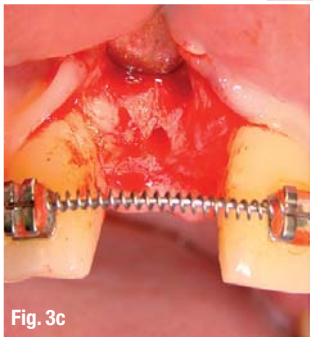


Fig. 3c

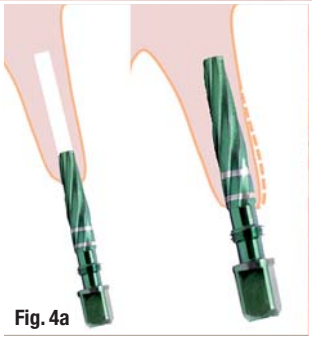


Fig. 4a

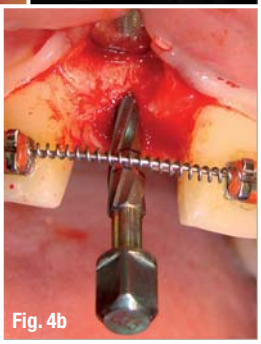


Fig. 4b

Figs. 1a & b_The countersinks (expanders) of the bone (a) and the conical implant (b).
Figs. 2a & b_Sinking of the bone (yellow arrow) before the surgery (a) and the radiograph thereof (b).
Fig. 3a–c_Bed preparation with a lance-shaped drill until planned depth was reached.
Fig. 4a & b_Sequence using the 3.5 mm expander.

_Introduction

Tooth extraction changes the height and thickness of the alveolar bone significantly, especially when tooth loss is the result of dental trauma, periodontal involvement, or when the vestibular wall is lost during extraction.[1] Bone deficiencies may hamper or prevent the use of dental implants owing to insufficient bone volume for holding implants of an appropriate size[2,3] or in aesthetic areas, hampering an adequate treatment of the case.[4] To correct this situation, various surgical procedures have been proposed. Bone grafts,[5] membranes for guided bone regeneration[6] and a combination of both of these techniques[7] have been used to increase bone volume.

Even though there is ample documentation on the success of bone grafts and membranes in terms of the number of cases and follow-up after the placement of implants in grafted areas, these procedures have some disadvantages, such the need for extra-oral or intra-oral bone, increased morbidity, risk of exposure and infection of the graft or membrane, and an unpredictable rate of bone resorption after implant placement.[8,9] Thus, surgical alveolar ridge expansion was proposed as an alternative in order to allow the placement of implants.[10] With the aid of hand tools, a longitudinal fracture is performed in the atrophic ridge, dividing it into two parts and thereby increasing its thickness for implant placement. Through the presentation of clinical cases, this article aims to demonstrate and evaluate a simple technique for increasing the bone volume in narrowed areas with the use of conical implants and bone expanders.

_Materials and methods

Two patients with missing teeth in different regions of the maxilla were selected. These patients, besides

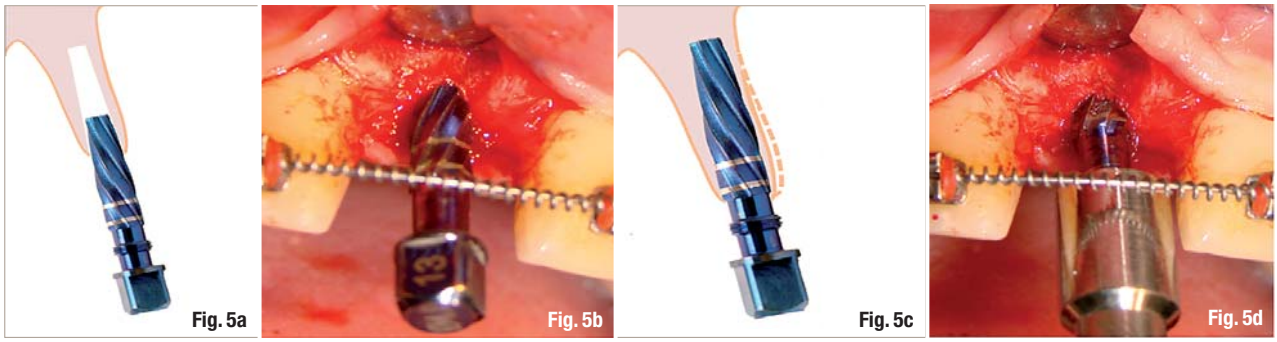


Fig. 5a–d_Sequence using the 4.0 mm expander.

meeting all the requirements concerning their general health, also exhibited the conditions necessary for the technique of bone expansion. The materials selected were countersinks and conical implants (Implacil De Bortoli; Figs. 1a & b). The design of the countersink must be appropriate to expand the design of the implant.

_Case presentation

Case I

A 21-year-old male patient presented to the clinic (Bioface Cirurgia Oral e Maxilofacial) for the replacement of tooth #11 with an implant. After a detailed anamnesis, it was found that the patient had no systemic involvement. From the clinical and radiographic examinations, we were able to verify the necessary conditions for the realisation of the expansion technique, followed by the immediate placement of the implant (Figs. 2a & b).

After obtaining consent to the proposed treatment plan, treatment was begun. After the initial perforation with a 2 mm drill, establishing the position and depth of the implant (Fig. 3), the countersink sequence was followed in order to expand the vestibular wall of the alveolus. The green colour corresponds to the countersink for a 3.5 mm conical implant (Fig. 4) and the blue to a 4 mm conical implant (Fig. 5). After this sequence, the site was finished (Fig. 6), an internal conical implant of 4.0 x 11 mm was inserted in the place of tooth #11

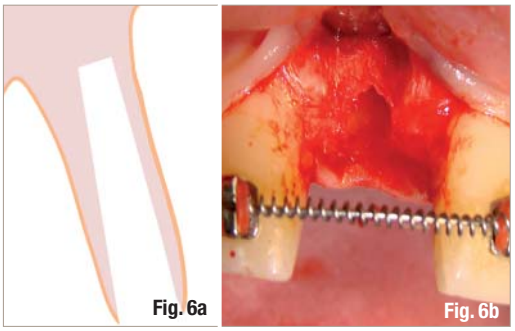
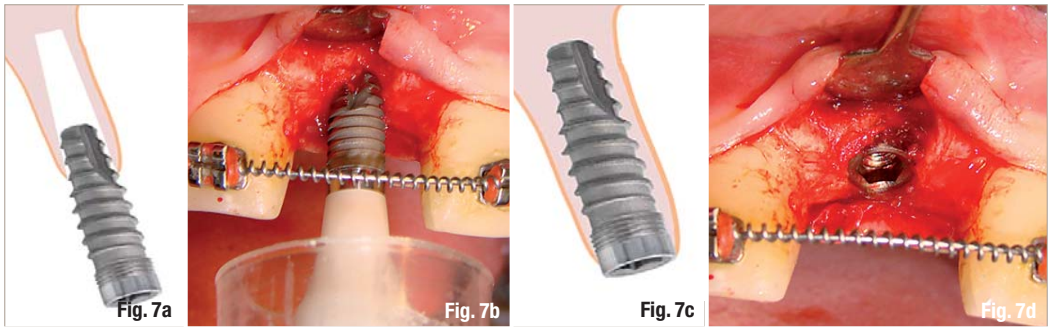


Fig. 6a & b_Prepared bed showing vestibular wall expansion.

(Fig. 7) and the site was sutured (Fig. 8). A prescription of 875 mg amoxicillin to be taken two hours before the procedure was given to the patient as preventive medication. He was also instructed to take the same amount of amoxicillin twice a day for five days to prevent post-operative infection, as well as 100 mg of the anti-in-



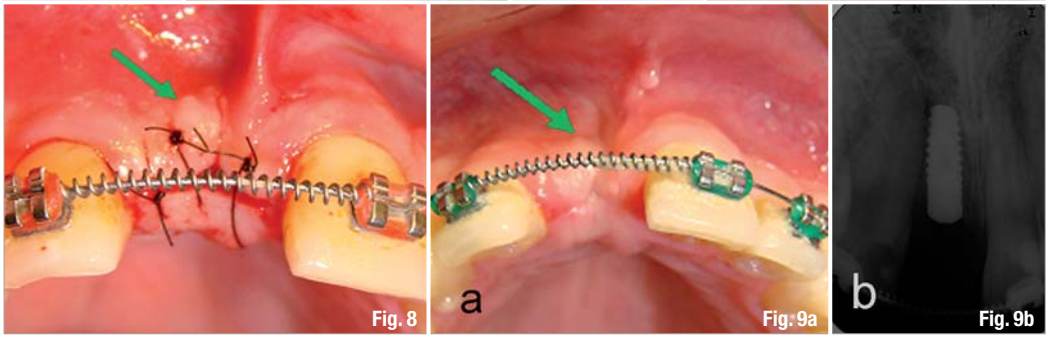


Fig. 7a–d_Placement of the implant with the same conical form of the instrument.
Fig. 8_After suturing, an increase in the volume of gingival mucosa was detected (green arrow).
Figs. 9a & b_Clinical (a) and radiographic control (b) after ten days. An increase in the volume of gingival mucosa was detected (green arrow).


Fig. 10a


Fig. 10b


Fig. 11

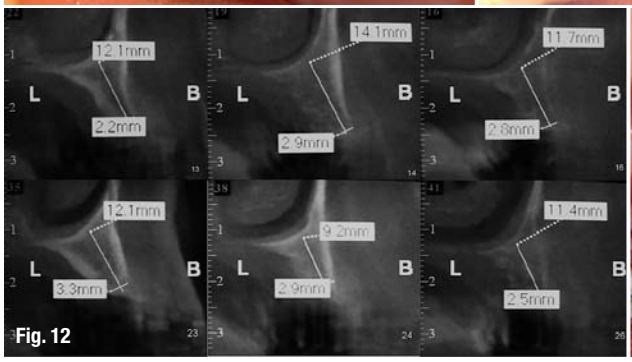


Fig. 12

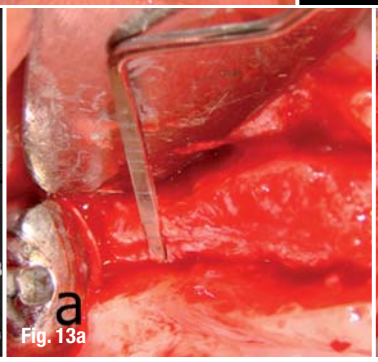


Fig. 13a

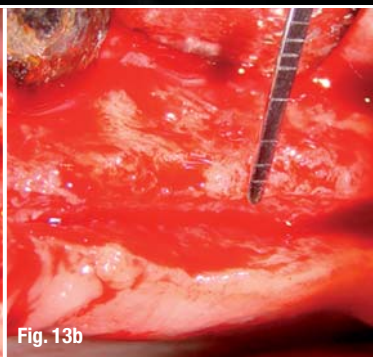


Fig. 13b

Fig. 10a & b_Clinical bilateral view of initial situation.
Fig. 11_Panoramic radiograph of initial situation.
Fig. 12_Tomograph of initial situation at each site.
Fig. 13a & b_Detachment of the mucosa and preparation of the implant bed, using countersinks to expand the bone area, resulting in an increase in volume.
Fig. 14a & b_Appearance of the implants immediately post-placement.
Figs. 15a & b_View of the mucosa (a) and radiographic control (b) three months after the surgery.

flammatory Profenid every 12 hours for three days post-operatively to control pain and prevent inflammation. In addition, rising twice a day with a 0.12% chlorhexidine mild mouthwash was recommended. Post-operatively, the implant was followed clinically and radiographically and no abnormality was detected after ten days (Figs. 9a & b).

Case II

A 61-year-old female patient presented to the clinic. Examination showed that bilateral tooth replacement was needed for teeth #13 to 16 and 23 to 26. After a detailed anamnesis, it was concluded that the patient had no systematic problems. After clinical (Fig. 10) and radiographic (Fig. 11 & 12) examination, the necessary conditions for the expansion technique and immediate placement of the implants were established as with the previous case.

The small volume of bone was confirmed after the opening of the mucosal (Fig. 13). Six internal conical implants, measuring 4.0 mm in diameter and of different lengths, were inserted (Fig. 14) and sutured. Post-operative prescription and care were the same as with Case I. Clinical and radiographic control followed post-operatively and after one month (Figs. 15a & b), showing good results. In both cases, the tomographic measurements after placement of the implant were used to measure and evaluate the expansion volume during surgery.

_Results

The volume of the bone regions that received the implants was measured prior to the expansion. The probing depth in millimetres at the flange was used for calibration and measurement around the implantation area (Fig. 16a) and confirmed with the tomographic measurements. After implant placement, these were used for calibration before the final measurement (Fig. 16b). Measurements were done using the Image Tool (version 3.0) for Windows (Microsoft), and the results are shown in Table I and Figure 17.

_Discussion

This paper presents a relatively simple technique for placing implants in regions with insufficient bone tissue, with the use of expanders to obtain an increase in bone volume. There have been fewer studies on the surgical expansion of the bed margin than studies on the


Fig. 14a

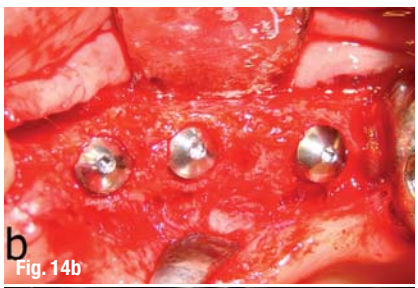


Fig. 14b


Fig. 15a

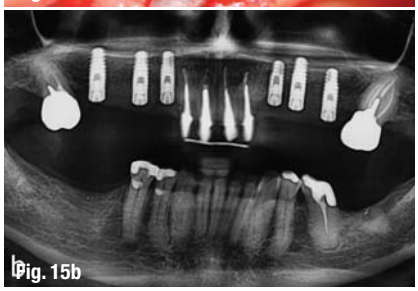


Fig. 15b

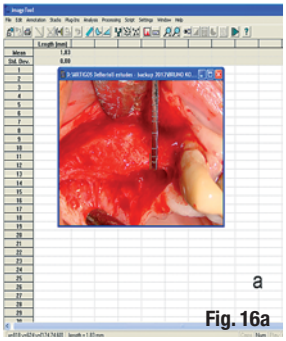


Fig. 16a

Fig. 16b

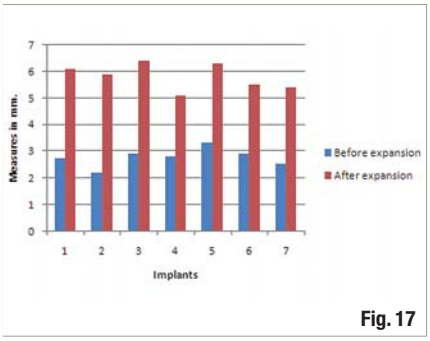


Fig. 17

Figs. 16a & b_Program, during calibration, used to measure the bone volume before (a) and after the expansion (b).
Fig. 17_Diagram comparing the measurements before and after the expansion.

use of surgical techniques for the same purpose.[11–14] Our technique offers some advantages over other techniques, such as being less invasive, requiring a shorter rehabilitation time and being of lower cost when compared with the costs of bone grafts and membranes. This technique should be applied only when the vestibular and lingual/palatal walls are separated by bone marrow[2, 15, 16] and when the base of the defect is greater than the bone crest at the border.[17]

Evaluation showed an average increase of 113.3 ± 29.6% when compared with the volume of the bone before surgery. In the literature, there is no information regarding the amount of expansion needed to allow implant placement. There are also only a few studies that evaluate the increase in bone thickness after expansion of an atrophic alveolar ridge.[2, 8, 16] Thus, it is recommended that more studies be conducted to investigate these aspects more accurately. Most reports focus on the maxilla. A probable reason for this might be researchers' preference for examining bone of low density. The technique reported on in this article can be said to be safe and to furnish predictable results. Very few complications have been reported,[17] but care must be taken not to create excessive expansion, leading to a fracture of the vestibular wall. In this case, it would be impossible to stabilise the implant. In a histological study evaluating the new bone formed in expanded areas, high osteogenic activity was revealed.[10] The authors mention important details that determine these conditions: the space created undergoes spontaneous ossification and the newly formed bone enables the consolidation of the palate and the vestibular wall. This procedure enables bone formation in an optimally expanded space.

_Conclusion

We conclude that the range of materials available on the market offers new alternatives with many advantages for the professional and the patient. The use of these materials can facilitate the placement of implants in areas of insufficient bone thickness, avoiding the need for regenerative procedures prior to and/or simultaneous with the implantation, and thereby reducing costs and treatment time. Further studies are necessary to assess these materials._

Editorial note: A complete list of references is available from the publisher.

_contact implants

Prof Sergio Alexandre Gehrke
Rua Bozano, 571
Santa Maria – RS
97015-001
Brazil

Tel.: +55 55 3222 7253
sergio.gehrke@hotmail.com

Case/Area	Volume	Final volume	Increase	Gain (%)
I/11	2.7	6.1	3.4	125.9%
II/13	2.2	5.9	3.7	168.1%
II/14	2.9	6.4	3.5	120.6%
II/16	2.8	5.1	2.3	82.1%
II/23	3.3	6.3	3.0	90.9%
II/24	2.9	5.5	2.6	89.6%
II/26	2.5	5.4	2.9	116.0%
Average/SD	2.7 ± 0.345	5.8 ± 0.491	3.0 ± 0.506	113.3 ± 29.6%

Table I

Table I_Values and averages obtained after measurement with Image Tool.