Surgical maxillary expansion anchored on dental implants: Case report

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Abstract

One of the most common transverse discrepancies and a frequent dentofacial abnormality is the transverse maxillary deficiency. Rapid maxillary expansion (RME) is the indicated treatment in these cases, but satisfactory anchorage is difficult to obtain in partially edentulous adult patients, which is a frequent contraindication for this type of orthodontic treatment. This study reviewed previous researches about surgically assisted methods of orthopedic expansion of the maxilla using dental implants as anchorage, and described a clinical case, in which two titanium implants were placed in the edentulous segment and a Hyrax expander was cemented to the provisional crowns, following a protocol described in the literature. Titanium implants remained stable and osseointegrated when forces were applied, which suggests that they may be suitable for orthodontic anchorage and support for maxillary expansion.

Keywords: Orthodontic anchorage. Dental implants. Rapid maxillary expansion.

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Introduction

Osseointegrated implants have proven to be a valuable tool in the treatment of some orthodontic conditions, particularly because an increasing number of adult patients, who have often lost one or more teeth, have sought orthodontic treatment. The use of implants to promote orthodontic movement has been reported regularly in the literature for over 40 years. Currently, the Bränemark system is commonly used when there are edentulous segments in patients that require orthodontic anchorage.[1]

Osseointegrated implants are similar to ankylosed teeth, which do not move when submitted to orthodontic forces. Therefore, they can be used as stable anchorage, as the absence of a periodontal ligament ensures that there will be no cell changes, which would, otherwise, result from tooth movement.

The indicated treatment for transverse maxillary deficiencies, dentofacial anomalies often seen in dental clinics, is rapid maxillary expansion (RME) using Hass or Hyrax expanders.[12]

The results of nonsurgical rapid maxillary expansion in adults are less than satisfactory, because their skeletal maturation reduces the response to expansion forces. Multiple missing teeth, severe buccal dentoalveolar inclinations, gingival recession, alveolar bone loss and mobility of maxillary posterior teeth are contraindications to rapid maxillary expansion in adults. These cases require maxillary osteotomies as an adjunct to expansion.[3]

The tooth-borne Hyrax expander — the appliance of choice in cases of surgically assisted rapid maxillary expansion (SARME) — is easy to clean, does not cause ulcers or erythema in the palatal mucosa, and does not affect the vascularization of maxillary bones.[13]

Before the development of dental implants, maxillary expansion was contraindicated for partially or totally edentulous patients because of the lack of teeth for anchorage. The need of anchorage is one of the greatest limitations in orthodontic treatments, as teeth have to move in response to the forces applied. Implants used as orthodontic anchorage are now a reality.

This study highlights the importance of a multidisciplinary approach, particularly including orthodontics, implantology and prosthetics, which ensures proper anchorage to movement teeth, correcting their position before prosthetic treatments; and the use of implants and abutments for prosthetic rehabilitation. High success rates have been achieved with this approach, and treatment results present long-term stability.[7,11,17]

This study describes surgically assisted maxillary expansion with tooth anchorage and discusses treatment advantages and efficacy based on a brief review of the literature and a clinical case report.

Clinical case report

A 42-year-old woman presented with transverse maxillary deficiency and bilateral posterior crossbite. Her partially edentulous maxilla precluded the use of a tooth-borne expander. She had a deviation of the maxillary dental midline, and one of her main complaints was the difficulty to breathe through the nose, probably due to maxillary deficiency (Figs 1 and 2).

Multidisciplinary treatment planning identified the need to restore function and esthetics, which were compromised because many teeth were missing. A surgically assisted orthodontic correction was chosen for rapid maxillary expansion. The expander had to be anchored at two different points in each half of the maxilla,

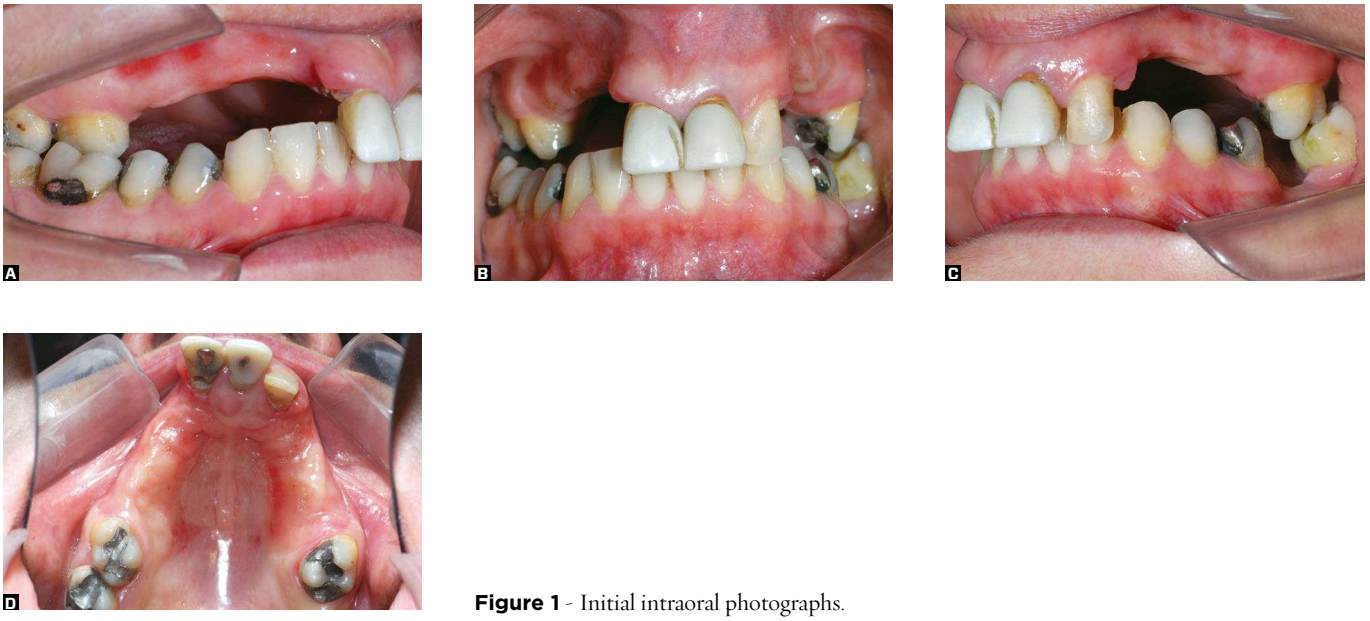

Figure 1 - Initial intraoral photographs.

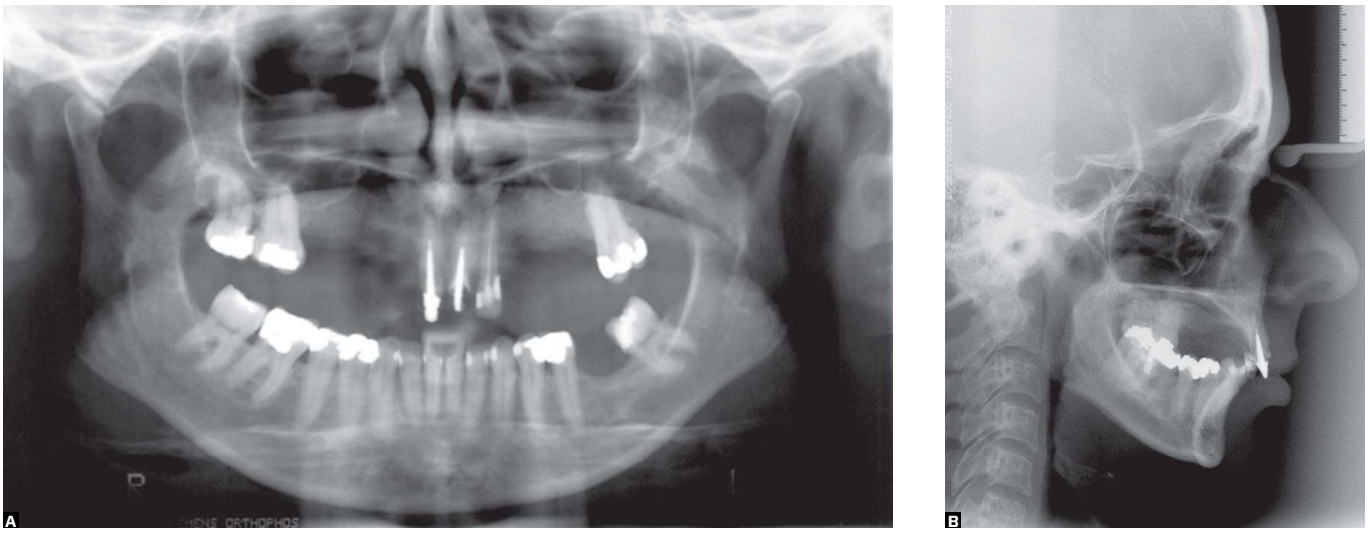

Figure 2 - Initial radiographs.

one in the anterior region, at the level of the first premolar, and another in a more posterior area, in the region of the first or second maxillary molar. Some of the maxillary teeth were missing, and satisfactory intraoral anchorage would not be possible. Therefore, two osseointegrated implants were placed in the region of the left and right maxillary canine and premolar, to be used as fixed anchorage for the expander. The treatment was then planned and conducted according to the following stages.

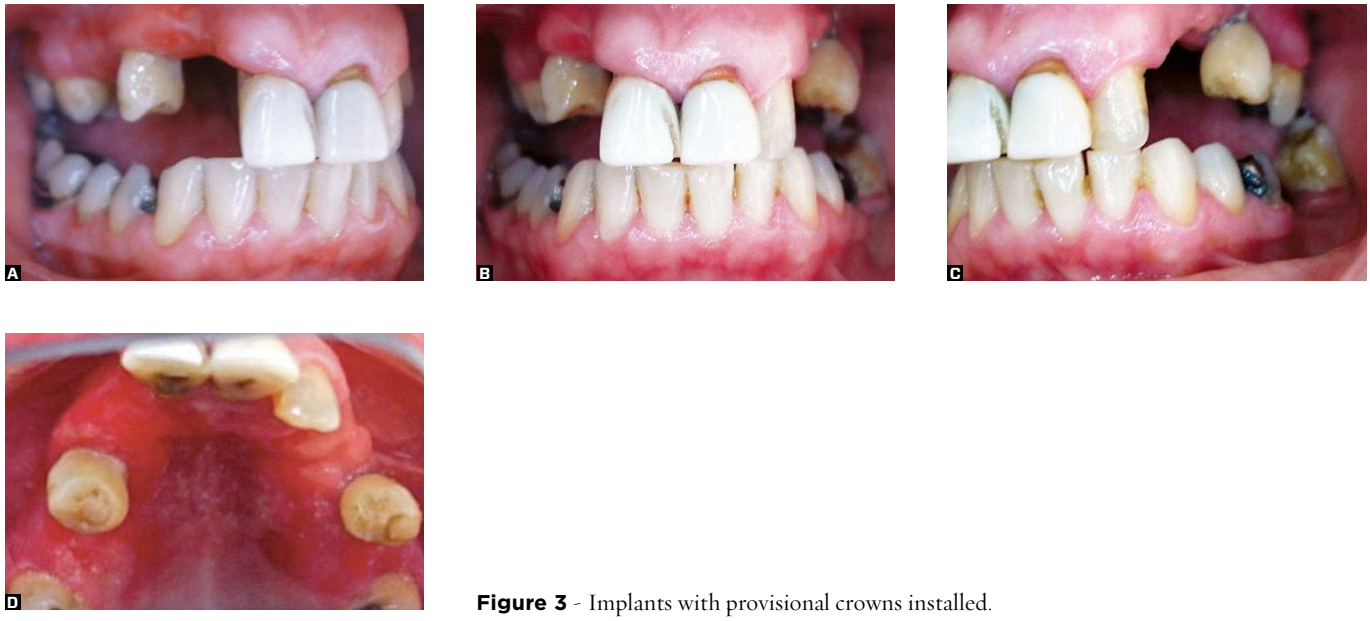

Figure 3 - Implants with provisional crowns installed.

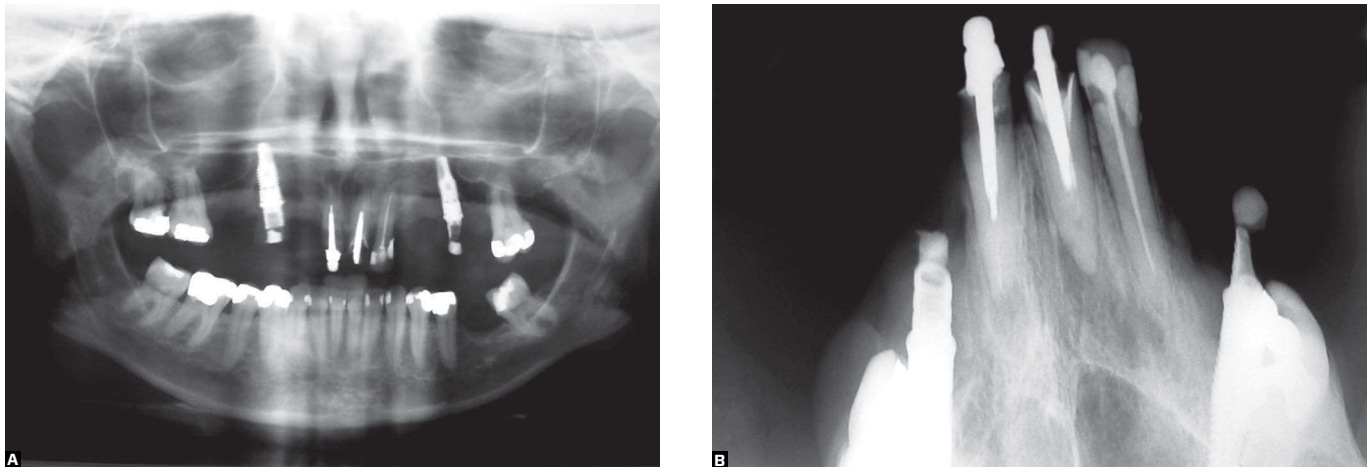

Figure 4 - Radiograph of implants with provisional crowns installed.

Placement of two dental implants in the right and left sides of the maxilla

As the patient did not have premolars and canines in either side, first we placed two dental implants in the region of teeth #13 and #25. The implants were positioned at sites where there were better bone conditions. The implants (Neodent, Alvim II Plus) were 4.3 mm in diameter and 10 mm long.

After three months of osseointegration, the implants were exposed again for the placement of the abutments and the temporary crowns (Figs 3 and 4).

Placement of expander and surgery to expand maxilla

The Hyrax expander was anchored using the two implants (region of teeth #13 and #25) and the teeth #16 and #27, and then the patient was referred to maxillary surgery. The high degree of integration between bone and the titanium implants provided the adequate stability for the anchorage of the expander.

The surgery was conducted in a hospital with the patient under general anesthesia. For the surgically assisted maxillary expansion, it was used a procedure similar to the Le Fort 1 osteotomy, and an osteotome was used for the immediate opening of the midpalatal suture (Fig 5). At this point, the expanding screw was activated three full turns. The appearance of a diastema between maxillary central incisors clinically confirmed the expansion.

Expander activation was resumed on the seventh postoperative day; the patient received instructions to activate the expander one full turn everyday (2/4 in the morning and 2/4 in the evening) until the transverse deficiency was overcorrected and the lingual tip of the maxillary cusps touched the buccal tip of the mandibular cusps. After the third full turn of the screw, incisors received the impact of maxillary expansion, characterized, from that point on, by a direct relation between the size of the diastema between incisors and the amount of orthopedic effect induced by expansion (Fig 6).

Figure 5 - Osteotomies in the maxillary expansion surgery.

After 14 days of expansion, the screw was locked and remained in the mouth as a passive retainer for another four months, the time necessary for new bone formation in the midpalatal suture. The expected expansion of 12 mm was achieved. The implants did not move and there was no pain.

The comparison of clinical findings and photographs confirmed the success of maxillary expansion using implant and tooth anchorage (Figs 7 and 8).

Orthodontic treatment with fixed appliances

The Hyrax expander was removed four months after the screw was locked, and the orthodontic treatment was completed using a fixed appliance in both maxilla and mandible. Maxillary teeth were moved using anchorage on the two implants, which remained stable and osseointegrated. Twenty months later, the fixed appliance was removed, and the patient received a removable maxillary retainer (Fig 9).

Figure 6 - Expanded maxilla, 30 days after surgery.

Figure 7 - Initial occlusal photograph.

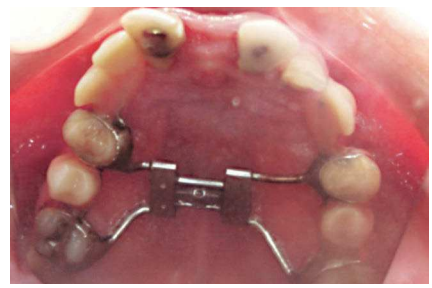

Figure 8 - Occlusal photograph after expansion.

Figure 9 - Finished orthodontic treatment.

Placement of implants in edentulous regions and definitive restorations in remaining spaces

Implants (Alvim Cone Morse, Neodent) 3.5 mm in diameter and 10 mm long were placed in the region of teeth #12 and #23. Biomaterials (BoneCeramic™, Straumann, Andover, MA) were placed in the buccal areas of the ridge and covered with resorbable membranes (Gen Derm™, Baumer).

Healing caps were used for three months to allow for osseointegration.

After that time, the definitive ceramic crowns were manufactured.

At treatment completion, radiographs were obtained to confirm results and, mainly, to check whether implant osseointegration was satisfactory (Figs 10 and 11).

Figure 10 - Final intraoral photographs.

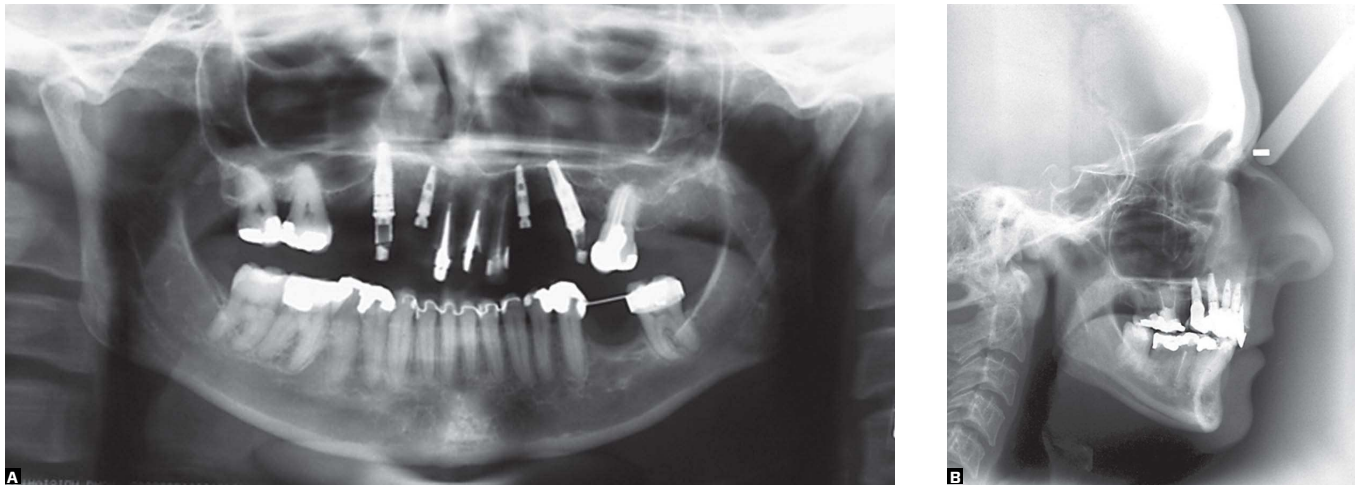

Figure 11 - Final radiographs.

Discussion

The excellent integration between bone and titanium implants provides suitable stability for the anchorage of an expander in orthodontic treatments. One of the main advantages of implants is their performance in conditions that require maximum anchorage, particularly in cases of patients with posterior edentulous segments.[5,16] Implants are also indicated when, in addition to serving as anchorage, they can later be used as abutments during the final stage of the orthodontic treatment.[11] In this case, the implant site should be carefully planned by the prosthetist. The implantologist and the orthodontist should share information to achieve a satisfactory result.

Dental implants ensure patient comfort, better esthetic results, faster treatment (because forces are applied for a shorter time), easy placement, great stability and the use of different activation rates.[6,19]

The clinical case described here confirmed what previous publications had already demonstrated, that is, that implants may be used as orthodontic anchorage without any peri-implant bone loss or loss of osseointegration. Implants in edentulous posterior segments can be used for fixed intraoral anchorage, and the orthodontic forces applied on them are directly transmitted to the peri-implant bone.[7,8,15]

Several types of implants and materials have been used by numerous authors, but most studies have been conducted with titanium implants: Orthosystem, Onplant, Sas, Gips, mini-implants, miniscrews, microimplants, titanium abutments, bicortical screws and osseointegrated implants currently used for prosthetic rehabilitation.[1,5,10]

Higuchi and Slack[14] and Ödman[18] studied the use of implants in human beings and found that there should be a time interval after implant placement to achieve ideal clinical and histological results. In their studies, orthodontic movements were always achieved and osseointegration was preserved until the treatment was complete.

A clinical pilot study[20] with six patients used endosseous implants as anchorage and a three-month interval before the beginning of the active phase of the treatment. During the nine months of the active phase, there were no signs of mobility or inflammation. Our study confirmed those findings.

The treatment of transverse maxillary deficiency using rapid maxillary expansion (RME) has been evaluated in several clinical and experimental studies, and RME has become a routine method for growing patients. In addition to increasing the maxilla transversely, RME also increase the nasal cavity width, which results in better air flow.

In adults, RME has limitations and complications, such as the resistance to expansion, little or no opening of the midpalatal suture, predominance of dentoalveolar expansion over transverse bone gains, excessive buccal tipping and extrusion of posterior maxillary teeth, absorption of buccal cortical bone, gingival recession, pain, edema, ulcers and ischemia of the palatal mucosa, besides a high relapse rate.[3] To avoid such complications, the treatment of choice is the surgically assisted maxillary expansion.

Expander anchorage using rigid implants has a number of advantages, such as preventing tipping of the teeth used as anchorage for the expander. Also, all the forces released by the activation of the screw are transferred to the separation of the intermaxillary suture. Other advantages, in addition to greater orthopedic effect, are the transverse increase of the maxilla, the reduction of relapses, and a consequent long-term stability.[2,9]

Maxillary expansion anchored on teeth results in a certain amount of buccal bone resorption, as well as greater risk of gingival recession. The teeth that anchor the expander move along the alveolar bone, and not together with it. These unwanted side effects may be avoided with the use of implant anchorage. Posterior teeth remain centralized in the alveolar ridge, and the periodontal anatomy is preserved, which promotes the health of the anchorage system and protects teeth in the long term.

No sign of mobility or inflammation around the implants was found during and after the treatment of this clinical case. The patient was very happy with the results achieved by the multidisciplinary team, and her esthetic, functional and respiratory conditions improved.

Conclusions

The description and analysis of this clinical case, together with our review of the literature, suggest that:

1) The benefits for the patient may be significant when the orthodontist coordinates tooth movements and implants, orthognathic surgery and prosthetic treatment to achieve all the treatment objectives.
2) The high degree of integration between bone and the titanium implants provides adequate stability for anchorage in orthodontics.
3) Basic conditions, such as the selection of implant placement site, bone quality, adjacent anatomic structures, implant size and the time necessary for osseointegration, should be considered in the analysis of demands for stability and effectiveness in receiving the forces that are applied to the implants.
4) The technique described in this study for maxillary expansion using dental implant anchorage led to a high degree of success for the treatment planned.
5) Osseointegrated titanium implants may be used as abutments for prosthetic rehabilitation after orthodontic treatment.

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