Case Report RS:

Guided tissue regeneration precedes tooth movement and crossbite correction

This patient presented with a Class III malocclusion and an anterior crossbite. Although spaces were present distal to the mandibular canines, the alveolar ridges were greatly atrophied. New bone was acquired through guided tissue regeneration. The alveolar ridges were augmented, followed by successful orthodontic tooth movement and correction of the Class III relationship and the anterior crossbite.

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The concept of guided tissue regeneration was developed from numerous studies on healing following periodontal surgery. Inconsistent bone healing is, to a large extent, caused by the rapid ingrowth of connective tissue into the wound area, which prevents osteogenesis. Studies in animals as well as in humans have shown that such ingrowth can be prevented by the placement of a biological membrane with a pore size small enough to prevent penetration of connective tissue (including the periosteum). In the empty space that is created, cells capable of inducing bone formation are allowed to proliferate. This results in closure of the space with bone tissue.[1]

Many researchers have documented the great potential of this technique for bone regeneration, not only in periodontics[2] but in osseous healing of various other types of bony defects as well.[3,4]

The boundaries of orthodontic tooth movement have broadened to include treatment of patients of all ages. Adult patients now represent a significant percentage of the population in almost every orthodontic practice, but treatment of these patients often raises some difficult issues. Old extraction spaces with subsequent atrophy of the alveolar ridges are a problem because they require either the insertion of implants or orthodontic movement of neighboring teeth into the spaces.

In the case reported here, guided tissue regeneration was used to acquire new bone in old atrophied extraction sites. Teeth were moved within the newly formed bone, spaces were closed, and the malocclusion was corrected.

Patient RS

When patient RS presented to our clinic, her mandibular left third molar and both maxillary third molars were partially erupted, and the mandibular right had been extracted. Both maxillary laterals were peg-shaped and the left one was severely resorbed. In centric occlusion, the molars on both sides were in a super Class I relationship and the canines were in Class III. The patient had a canine-to-canine anterior crossbite (Figure 1). Spaces of 3 to 4 mm were present in the mandibular arch distal to the canines. The alveolar ridges in these areas were very narrow and deficient (Figure 4). The patient's medical history was noncontributary. Oral hygiene was good and she had received regular dental care. The patient had received orthodontic treatment as a youngster; that treatment included removal of the impacted maxillary left canine, maxillary right first premolar, and both mandibular first premolars, and alignment of the maxillary right canine.

Pretreatment periodontal evaluation revealed no inflammation or pockets.

Cephalometric analysis yielded the following measurements: SNA=82°, SNB=84°, and a negative ANB=-2° indicating a skeletal Class III relationship. The mandibular incisors were upright (1:GoMe=90°, 1:NPog=4 mm), while the maxillary incisors were protruded (1:SN=114°). The

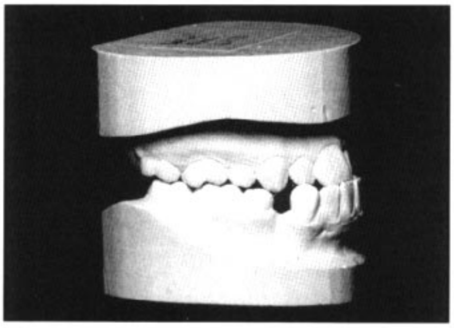

Figure 1A

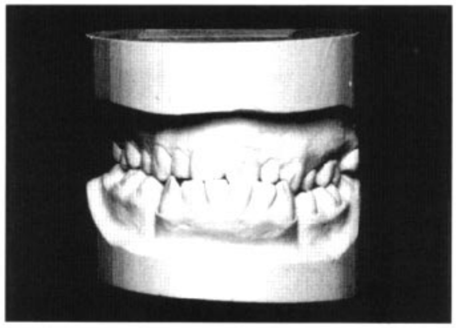

Figure 1B

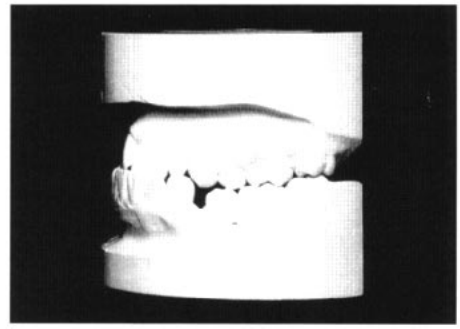

Figure 1C

Figure 1A-C
Pretreatment study models.

Figure 2
Pretreatment cephalometric analysis.

Figure 3A-C
Pretreatment radiographs.

Figure 4A-B
Occlusal view of the left and right deficient alveolar sites.

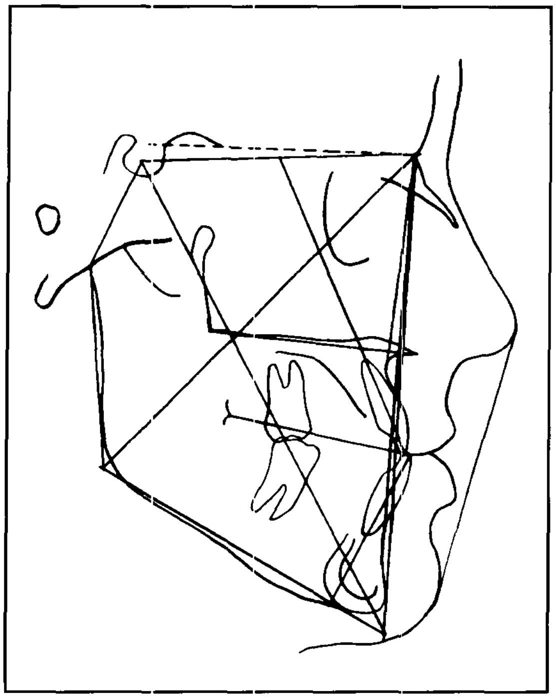

Figure 2

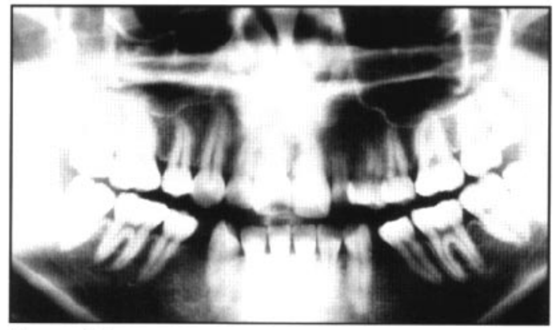

Figure 3A

Figure 3B

Figure 3C

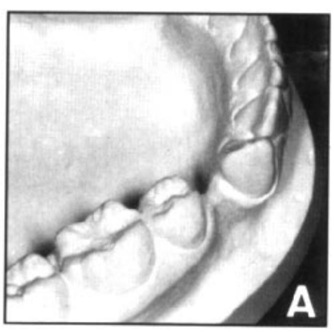

Figure 4A

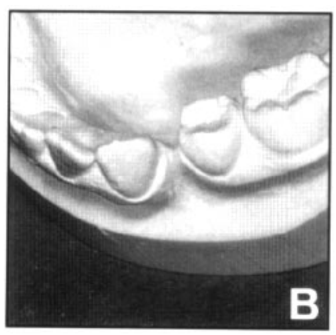

Figure 4B

patient had a slight Class III profile with a retruded upper lip and a prominent lower lip (Figure 2).

Treatment plan

The patient did not exhibit a severe Class III profile, although an anterior crossbite was present.

Orthognathic surgery was proposed at first. Tooth movement on very narrow alveolar ridges and against cortical bone could compromise the integrity either of the moved tooth, causing root resorption, or of the periodontium, causing bone loss.

However, any surgical procedure in this patient would have had an adverse effect on the profile. These considerations led us to search for alternatives to circumvent the alveolar deficiency.

Guided tissue regeneration has been used to augment alveolar ridges prior to the placement of titanium dental implants.[4] We decided to take an analogous approach and initiated guided tissue regeneration prior to orthodontic space closure. This technique is fully described elsewhere.[5] Briefly, however, after preparation of a full thickness flap, the alveolar bone was perforated and covered with a GTAM-membrane to create a space filled with blood (Figure 5). The patient remained under regular observation, and after 6 months the membranes were explanted. Enough bone was present (Figure 6), and 3 months later orthodontic treatment was initiated.

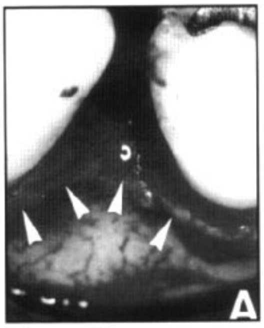

Figure 5A

Figure 5B

Figure 5C

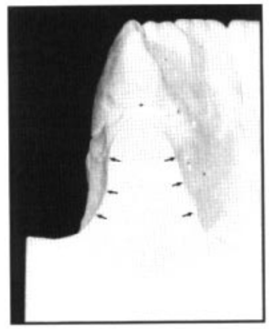

Figure 6A

Figure 6B

Figure 5A-C
Intraoperative photos of deficient alveolar ridges (right side).
A. Before augmentation. Note the curvature of cortical bone (white arrows).
B. The membrane in place covering the defect and creating a space unterneath filled with blood.
C. Six months later, new bone covers the defect on the alveolar ridge.

Figure 6A-B
Model sections perpendicular to the right side alveolar ridge (A) before and (B) after the augmentation. Note the marked widening of the alveolar ridge.

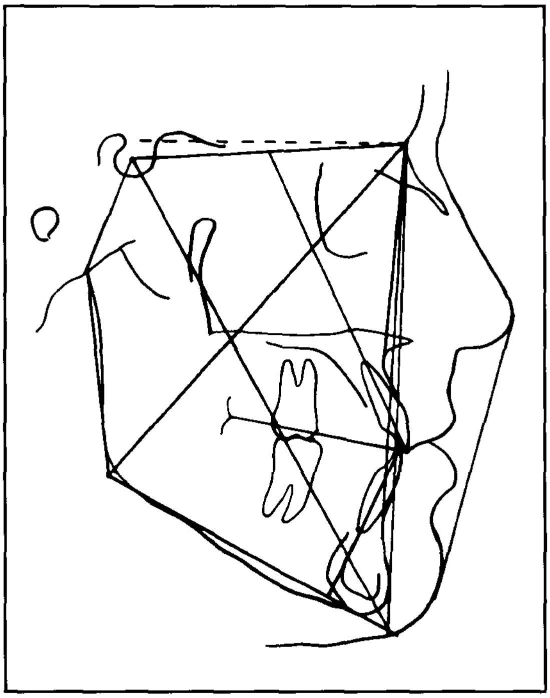

Figure 7

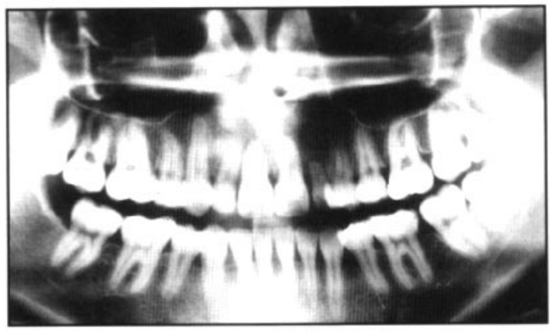

Figure 8A

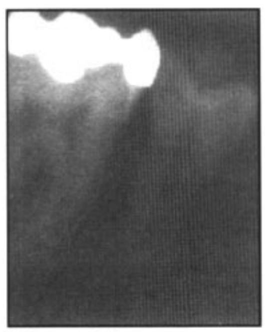

Figure 8B

Figure 8C

Figure 9A

Figure 9B

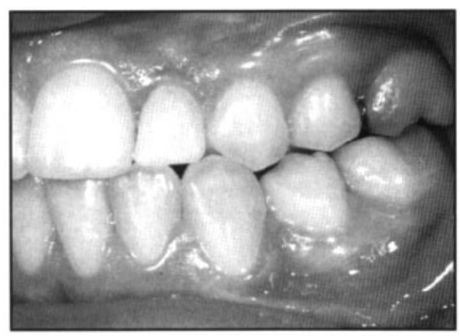

Figure 9C

Orthodontic treatment

Both arches were fully bonded or banded. The mandibular canines were moved distally using very light forces, and the incisors were retracted. The maxillary arch was expanded slightly to correct the anterior crossbite. The superimposed cephalograms showed improved maxillary and mandibular incisor positions, and the appliances were removed 19 months after the initiation of orthodontic treatment. Maxillary and mandibular Hawley retainers were inserted as retention appliances.

Treatment results

The treatment was a satisfactory alternative to surgery. The Class I molar relationship was retained, a Class I canine relation was achieved, and the anterior crossbite was corrected.

The inclination of the maxillary front teeth had improved (1:SN=111°), the mandibular front

Figure 7
Posttreatment cephalometric tracing.

Figure 8A-C
Posttreatment radiographs.

Figure 9A-C
Posttreatment intraoral photographs.

teeth had moved posteriorly (1:MeGo=88°), and a positive overjet was achieved. The profile appeared straight and was obviously improved.

Posttreatment periodontal evaluation of the mandibular canines and the neighboring premolars revealed no present inflammation and no apparent pockets. Radiographic examination showed no detectable bone loss (Figure 8).

Discussion

After 19 months of treatment a very good result was achieved and surgical correction was no longer needed. Though surgical techniques are often the only solution in treating certain skeletal discrepancies, risks and complications associated with surgery must be considered in borderline cases. Greater stability has recently been reported for orthodontically treated Class II borderline cases when compared with surgically treated cases.[6]

The biologic principle underlying the guided tissue regeneration technique was the means to regenerate alveolar bone prior to orthodontic tooth movement.

Increased connective tissue attachment has been reported when employing guided tissue regenerative techniques for the treatment of periodontal defects.[2] It has also been shown that by using a membrane technique, healing is greatly facilitated and bone regenerates in bony defects.[1,3] Application of the principles of GTR techniques appears to hold great promise in the development of new methods for treating bone deformities. Examples of such situations include healing of long bone, augmentation of the crestal bone in edentulous areas of the jaws, and healing of cystic bone defects, as well as applications within craniofacial surgery.

In the case presented here, successful orthodontic tooth movement occurred within newly acquired bone. The teeth were moved a relatively small distance of 3 to 4 mm in an area of new bone tissue without compromising the integrity of the moved teeth and without losing any bone, as the radiographic and periodontal evaluation revealed. The GTR technique holds much promise for orthodontic patients. The generation of bone tissue and subsequent tooth movement can be the solution for many difficult situations, especially in adult patients. More case reports are needed to establish routine procedures, identify problems that might occur during treatment, and explore the limitations of this technique.

The incorporation in orthodontics of advanced techniques used in other dental fields broadens our perspective and provides us with alternatives to resolve difficult therapeutic problems.

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