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CASE REPORT Orthodontic Traction of a Permanent Canine Through a Secondary Bone Graft in a Unilateral Cleft Lip and Palate Patient

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The treatment protocol for patients with complete unilateral clefts of the lip and palate1 (UCLP) in our center at the University of São Paulo, Brazil, includes cheiloplasty, performed after the age of 3 months, and palatoplasty, performed after the age of 1 year. 2,3 However, this early intervention leaves a residual alveolar cleft between the maxillary processes that can compromise further dental rehabilitation.

Because primary surgery cannot prevent the cleft from affecting midfacial growth, the UCLP patients tend to demonstrate a Class III relationship, maxillary constriction, and anterior crossbite during adolescence.2-4 Orthodontic intervention is usually required, in conjunction with orthopedic procedures (if growth remains) or surgical repositioning.3

A periapical radiograph of the cleft area is important in determining the length of the bone deficiency and its relationship to the dentition. Lack of alveolar bone may impede orthodontic movement of the adjacent teeth to the point that prosthodontic treatment is needed.

Missing, malformed, or malpositioned teeth are often found adjacent to the cleft. The lateral incisor tends to be missing in clefts with complete alveolar involvement; even when this tooth is present, it usually has an abnormal morphology and structure. In large cleft areas, permanent canines will have difficulty in erupting due to bone deficiency, and when they finally erupt, progressive bone loss is usually seen in the surface adjacent to the cleft.

Depending on the extent of the bone defect, the mesial bone on the cleft side and on the distal surface of the adjacent central incisor may be limited to cortical bone. The canine and the lateral incisor (if present) can erupt without periodontal problems only if the alveolar cleft is filled with alveolar-like bone. This procedure is called bone grafting—primary if performed before or during the primary dentition, or secondary if performed at the end of the mixed dentition.

Our hospital has never used primary bone grafting because of its adverse side effects. In fact, most rehabilitation centers are now eliminating this technique in favor of secondary bone grafting for the treatment of residual alveolar clefts.

Secondary Bone Grafting

Although bone grafting is more than 100 years old, the current procedure of secondary bone grafting was established by Boyne and Sands in the 1970s.5-7 The technique involves autogenous transplantation of highly cellular cancellous bone from the iliac crest to the alveolar ridge, completely filling in the residual alveolar cleft.5-14

This procedure is indicated for all types of clefts involving the alveolar ridge. Secondary bone

grafting is usually performed at age 9 to 12, immediately prior to the eruption of the permanent canine. The ideal timing, regardless of chronological age, is when the roots of the canines show one-fourth to three-fourths of their development.1,6,9,10,12,13,15-21

Secondary bone grafting offers the following benefits:

- Stabilization of the maxillary segments, mainly the premaxilla, in bilateral cleft cases.
- Bone support for the alar cartilage.
- Continuity of the alveolar ridge from the creation of new alveolar bone in the cleft area.
- Continuity of the dental arch, with the possibility of moving teeth through the grafted area.
- Opportunity for spontaneous or induced eruption of the permanent canine as the periodontium develops.6,7,9,10,13,16,17,19,22

Orthodontic Treatment

Secondary bone grafting requires orthodontic preparation in leveling and aligning the maxillary teeth. Maxillary deficiency seems to be the most common pattern in UCLP patients, but the magnitude of the skeletal problem is highly individual. The treatment plan usually includes rapid maxillary expansion followed by maxillary protraction. Subsequent bone grafting would seem likely to make the expanded maxillary arch more stable, but this does not always happen,23,24 probably because the grafted bone becomes part of the alveolar bone and does not function as a wedge.

Unlike primary bone grafting, which uses rib bone, successful secondary bone grafting will show normal trabecular features of alveolar bone radiographically within three or four months after the grafting.5,10 This provides the tooth-bearing function for the developing dentition and allows for dental eruption and formation of a normal supporting periodontium.

The likelihood of spontaneous eruption of the permanent canine through the grafted area significantly decreases if the canine erupts prior to the secondary bone grafting.10,19 If the canine does not erupt spontaneously, however, it can be pulled orthodontically through the grafted bone.

A retrospective study of secondary bone grafting in 46 patients with complete alveolar clefts, age 7 to 14, found that all canines reached their correct positions in the alveolar ridge.16 The canines erupted spontaneously in 27% of the cases; 17% required surgical removal of soft tissue and/or bone to expose the impacted canines, and the remaining 56% required orthodontic traction. In a similar study of 18 patients with unilateral clefts, the same authors found that 44% of the canines on the cleft sides needed orthodontic traction.17 The present article describes such a case.

Case Report

A boy with a complete left UCLP received a cheiloplasty at 6 months of age and palatoplasties at 18 and 24 months (hard and soft palate, respectively). A secondary lip repair was performed at age 9 years and 4 months.

At age 12 years and 6 months, clinical examination showed the typical facial and occlusal characteristics of early-operated UCLP patients: a residual alveolar cleft, a Class III relationship, maxillary arch constriction, and anterior crossbite2-4 (Fig. 1). Radiographic examination revealed a missing maxillary permanent lateral incisor and a peg-shaped pre-canine mesial to the permanent canine on the cleft side (Fig. 5A).

The maxillary arch, although constricted, had acceptable morphology. Therefore, the treatment plan involved correction of the interarch sagittal discrepancy by rapid maxillary expansion, followed by maxillary protraction with a facial mask (Fig. 2). This is our usual approach for patients who do not require orthognathic surgery. In 10 months, the orthopedic maxillary advancement produced a good facial result and eliminated the anterior crossbite, thus eliminating the need for orthognathic surgery (Fig. 3). At age 14, the patient underwent a secondary bone graft and the closure of an oronasal fistula (Fig. 3B). The permanent canine did not erupt spontaneously through the grafted bone. Ten months after the secondary bone grafting, it had to be moved orthodontically using vertical elastics anchored to the mandibular arch (Fig. 3D).

The maxillary expansion did produce a certain amount of dental compensation, as confirmed by the cephalometric superimposition (Figs. 4A and 4B).

The canine did not show any crown or root alterations during any phase of the treatment (Fig. 5). Several authors have mentioned a slight risk of external root resorption near the cementoenamel junction of the canines adjacent to the bone graft, but these cases all involved bone grafting after the eruption of the canine.10,12,25,26 The canine that was pulled through the bone graft in the present case demonstrated clinically acceptable periodontal support, confirming other reports.17,27,28 □

FIGURES

Fig. 1 12-year-old male in permanent dentition with Class III malocclusion and anterior crossbite. Cleft divides maxilla into two segments, with smaller alveolar segment on left.

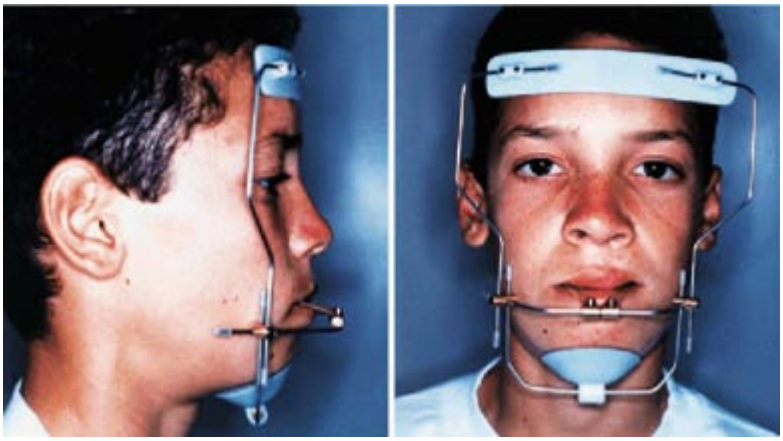

Fig. 2 Protraction appliance for maxillary advancement.

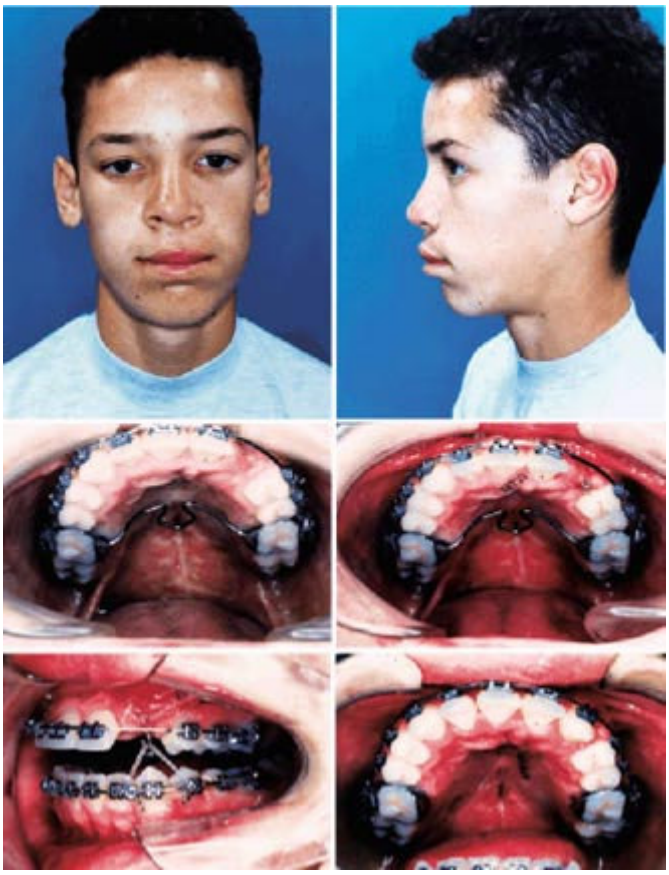

Fig. 3 A. After 10 months of treatment, showing effect of maxillary advancement on facial pattern and significant improvement in anteroposterior relationship. B. After secondary bone graft at age 14. C. Before orthodontic traction of maxillary left permanent canine. D. During orthodontic traction. E. After orthodontic traction.

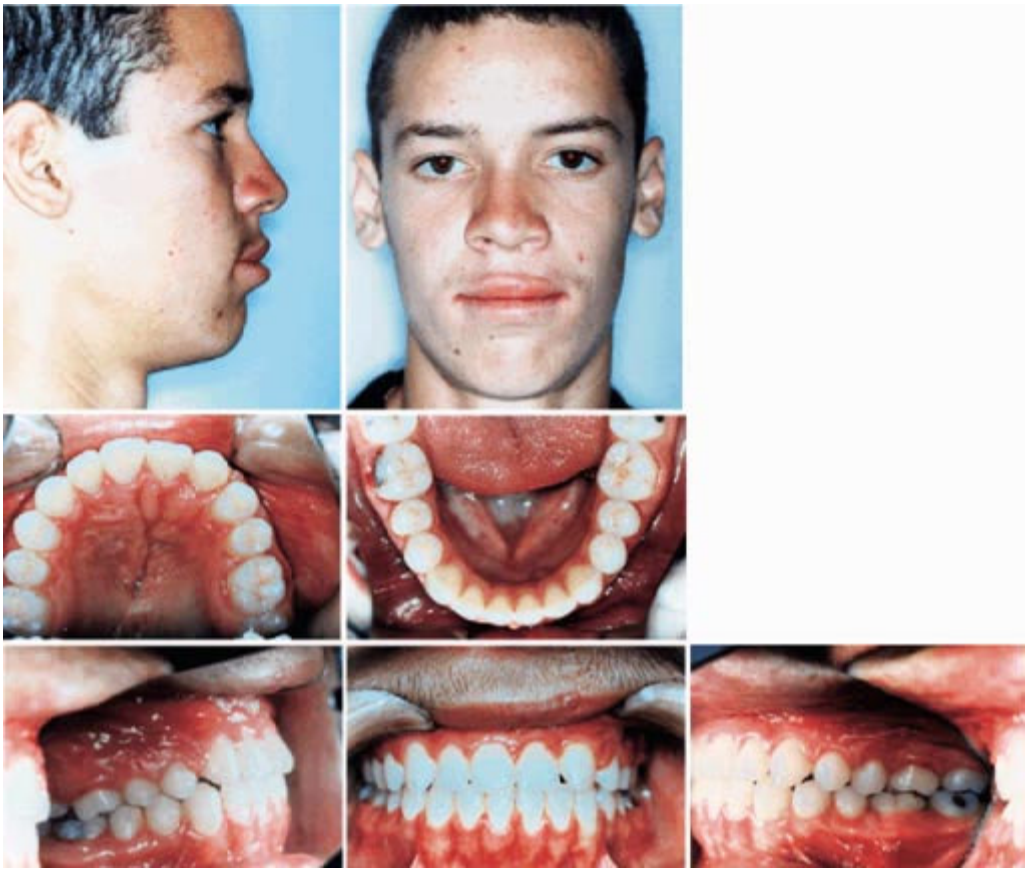

Fig. 4A Patient at age 16, after completion of orthodontic treatment. With elimination of alveolar cleft, maxillary left permanent canine replaced missing maxillary permanent lateral incisor.

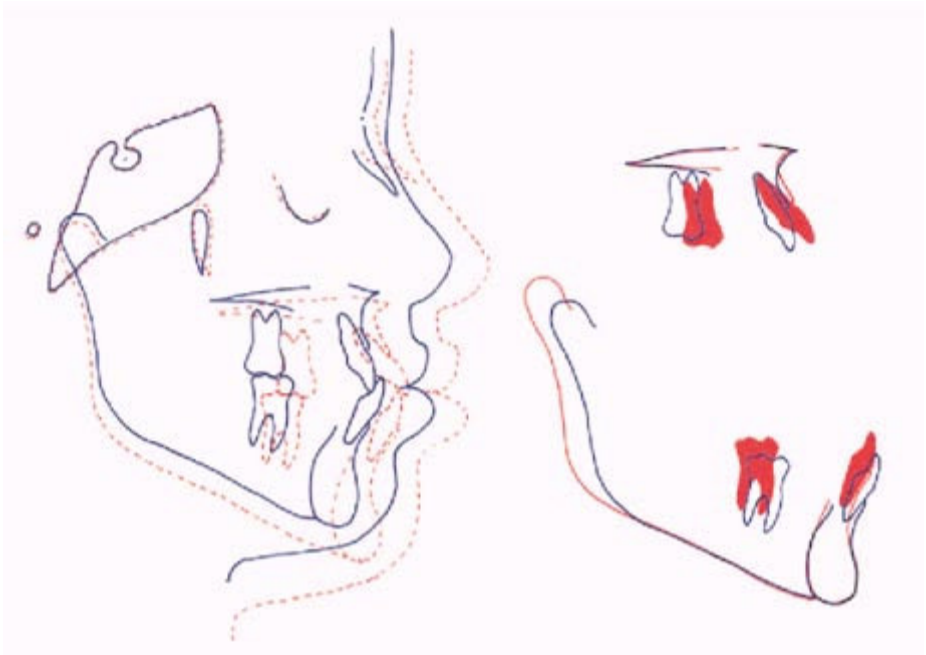

Fig. 4B Superimposition of cephalometric tracings before (blue) and after (red) treatment, showing facial and dentoalveolar alterations due to growth and orthopedic-orthodontic therapy, as well as dental compensation of maxillary incisors (1-PP from 111° to 127°) and mandibular incisors (IMPA from 93° to 85°).

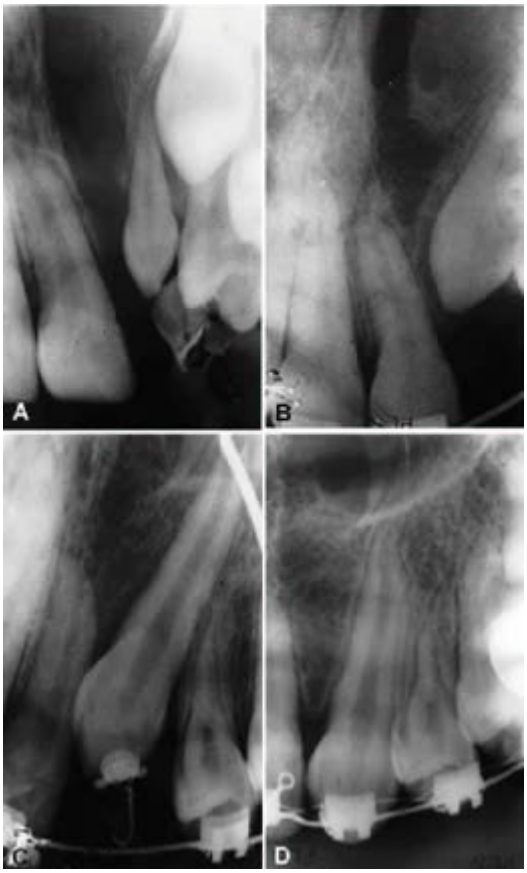

Fig. 5 Path of maxillary left permanent canine on cleft side. A. Before treatment. B. After secondary bone graft. C. During orthodontic traction. D. After orthodontic traction.

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