Secondary Bone Grafting in Cleft lip and Palate with Eruption of Tooth into the Graft: A Case Report.

BATRA P a, SHARMA J b, DUGGAL R c, HARI PARKASH d

ABSTRACT
Secondary bone grafting in cleft lip and palate patients is performed preferably before the eruption of permanent canine in order to provide adequate periodontal support for eruption and preservation of the teeth adjacent to the cleft. Presented here with is a case of unilateral cleft lip and palate, which was followed up from birth to 15 years of age. The role of an orthodontist in the team approach for management of such anomalies is described. Also discussed in detail is the entire range of treatment procedures the child underwent, especially the role of secondary bone grafting.

Keywords : Bone grafting, Cleft lip, Cleft palate, Secondary

INTRODUCTION
The main difference in the interdisciplinary treatment protocol in the management of cleft lip and palate is the timing of occurrence of bone grafting. Accordingly the graft may be classified as primary, secondary and tertiary. When performed during early childhood, at the same time as the primary repair surgeries, bone graft is called as primary. Some authors believe that this early procedure can cause impairment of the maxillary growth. Because of its controversial and counterproductive aspect, most rehabilitation centers that used to perform it have abandoned this technique. Bone grafting is called as secondary when performed later at the end of the mixed dentition. It is the most accepted procedure and is performed preferably before eruption of the permanent canine in order to provide adequate periodontal support for eruption and preservation of the teeth adjacent to the cleft. When bone grafting is performed in the permanent dentition after the completion of orthodontic treatment, it is called a tertiary or late graft. Tertiary grafts are performed to enable prosthetic and periodontal rehabilitation and to assist in the closure of persistent bucconasal fistulae. A tertiary or late bone grafting cannot repair bone loss in teeth adjacent to the cleft. Occasionally, tertiary grafts cause progressive root resorption on the cervical thirds of roots of teeth adjacent to the cleft, especially canines. Such root resorption is caused by the contact of the grafted bone to the exposed root surface1-5. Studies show that secondary bone grafting can repair the cleft alveolus without increasing the already known iatrogenic effects of primary surgery on the maxillary growth. Mostly the Oslo cleft team is based on sound biological and technical principles and has extensively reported secondary bone grafting in literature. Grafted cancellous bone fills in the residual alveolar cleft and is anatomically joined to the adjacent bone, becoming indistinguishable in radiographic images after an average period of 3 months. From an orthodontic viewpoint, the most important benefit of secondary bone grafting is that the newly grafted bone acts as the alveolar bone, allowing the spontaneous migration of the adjacent canine towards the alveolar ridge. Therefore, bone grafting has become mandatory in the treatment protocols of cleft patients, establishing two well-defined stages for orthodontic mechanotherapy (pre and post secondary bone grafting). During the prebone grafting orthodontic phase, the upper dental arch is prepared for the graft and the permanent incisors are aligned whenever necessary. The pregraft orthodontic treatment also results in better access for the surgeon at the time of the grafting procedure. The presurgical orthodontic preparation involves predominantly transverse mechanics with the use of orthodontic or preferable orthopedic expansion during the mixed dentition in order to reposition the palatal segments. Occasionally some patients are subjected to maxillary protraction in addition to expansion in order to correct maxillary antero-posterior deficiencies. Three months after the bone graft procedure, and depending on the radiographic image of the area, orthodontic treatment is restarted to correct the position of the permanent teeth. This phase involves movement of the teeth through the grafted area6-11. Here a case of unilateral cleft lip and palate is described, which was followed up in our hospital from birth to 15 years of age. The role of an orthodontist in the team approach for management of such anomalies is also discussed.

CASE REPORT
A 2-day-old child born in a district hospital was referred to the dental surgery department of AIIMS for management of facial deformity. The child had been born with unilateral cleft lip and palate (primary palate). The patient’s parents were counseled, as they were very apprehensive and disturbed. The parents were explained the management procedures
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regular follow-up. Feeding instructions were given. The lip repair was done when the child was three months old and the palate repair was carried out when he was eighteen months old (Fig 1). The patient was referred to a speech therapist for speech correction. Meanwhile the patient was under regular recall in the dental OPD where instructions were given regarding maintenance of good oral hygiene. When the patient was in mixed dentition he was referred to the orthodontic clinic for further management. The initial treatment comprised of only crossbite correction of the upper left central incisor by removable appliance only. When the patient was in late mixed dentition the radiographic records like the lateral cephalogram, OPG and occlusal x-rays of the maxilla were evaluated. It was found that the upper left lateral incisor adjacent to the cleft site had no bone support. Also a posterior crossbite had developed. However the extraoral photographs showed an acceptable result of the lip repair (Figs 2 and 3). Expansion was done in the posterior segment using a NiTi palatal expander. Post expansion the patient underwent a secondary bone grafting in the cleft region. The bone was harvested from the iliac crest (Fig 4). Simultaneously lip revision with columelloplasty was done to correct the nasal deformity (Figs 5 and 6). After 3 months full comprehensive orthodontic treatment was initiated. After the leveling and alignment the patient was referred to the prosthodontic division for fabricating the crowns in the left central and lateral incisors as they were hypoplastic and the lateral was peg shaped as well as the canine. Debonding was done after attaining a good occlusion (Fig 7). The facial photographs after the bone grafting and lip revision showed a commendable change in the nasal and lip deformity. The lateral incisor erupted through the newly grafted bone. The OPG of the patient 6 months after the grafting procedure showed an adequate bone in the cleft site (Fig 8). Thus with a team approach an acceptable face and occlusion was given to this child.

DISCUSSION

All the patients at the combined cleft lip and palate clinic at AIIMS undergo the following treatment protocol:
- Primary surgery performed during childhood (lip repair after 3 months of age and palate repair after 12 months of age)
- No early pre and post surgical maxillary orthopedics
- Orthodontic treatment during the mixed dentition
- Secondary bone grafting at the end of mixed dentition
- Early orthodontic treatment during the mixed dentition

Surgical goals of alveolar bone grafting and reconstruction\textsuperscript{12,13}
- Stabilization of the dental osteal segments
- Oronasal fistula closure
- Improvement in the alveolar ridge form
- Prevention of tooth loss due to lack of periodontal bone support
- Provision of the nasal alar base support
- Stabilization of the dental arch and closure of the oronasal fistula
- The greater segment has a tendency to collapse due to lack of alveolar continuity and palatal scarring
- Transverse deficiency with posterior lateral crossbite
- Lack of vertical growth in the cuspid region resulting in a vertical maxillary deficiency
- Anterior maxillary crossbite

Early secondary bone grafting, between the ages of 2 and 6 is done primarily to provide alveolar bone support for the eruption of the lateral incisor. The lateral incisor is often malformed, congenitally missing, or erupts ectopically. Radiographic evaluation of the lateral incisor and canine associated with the cleft defect will help to determine timing of the graft. 95% of the anteroposterior and transverse growth is completed by the age of 8 and therefore the most common time for alveolar cleft grafting is between the ages of 9 and 11 (before the eruption of the canine when the root is 1/2 to 2/3 formed). Anteroposterior and transverse growth is completed by this age and only vertical growth remains. Grafting between the ages of 9 and 11 does not have much effect on midface growth and will provide bony support for the erupting canine\textsuperscript{14,15,16}. The anterior iliac crest is the most common donor site used today (gold standard). This site is preferred as the amount of bone, which can be mobilized in adequate amount and has high particulate cancellous bone content. Calvarium and mandibular bone has been advocated, as being a superior donor however there is inconsistent clinical results. However the bone is membranous, less particulate cancellous bone and quantity harvested is inadequate.

Radiographic follow-up demonstrated adaptation of the cancellous bone of the iliac crest to the host area, making it impossible to distinguish the mesial and distal limits of the cleft. In addition, it was radiographically apparent that canines migrate towards the occlusal plane through the grafted bone and create good periodontal conditions. The findings of present case agree with other studies in which teeth erupted through the grafted bone. Cancellous bone graft is quickly incorporated and vascularized and most importantly, does not interfere in
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Fig. 1: Patient before lip repair and 2 months after repair.

Fig. 2: Pretreatment extraoral views at 10 years of age.

Fig. 3: Pretreatment intraoral photographs.

Fig. 4: Harvesting bone from iliac crest and grafting into the cleft site.
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Fig. 5: Extraoral photographs after secondary bone grafting and lip repair.

Fig. 6: Post bone grafting extraoral photographs.

Fig. 7: Post treatment intraoral photographs.

Fig. 8: Pretreatment OPG and OPG after 6 months of bone grafting.
presence of the tooth contributes to the preservation of the
grafted bone and to the differentiation of the periodontal
support\textsuperscript{7,8}.

Pre-bone grafting orthodontic management is begun in the
mixed dentition stage with the correction of cross bites and
the alignment of the anterior teeth. Expansion appliances
should be left in place for a minimum of 3 months following
placement of the graft to prevent a relapse. Preoperatively
the surgeon must evaluate soft tissue for adequate closure,
must plan flap design to maintain adequate blood supply,
periodontal support of dentition, oronasal communication, and
support of the alar base and evaluate the donor site. The
three fundamental principles: nasal side closure first, adequate
volume of bone and water tight tension free closure of the
mucosa. Nasal intubation should be done opposite the side
of the cleft. Incision is made as to allow the mucosa of the
vertical portion of the cleft to be used for the closure of the
nasal floor. The surgical goal is a three-layer closure. Following
a watertight closure of the nasal floor the palatal and buccal
mucosal flaps are elevated and mobilized. Flap design and
blood supply is paramount in successful grafting\textsuperscript{19,20}.

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Reprint requests to:
Dr. Ritu Duggal
Assoc. Professor,
Dept. of Dental Surgery,
All India Institute of Dental Sciences, New Delhi.