INTRODUCTION
The incidence of cleft lip and palate in multi ethnic Hawaii population was reported as 12.5 per 10,000 live births\(^1\) and that of Australian children from Victoria as 7.8 per 10,000 pregnancies.\(^2\) According to Wikipedia, the highest prevalence rates for cleft lip and palate are reported for Native Americans (3.74/1000) and Asians (Japanese: 0.82/1000 to 3.36/1000, Chinese: 1.45/1000 to 4.04/1000). African-Americans (0.18/1000 to 1.67/1000) have been reported to have the lowest prevalence rates and in Caucasians as 1.43/1000 to 1.86/1000.\(^3\)

In the mixed dentition stage, the initial orthodontic treatment comprises cross bite correction whether transverse, sagittal or both. In cleft children, restricted maxilla may present both transverse and sagittal cross bite. Expansion of the maxillary dental arch can be attained by various means such as ordinary removable screw plates or fixed expanders in the form of Trihelix, Quad Helix,\(^4\) soldered Hyrax\(^5\) or Hyrax with acrylic splint\(^6\) and Haas screw appliance\(^7\). Bonded acrylic expanders incorporating midline screw or fan shaped screw is the recommended treatment for transverse deficiency\(^8\). The modified expansion device (MED)\(^4\)\(^9\), a bonded expander addresses the problem of transverse along with minor correction of sagittal cross bite by providing occlusal clearance.

On correction of cross bites and incisal rotations, bone grafting is performed. Secondary bone grafting is the most accepted procedure and is performed preferably before eruption of the permanent canine\(^10\). The grafted bone provides adequate periodontal support\(^11\) for eruption and preservation of teeth adjacent to cleft\(^12\). Secondary graft is placed during mixed dentition stage\(^13\). The anterior iliac crest is the most common donor site, providing an adequate amount of bone with high particulate cancellous bone content. This article reports on combined orthodontic and surgical management on three patients presenting with cleft of the lip and palate in mixed dentition stage. A male patient with repaired unilateral cleft of the lip and palate on the right side, the other one with bilateral cleft lip and palate and a female patient with repaired left side cleft of lip and palate are described.

CASE 1
A male child age 6\(\frac{1}{2}\) years was referred to the cleft centre of The Children’s Hospital (Fig 1-10). The presenting complaint was an unpleasant facial appearance and deranged dentition. He was born with right unilateral cleft of the lip and anterior palate. Initial lip repair was reported at 3 months and palatoplasty at one year of age. Intra oral examination (Fig 3, 4) revealed an apparent cleft in the right alveolus. The teeth were in early mixed dentition stage. Lower permanent central incisors were partially erupted and the rest of teeth in both of dental arches were deciduous. The primary teeth lying in line of the cleft i.e. the right upper central and lateral incisors were in gross palatal rotation with localized open bite because of the defect. The right upper quadrant was in crossbite up to first deciduous molar. The OPG revealed an inverted pear shaped radiolucent area which was 2.8 x 2cm in dimensions. On the occlusogram, the cleft extended backward to first deciduous molar region. Cephalometrically, the child was analyzed to have skeletal 1 pattern.

Treatment Plan
The treatment plan for this patient was unilateral expansion of the collapsed segment after eruption of...
permanent first molar. When the upper first permanent molars were adequately erupted, the modified expansion device with unilateral screw was bonded to upper arch (Fig 5). The soft acrylic was applied on top surface of the expander to fill the defect part. The screw was opened at the rate of two turns every alternate day. On correction of the right cross bite, the screw was ligated, post expansion records were obtained. (Fig. 6) and the patient was sent for six weeks stabilization along with oral hygiene instructions. After wards, the fixed retention appliance, Nance with extended arm (Fig 7) was cemented and the patient was referred for secondary graft surgery at 9 years of age. One and a half month after surgery the patient was examined and the intraoral examination revealed a successfully healing graft (Fig 8). The extra oral views reflected an improved contour of the face and better upper lip support (Fig 9, 10).
CASE 2

An 8 years old boy with repaired bilateral cleft of the lip and palate was referred to the cleft centre of the CH&ICH (Fig 1-10). Cleft lip was repaired at 3 months and palatoplasty was performed at 1 year of age. Bilateral scars of the upper lip and nasal base deformity and deranged occlusion were the major concerns of the parents. On intra oral examination, the premaxilla was displaced laterally and inferiorly and the midline of the premaxilla was deviated 6mm to the left of the facial midline (Fig 3). Occlusion was acceptable in the molar region, whereas it was in cross bite in the canine and deciduous molar region on both sides. The dentition was in early mixed dentition stage. Right upper central and lateral permanent incisors were erupted and rotated while left deciduous central had recently been shed and the deciduous lateral incisor was present. Supernumerary teeth were present bilaterally in the line of cleft, one on either side (Fig 4).

Treatment Plan

The custom made modified expansion device with midline screw and fan shaped spring (Fig 5) was planned for this patient as the cross bite was gross in the anterior buccal segment necessitating more expansion anteriorly. The cleft part was filled with soft acrylic. Expansion was done at the rate of two turns every alternate day. On completion of expansion and correction of cross bite, routine management was undertaken as mentioned earlier (Fig 6) and the patient was referred for secondary graft surgery. Six weeks after secondary graft post-surgical records were attained that revealed a pleasant change in the transverse dimension, facial contour on both sides, better lip support and a successfully healing graft (Fig 8, 9, 10).
Fig. 2: Pre-treatment Profile

Fig. 3: Intra-oral Front View

Fig. 4: Upper Occlusal View

Fig. 5: MED with Midline Screw and Fan spring

Fig. 6: Post-expansion Occlusal View

Fig. 7: Post-Graft Front View

Fig. 8: Post-Graft Occlusal View

Fig. 9: Post Graft Front View
CASE 3

An 8 years female presented with repaired unilateral cleft of the lip and palate on the left side (Fig 1-10). Cheiloplasty was reported at 3 months and palatoplasty at one year of age. History of consanguineous marriage was recorded. This patient was the second out of four kids (two females and two males). The youngest brother was also reported as born with unilateral cleft of the lip and palate (Fig 1, 2). On intraoral examination the patient showed mixed dentition with deranged occlusion and localized open bite at the cleft site (Fig 3). On the occlusal surface, the cleft was in the form of a fissure (Fig 5) but on the labial side it appeared like a slit (Fig 4). The occlusal view showed a pear shaped radiolucent area (1x1 ½ cm) in the left lateral region. On the OPG, the cleft appeared as a slit like radiolucent area. A supernumerary tooth was also seen in the cleft line. Cephalometrically, the patient was found to have skeletal II pattern (SNA 84, SNB 76).

Treatment plan

Her treatment plan was presurgical orthodontic alignment of rotated teeth without involving left upper lateral incisor, being placed in the line of cleft. The upper anteriors were bonded and included in the straight wire system till alignment of the rotated centrals (Fig 6, 7, 8). On correction of rotation of the left central incisor, the cleft on the labial surface became more prominent. The aligned incisors were then stabilized with rectangular arch followed by routine records. The patient was then referred for secondary graft surgery. Three months after graft procedure, successful results with improved contour of the face and better lip support were seen (Fig 9, 10).
DISCUSSION

Rapid palatal expansion produces larger forces at the sutural site over a short period of time. These heavy forces maximize skeletal expansion of midpalatal suture before any dental movement or physiological sutural adjustment can occur. As seen in a number of studies, skeletal and dental effects are easy to achieve and relapse is rare when RME is performed in the prepubertal period or during puberty. In cleft palate cases, as buttressing effect from zygoma is not present, slow expansion of the constricted palate can be achieved.

The custom made MED (modified expansion device) was given in two male patients. In one patient, MED with unilateral screw was bonded to expand the collapsed minor segment of the right unilateral cleft. Expansion was followed by retention and further graft procedure. Fan shaped MED was given in other patient in early mixed dentition with repaired bilateral cleft lip and palate. Custom made fan shaped MED
was applied to get desired expansion which was followed by retention and further secondary alveolar bone graft.18

Toygar19 in his case report, used rigid acrylic bonded RME appliance, very similar to MED, in a 13 year old girl and concluded that the rigid acrylic bonded RME prevented upper molar extrusion and provided more parallel expansion, with less tipping of the posterior teeth, than could have been achieved with conventional banded expanders. During expansion, little change was reported in vertical dimension with only a slight posterior rotation of the mandible. He used the same appliance for retention purpose. Neel Reed6 compared treatment outcome with banded and bonded rapid palatal expansion appliances and found that the bonded rapid palatal expansion group had more vertical change than the bonded one. The stability of maxillary expansion has been widely examined with significant relapse reported by Stockfish20, Linder-Aronson and Lindgren21. However, numerous other studies strongly contradicted these findings. Moussa22 found goal stability in 55 of Hass patients 8 to 10 years after retention, Mew23 found no significant relapse after 2 ½ years after retention in 25 consecutive treated patients.

In our experience, the bonded expander was used for vertical control as well as to stabilize the expanded dentoalveolar segments till fabrication of the retention appliance. In the female patient, the upper and lower dental arches were well coordinated and therefore expansion was not indicated. The left upper central incisor which was grossly rotated was included in the bracket system16, 18 as it moved away from the cleft during presurgical alignment. Tooth movement towards the cleft does not bring the bone along, unless and until the graft is accepted. The lateral incisor was planned to be left as such till second phase of orthodontic treatment after graft acceptance. Presurgical alignment was done to facilitate graft placement and postsurgical closure.

In all of three cases iliac bone was used to harvest the bone graft. Donor site wound was closed in layers with a suction drain inside, which was removed on third postoperative day. This donor site is easily reachable, provides sufficient graft with a good cancellous bone ratio and leaves a good scar that is parallel to the skin tension lines and thus gives good cosmetic results. Moreover the scar is concealed in the belt area. Bone graft at the recipient site needs a good soft tissue cover and it was provided with local mucosal flap from the adjacent buccal sulcus. The flap donor site was closed primarily. Absorbable sutures were used both at recipient and donor site. In all of three cases the flaps and donor sites healed uneventfully.

The outcome of this combined presurgical orthodontic management and secondary graft surgery in these patients was a pleasant change in the facial appearance. In the male patients horizontal dimension of the face particularly the mid face was improved by expanding the collapsed alveolar segments, with unilateral bonded expander in the first patient with fan shaped expander for bilaterally collapsed buccal segments. The upper lip and nasal alar base support was improved by restoring contour of the grafted alveolus and partly due to improved axial inclinations of the upper incisors in case of the female patient.

SUMMARY

Three cases of cleft lip and palate are presented which were dealt with presurgical orthodontics followed by secondary bone grafting of the alveolar defects. This combined approach improved the deranged occlusion, arch malalignment, problems of cross bite and localized open bite at cleft site along with the midface cosmesis.

REFERENCES


