Orthognathic Surgery in Cleft Patients

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Chapter outline

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Introduction

It is estimated that around 25 percent of patients with unilateral facial clefts have a class III malocclusion and midface deficiency requiring surgical intervention.[1,2] Historically the treatment used to be confined to a mandibular setback that acted more like a camouflage rather than treating the underlying skeletal problem. With the availability of newer surgical technology and a better understanding of surgical anatomy, perfusion and revascularisation of the midface, holistic treatment of the skeletal deformity of the midface is possible.

The cleft maxilla and midface - How is it different?

Cleft deformity often presents with midface deficiency, which remains one of the most obvious growth disturbances seen in such patients. The midface hypoplasia is almost always a direct consequence of multiple surgical interventions done as part of the staged repair of cleft lip and palate. The alveolar repair of the cleft maxilla, usually taken up during the mixed dentition period, often before the eruption of canine, further adds to the

insult. Every surgical procedure that is taken up, although functionally and aesthetically significant, creates scar tissue.

Biologically, the scar tissue is less elastic and has more tissue memory compared to the normal tissue, which eventually hinders the normal growth of maxilla and midface. These properties of scar tissue that envelopes the skeletal base make the corrective skeletal surgery difficult with questionable long-term stability post advancement surgery.

It is important to note that the dysmorphology extends beyond the obvious class III skeletal base and maxillary deficiency. The deficiency is not just restricted to the maxilla and the alveolus but extends to the paranasal, nasal, infraorbital and other adjacent bones. Most cleft maxillary patients have massive buttresses in the pyriform rim and the pterygomaxillary region of the posterior maxilla. It becomes imperative that a thorough osteotomy has been performed in these areas before a down fracture of the maxilla is attempted, minimizing the risk of an unfavorable fracture extending skull base and orbit, during a Le Fort I procedure.

Since the perfusion of the maxilla is dependent on vessels coming from overlying soft tissue, cleft maxilla has reduced perfusion due to the discontinuity in the hard and soft tissue in and around it. In addition to the discontinuity, the presence of scarred and fibrotic tissue as envelope further complicates the perfusion of the mobilized maxilla.

Understanding the anatomical difference between an orthognathic patient with and without cleft deformity helps in planning and guiding a successful treatment plan.

The need for treatment

It is important for a clinician to understand the impact of a cleft deformity on the psychological well being of the patient. These patients are often different from a non-cleft orthognathic patient as they are often subjected to multiple psychological adjustments over the course of their staged treatment.[3] They react differently to the surgical outcome owing to the stigmata attached to

the congenital nature of the dysmorphology. This becomes even more pronounced during adolescence when social interaction increases.

Apart from the obvious aesthetic need for surgical intervention, there are several functional problems that require surgical attention. The midface deficiency often leads to problems with speech, nasal respiration, olfaction, and hearing.
The goal of treatment should be to achieve overall aesthetic and functional improvement.

Presurgical planning and technical considerations
The presurgical workup is usually the same as that of non-cleft orthognathic cases. Accurate dental models, face bow transfers, intraoral and extraoral photos, lateral cephalometric analysis, OPG are necessary for adequate treatment planning. Patient's surgical History gives an insight into the effect previous surgeries might have on the orthognathic procedure. For example, palatoplasty done with palatal island flap can reduce the vascularity required for optimal perfusion of maxilla during down fracture. History related to systemic diseases and previous surgeries should rule out any presence of pharyngeal flap as it poses a problem during intubation and down fracture of the maxilla. Any pharyngeal flap should be depedicalised before any orthognathic procedure is undertaken.

The treatment of cleft maxilla in the form of alveolar bone graft reconstruction helps in streamlining the future Le Fort I advancement surgery that may be needed. This not only provides a bony matrix for teeth to erupt but also forms a continuity between the fragmented portions of the maxilla, thereby making the conventional Le Fort I procedure possible and straightforward. If the grafting has not been done or rather had failed, the fistula and dental gaps make the procedure a lot more complex. The incision design has to be altered from the conventional circum-vestibular degloving incision to maintain adequate perfusion to the fragmented maxilla. The attempt to repair the fistula, further scars the palate and makes it more fibrotic, thereby reducing the perfusion even further.

However, in the case of bilateral clefts, some authors prefer to leave an anterior pedicle for perfusion to premaxilla while making a circum-vestibular incision. This method increases the operative complexity, and the visualization is reduced, which prevents mobilization of the maxilla by down fracture. Mobilization is then achieved by in-fracturing by tunneling and giving anterior traction. **Fig 1.1**

Fabrication of a robust occlusal splint remains one of the most important aspects of any orthognathic procedure. A well-fitted splint not only guides the maxilla into occlusion during the advancement but also counters any unfavorable movements due to the scar. The author prefers to attach an arch bar on the anterior aspect of the splint to prevent any posterior collapse of the arch. **fig 1.2**

Fig 1.2 Occlusal splint with cross bar

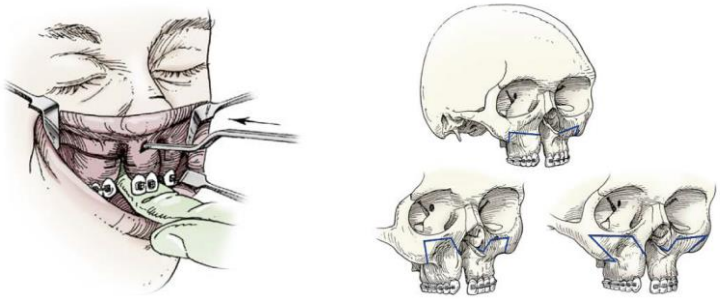


Fig 1.1 & Fig 2.1 (Sourced from Turvey TA, Ruiz RL, Costello BJ: Surgical correction of midface deficiency in cleft lip and palate malformation, oral Maxillofac Surg Cli North Am 14:491, 2002)

It is the author's preference to perform the surgical correction of skeletal deformity secondary to cleft after the completion of growth. This approach improves the predictability of the surgery. The parents and child may demand an early surgical correction at teenage under peer pressure and due to psychological disturbances.

Discussion about early orthognathic surgery must include an understanding that a secondary revision surgery might be needed after the cessation of facial growth.
The patient should be counseled that midface advancement sets the platform for definitive lip and nose surgery as it provides a skeletal base for lip fullness and nasal tip projection.

The Corrective Surgery – Variations and techniques
The goal of surgical treatment should not only be to achieve improvement by correcting skeletal balance but also to rectify the functional capacity of the patient by improving nasal breathing, closure of any residual defect such as fistulas, the olfaction, and hearing. Although the basic surgical technique remains the same as that of non-cleft orthognathic corrections, there are several variations that need to be applied owing to different and complicated anatomy of a cleft maxilla in cleft patients. The perfusion of bone, scar envelope, discontinuity in hard and soft tissues, need to be kept in mind

designing the incision and osteotomies. As discussed in earlier sections of this chapter, the incision design can be a conventional circum-vestibular incision if bone grafting has been successfully carried out at an appropriate age. The scenario in the bilateral cleft maxilla is a bit more complicated, and the incision design is made keeping in mind the restricted blood supply of premaxilla. Therefore, some authors advocate leaving an anterior pedicle over premaxilla.

Osteotomies for cleft patients also should be designed to address specific skeletal dysmorphology. Over the years several modifications have been proposed. **Fig.2.1** As previously discussed the midface deficiency secondary to cleft is just not restricted to the alveolar portion of maxilla but extends beyond to adjacent bones. It is author's school of thought that the midface deficiency can be divided into; infra-orbital, nasolabial, maxillary and dentoalveolar. F**ig**. **3.1** This helps in designing the osteotomy which can broadly be classified into two categories; Le forte I F**ig 4.1** High Le fort I. F**ig 4.2**

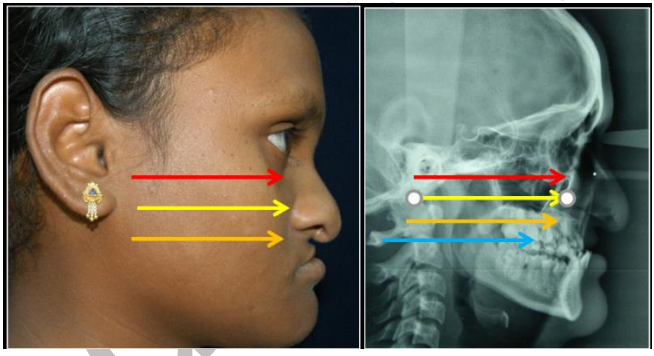


Fig 3.1 infraorbital (red), Nasolabial (yellow), maxillary (orange), dentoalveolar (blue)

Fig 4.1

Fig 4.2

Historically, if the midface discrepancy was more than 8 mm, many surgeons used to split the anteroposterior discrepancy by repositioning the mandible posteriorly and achieving a class 1 occlusion.[4] This not only lead to a compromised aesthetic outcome but also had functional implication such as obstructive sleep apnea due to the narrowing of posterior airway space. As a rule, determined cephalometrically, if the mandible is at its normal AP position then, it should not be repositioned.[5] A distraction protocol is rather employed to achieve a stable advancement with gradual stretching of soft tissue envelope. If skeletal class III is due to the forward placement of mandible along with mid-face deficiency, then a bi-jaw surgery is done with retro-positioning of the mandible using BSSO.

The surgical technique

With the exception of few cases discussed earlier such as island flap for palatal repair and bilateral cleft maxilla without bone grafting, almost all mid-face advancement can be done via a circum-vestibular incision exposing the entire maxilla extending from pyriform to pterygoid buttresses. The incision is easy to perform and gives excellent exposure of the midfacial skeleton. Subperiosteal dissection should be restricted only in the superior direction, and alveolar dissection should be kept to a minimum to retain healthy perfusion.

Some surgeons use a palatal splint fixed preoperatively to stabilize the cleft maxilla during advancement. It is the author's approach to fix a

reconstruction plate extending from zygomatic buttress on one side to the other side before the osteotomy is performed. **Fig 5.1** This stabilizes the fragmented maxilla. The plate can be left in situ without any complication. After adequate exposure has been achieved by subperiosteal dissection, the osteotomy design is marked with a lead pencil. In conventional Le fort 1, the markings extend from piriform to zygomatic buttress just above the alveolar bone parallel to maxillary arch-like in a conventional Lefort 1. If the high Lefort 1 surgery is planned, the markings are kept higher on the pyriform area, extending to infraorbital region circumventing the infraorbital foramen, along the malar region ending in zygomatic buttress. **Fig. 6.1** The guiding splint is then placed on to the teeth using the ivy loops placed preoperatively.

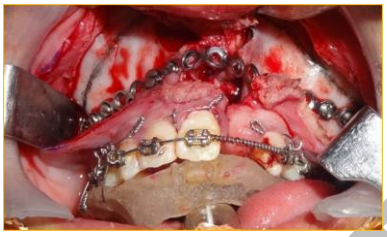
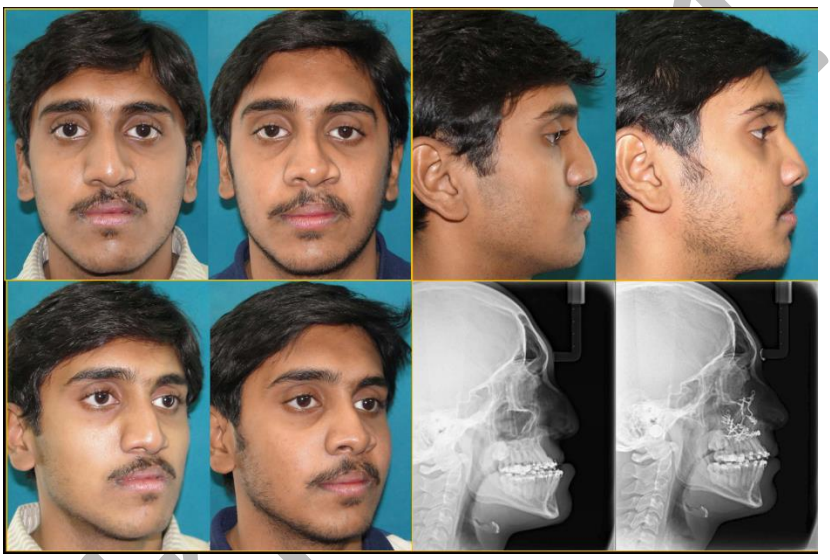


Fig 5.1

Fig 6.1 High vs Low Le fort 1 osteotomy

The osteotomy is completed using a reciprocating bone saw starting from lateral pyriform rims to the pterygomaxillary buttress in inside out fashion. Care should be taken to protect the nasal mucosa. The pterygoid chisels are used to complete the pterygomaxillary disjunction. The lateral nasal chisels are used to complete the pyriform osteotomy. It's imperative that osteotomy of the pterygoid buttress and pyriform buttress are completed thoroughly with patients because cleft patients often have heavy buttressing in these regions. The vertical portion of palatine bone is another area of resistance for mobilization of the maxilla. Failure to weaken these regions before the down fracture may result in inadvertent and unfavorable fracture extending up to the base of the skull and orbits. After the osteotomy is completed and the buttresses are weakened, a smith spreader may be used to complete the down fracture. A radical mobilization of the maxilla is performed by stretching it outside the oral cavity using Rowe's disimpaction forceps and

holding it for 5 minutes to stretch the fibrotic scar tissues properly. IMF is done advancing and putting the maxilla into the planned occlusion.
Rigid internal fixation is used to stabilize the mobilized maxilla in a conventional fashion. Rigid fixation helps in reducing the time period for intermaxillary fixation.



Case 1: High Le fort 1; preoperative and postoperative results. Note the fullness in the infraorbital and malar region

Case 2: Le fort 1 preoperative and postoperative results

Case 3: Le fort 1 for maxillary advancement with BSSO for mandibular retrusion

Postoperative Implications

Cleft orthognathic procedures have a higher rate of relapse owing to the resistant scar tissue. Posnick et al. have reported a relapse of some degree in almost 15 percent of the cases that underwent cleft orthognathic surgery.[6,7]

The heavy buttressing in the pyriform and pterygomaxillary region, If not appropriately weakened, may lead to unfavorable fractures reaching the orbits and skull base with a high risk of neurological injury and even blindness.[8,9]

Maxillary advancement may also lead to velopharyngeal incompetence and potential deterioration of speech in the postoperative period. A patient with short palatal length with scarring may not respond well to maxillary advancement and change in position of the soft palate. The postoperative response depends greatly upon the preoperative situation of velopharyngeal closure.[10]

Almost all patients tend to have some amount of hypernasality in the speech, which gradually reduces with time if no intraoperative complications had occurred.

Key points

1. It is estimated that around 25 percent of patients with unilateral facial clefts have a class III malocclusion and midface deficiency requiring surgical intervention.

2. Cleft maxilla is different from noncleft maxilla in its anatomy and blood supply, which is compromised due to scarring caused by multiple surgeries.

3. Presurgical planning and technical considerations should include details work up supported with diagnostic records.

4. History of pharyngeal flap surgery should alert the anesthetist about difficult nasal intubation.

5. Early orthognathic surgery should be avoided. Should it become a must, the discussion must include an understanding that a secondary revision surgery might be needed after the cessation of facial growth.

6. Relapse in the inherent complication of orthognathic surgery. A relapse of some degree in almost 15 percent of the cases that underwent cleft orthognathic surgery.

7. Correction of midface hypoplasia with maxillary advancement by orthognathic surgery may lead to serious speech issues. These aspects should be well analyzed before orthognathic surgery is undertaken. Alternatively, distraction osteogenesis should be considered where speech issues are likely to be serious.

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