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Craniofacial/Pediatric

Segmental Cleft-orthognathic Surgery to Achieve Facial Balance, Fistula Closure, and Arch Unification

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Skeletal discrepancies and residual fistulae are challenging to correct in adult cleft lip and palate (CLP) patients. This video demonstrates the presurgical planning and operative sequence of a two-piece Le Fort I osteotomy to achieve concurrent alveolar fistula closure, dental substitution, and correction of the anteroposterior discrepancy (**See Video [online]**). Alveolar bone grafting, fat grafting, and second-stage septorhinoplasty techniques are also highlighted.

INTRODUCTION

The ideal sequence for cleft-orthognathic surgery involves successful alveolar bone grafting of the residual cleft site and fistula closure between 9 and 12 years, followed by orthodontic arch alignment and space closure.[1] Following growth cessation, a single-piece LeFort can correct the remaining skeletal discrepancy and a definitive rhinoplasty can achieve the desired facial profile. However, lack of timely treatment or prior unsuccessful repairs may result in a persistent alveolar cleft, unerupted canine, and other dentofacial deformities in the skeletally-mature patient.

This article illustrates our surgery-first approach for treating residual deformities in the adult cleft patient. The video demonstrates the planning and technique of Le Fort-I-associated segmental maxillary osteotomies with concurrent fistula closure and use of a modified Hawley-type palatal splint. A definitive septorhinoplasty further enhances the facial harmony and balance.

INDICATIONS AND MANAGEMENT

A 33-year-old man presented with a history of left, unilateral cleft lip and palate with maxillary hypoplasia, alveolar cleft, cleft-dental gap with missing lateral incisor, and an impacted, buccally-erupting canine (Fig. 1A). (**See Supplemental figure 1A,** which shows intraoral preoperative image depicting cleft-associated dental deformities: residual alveolar cleft, Class III malocclusion, missing lateral incisor, and an impacted, buccally-erupting canine. **http://links.lww.com/PRSGO/B842**.) Significant nasal deformity with asymmetry, lack of tip support and projection, rim deficiency, and scarring were also evident. The patient underwent limited presurgical orthodontic alignment (hybrid surgery-first approach), maintaining the fistula and impacted canine to be addressed at the time of orthognathic surgery. Presurgical planning with custom-printed surgical guides and splints were also utilized to ensure intraoperative accuracy.

CANINE REMOVAL

A flap was elevated around the keratinized tissue to expose the crown and the cementoenamel junction of the canine. A periosteal elevator was used to remove bone and to allow root exposure. The tooth was luxated, and extraction forceps were used to remove the impacted tooth. The socket was curetted and irrigated. All sharp bony edges were smoothed out, and the tissue was closed.

ORTHOGNATHIC SURGERY

A mandible-first orthognathic sequence was elected. Bilateral sagittal split osteotomy with pitch and yaw correction was performed in a standard fashion (**See Supplemental figure 2,** which shows presurgical 3D planning depicting a 2-piece segmental, Le Fort I osteotomy with 7 mm advancement, global disimpaction, and segmental repositioning for closure of the cleft gap, mandibular BSSO to alter the occlusal plane, and 4 mm osseous genioplasty advancement. **http://links.lww.com/PRSGO/B843**). Local anesthesia was injected followed by a hockey-stick-like incision to expose the external oblique ridge. The inferior alveolar nerve was exposed and the first corticotomy was made using a reciprocating saw, extending from just behind the lingula coursing down and anterior.[2] The anterior, midbody, dissection and corticotomy was then performed. The same approach was taken on the opposite side, followed by

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Fig. 1. Preoperative versus postoperative images. A, Preoperative images showing residual skeletofacial cleft deformities: maxilla-mandibular discrepancy with significant maxillary hypoplasia and cleft nasal deformity. B, Postoperative images following segmental cleft-orthognathic surgery and second-stage septorhinoplasty showing improved facial profile and balance.

splitting the mandible, ensuring the nerve laid on the distal segment. An intermediate splint was used, and mandibular internal fixation applied bilaterally.

A modified LeFort I segmental maxillary osteotomy was performed with simultaneous fistula closure. Local anesthesia with vasoconstrictor was injected into the labio-buccal sulcus extending from the midline to the pterygomaxillary areas. In our patient, incision was first made in the maxillary vestibule then around the large anterior fistula to allow draping into the nasal side. This was connected to a V-Y incision at the upper lip frenulum. Subperiosteal dissection extended posteriorly to the level of the pterygomaxillary fissure, allowing complete exposure of the anterior surface of the maxilla.

The nasal mucosa was dissected anteriorly, exposing the septum, nasal floor, and walls. A reciprocating saw was used to create the osteotomy extending anteriorly toward the piriform recess. Lateral nasal wall and septal osteotomies were performed. A series of osteotomes were used to allow for maxillary down-fracture and mobilization. The maxilla was divided into two segments along the cleft site using a fissure burr and fine osteotomes.

At this time, nasal mucosa and palatal flaps were created to close the alveolar fistulae. Off the shelf bone (ViviGen, DePuySynthes, West Chester, Pa.) as well as bone graft from the mandibular osteotomies were mixed and packed into the nasal floor and fistula. The maxillary segments were repositioned using a Hawley-type palatal splint

(**See Supplemental figure 3,** which shows the Hawley-type 3D printed splint used to maintain and stabilize the maxillary segments. **http://links.lww.com/PRSGO/B844**). Internal fixation ensured correct maxillary positioning at the lateral and medial buttresses. A septal reset and repositioning, alar cinching, and V-Y mucosal closure were completed.

A single-piece sliding genioplasty with advancement for asymmetry correction and lengthening was also performed. Lastly, abdominal fat was harvested and injected into the lip, cheeks and labiomental crease.[3–5]

POSTOPERATIVE CARE AND SEPTORHINOPLASTY

The Hawley-type palatal splint was left in place for 4 weeks postoperatively. Intermaxillary elastics were placed to guide the occlusion. Active orthodontic tooth movement was resumed after 6 weeks. Three months following cleft-orthognathic surgery, the patient underwent a definitive rhinoplasty for correction of his residual cleft nasal deformity.[6–8]

DISCUSSION

Correcting persistent fistula and skeletal discrepancies in the adult cleft lip and palate patient is challenging for reconstructive surgeons. Alveolar grafting can stabilize the arch and eliminate the residual fistula.[1] Ideally, this is performed just before eruption of permanent canines, but in cleft patients who fail to undergo secondary grafting or where alveolar clefts persist into adulthood, tertiary grafting can be done.[1,9] Later, prosthodontic reconstruction of the residual cleft site can be undertaken, ideally with an endosseous implant and crown or fixed bridge.[10] Alternatively, a more efficient rehabilitative option is dental substitution, which can be performed through concurrent segmental LeFort I and fistula closure.[11–14] This approach is not only more cost-effective but can also eliminate the potential unpredictability in implant survival.[15] It also avoids a prolonged orthodontic or distraction phase to close the cleft-dental gap, decreases repeat anesthesia-associated risks, and increases patient satisfaction.[16]

Here we demonstrate segmental LeFort I osteotomy with fistula closure, bone grafting, and dental substitution in a single stage surgery. The hybrid surgery-first approach requires limited orthodontic alignment and leveling to prepare the grafting site and initiate orthognathic surgery. Differential segmental repositioning allows for arch unification with tension-free closure and limits the need for significant grafting at the cleft. Use of off-the-shelf bone with autogenous bone from the mandible further avoids the need for a hip donor site and its associated morbidity.[17]Additionally, three-dimensional surgical planning enhances the efficiency and accuracy of cleft-orthognathic surgery and assists in developing the modified Hawley-type palatal splint.[18,19] The use of this splint is critical in maintaining arch stability for optimal healing of the maxillary segments. Fat grafting and crushed cartilage techniques are also illustrated, minimizing postoperative edema.[3–5] A definitive septorhinoplasty adds the final finishing touches for the patient, achieving an ideal facial harmony and balance (Fig. 1B). (**See Supplemental figure 1B,** which displays intraoral postoperative image following cleft-orthognathic surgery with segmental osteotomies allowing simultaneous alveolar fistula closure, dental substitution, and arch unification. **http://links.lww.com/PRSGO/B842**).

CONCLUSIONS

When executed correctly, our cleft-orthognathic surgical approach allows for simultaneous cleft-dental gap reduction, alveolar fistula closure, and correction of residual skeletal discrepancies. The video further highlights the surgical approach, emphasizing the operative order and surgical planning.

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PATIENT CONSENT

The patient provided written consent for the use of his images.

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