Successful Treatment of Postoperative Mouth Opening Limitation Following Le Fort III Distraction with Bilateral Coronoidectomies

M. R. Greives¹ · A. A. Figueroa² · Russell R. Reid³

Received: 19 February 2015 / Accepted: 15 April 2015 / Published online: 28 April 2015
© The Association of Oral and Maxillofacial Surgeons of India 2015

Abstract

Introduction Distraction osteogenesis is a powerful tool in craniomaxillofacial surgery, allowing for large advancements of osteotomized segments in the setting of a restrictive soft tissue envelope. Despite its benefits, distraction can have negative functional consequences. We present a case of a patient with Crouzon syndrome who developed reduced mouth opening capability after a Le Fort III midfacial advancement with rigid external distraction.

Technique Radiographic evaluation revealed that the coronoid process was restricting the normal excursion of the mandible by contacting the posterior zygoma. The patient was subsequently treated with a bilateral coronoidectomy via an intraoral approach, which improved his interincisal opening. Maximum interincisal distance was improved from 18 mm to 33 mm following bilateral coronoid resection.

Conclusion We report coronoid impingement as a potential complication after Le Fort III distraction. Such a finding suggests the need for a detailed vector analysis in cases undergoing midface advancement with distraction. Post-distraction coronoidectomy is a useful surgical

procedure to treat mouth opening limitation due to coronoid impingement against the zygoma after midfacial advancement.

Keywords Le Fort III distraction · Limited opening ability · Coronoidectomy

Introduction

Classically, the proximity of the coronoid process to the zygoma is a well-established anatomical relationship from the trauma literature and is an indication to reduce zygomatic or zygomaticotemporal (arch) fractures that impinge on this mandibular subunit. This obstruction may cause reduced mouth opening ability and masticatory limitations [1, 2]. Hypertrophy of the coronoid process can also lead to mouth opening limitations and has been described for both unilateral and bilateral cases [3–8]. The etiology of this hypertrophy can be idiopathic, muscular, post-traumatic, neoplastic, and a sequelae of Jacob's disease [9]. Examination of these children has demonstrated contact of the coronoid process on the posterior aspect of the zygoma, thereby restricting the normal opening rotation of the mandible. The authors of these studies, as well as similar cases in the adult population, recommend excision of the affected coronoid process(es), usually via an open intraoral [10] or more recently endoscopic assisted approach [11, 12].

Reduced mouth opening ability is a known complication of the LeFort III advancement surgery, and has been well described in the craniofacial literature [13]. In some cases it has been related to a combination of post-surgical scar tissue formation and interference of the temporalis muscle with the distractor in cases where internal distractors were utilized. This mouth opening limitation often resolves with removal

✉ Russell R. Reid
rreid@surgey.bsd.uchicago.edu

¹ Division of Pediatric Plastic Surgery, Department of Pediatric Surgery, University of Texas Health Science Center at Houston, Houston, TX, USA

² Division of Plastic and Reconstructive Surgery, Rush University Medical Center, Chicago, IL, USA

³ Bernard Sarnat Scholar of Craniofacial Research, Section of Plastic Surgery, The University of Chicago Medicine and Biological Sciences, 5481 S. Maryland Ave., Room J-641, MC 6035, Chicago, IL 60637, USA

of the distractor device, with or without aggressive physical therapy in the post distraction period. Also, as many of these patients are syndromic (e.g., Apert or Crouzon), they have abnormal skeletal form and relations including the mandible [14] and are prone to ankylosis of their temporomandibular joint (TMJ), especially postoperatively [15].

After midfacial advancement surgery through monobloc or Le Fort III osteotomies, the zygoma is repositioned forward and downward with respect to the arc of rotation of the coronoid process of the mandible. We present a case report of a patient who underwent LeFort III distraction with secondary limited opening ability caused by physical obstruction of the newly repositioned zygomatic arch on the movement of the coronoid process during opening.

Technical Report

The patient was a 9 year-old male with Crouzon's syndrome, who was 3 months post Le Fort III distraction with an external halo device and a tooth-borne intraoral splint appliance with external traction hooks. The distractor was connected to the splint external traction hooks and malar bones bilaterally with surgical wires. Distraction parameters included a 3-day latency period, an activation rate of 0.5 mm BID for 21 days, and a 5-week consolidation phase. The patient was placed on a soft diet during both the activation and consolidation phases. Since the initiation of the consolidation phase, he complained of limited mouth opening and difficulties with mastication. On physical exam his maximal interincisal opening was only 18 mm (Fig. 1). Radiographic analysis was performed, demonstrating that the anterior edges of the coronoid processes were in contact with the posterior surface of the advanced zygoma bilaterally (Fig. 2).

To treat the restricted mouth opening, bilateral coronoidectomies were performed under general anesthesia via

Fig. 1 Preoperative maximal interincisal opening of 18 mm

Fig. 2 Post distraction 3D CT demonstrating close approximation of coronoid process to posterior surface of the zygoma

an intraoral approach. Temporalis muscle attachments were bluntly stripped from the surface of the coronoid. The process was then osteotomized with a reciprocating saw from the anterior oblique ridge to the sigmoid notch under direct visualization, with removal of the coronoid processes following their release. There was minimal blood loss and the patient tolerated the procedure well. Occlusal splints and/or guiding elastics were not used. To prevent recurrence active movement of his mandible through normal masticatory function was encouraged. He was discharged on post-operative day one on a soft mechanical diet. A panorex obtained on the day of discharge demonstrated successful resection of the coronoid process bilaterally (Fig. 3).

Fig. 3 Post operative panorex demonstrating successful removal of bilateral coronoids

Fig. 4 5 months post coronoidectomy with maximal interincisive opening of 33 mm

Post-operatively, he was given a regimen of oral stretching and physical therapy to improve his maximal interincisal distance from 18 mm preoperatively to a stable 33 mm (Fig. 4). There were no adverse sequelae from this procedure.

Discussion

Limited mouth opening capability in the post monobloc and LeFort III patient can be attributed to many causes and most resolve spontaneously in the postoperative period. Of note, some previously described cases involved internal distraction devices, where it is conceivable that the cause for the mouth opening limitation was device- or scar-related [13]. In patients with internal distractors, the removal of the device usually resolves the problem. In cases in which internal and rigid external distraction devices are used, the restrictive musculoskeletal relationships must be carefully evaluated to determine its cause. Musculotendinous attachments may be affected, either from surgery, postoperative scarring, or rarely, from stretching by the distraction process. For muscular issues related to muscular stretching, postoperative therapy and stretching exercises should adequately correct the limited mouth opening. In terms of muscular stretching, the gradual process of distraction most likely prevents muscular dysfunction from stretching. For our patient, similar to patients who present with hypertrophy of their coronoid process or processes, the close postoperative proximity of the coronoid process to the posterior aspect of the zygoma restricted the normal anterior arc movement of the entire mandible during mouth opening.

This postoperative phenomenon is not uncommon and has been noted by others in cases of conventional and rigid

external distraction monobloc cases (Figuerola and Polley, verbal communication). The mechanism causing the coronoid restriction is based on the fact that in many cases the advancement is not only forward but also downward.

Depending on the skeletal anatomy of the mandible and malar bones an unfavorable relation might be obtained at this level despite the orbital and facial improvement. It should be noted that many syndromic patients require advancements at different levels based on the existing dysmorphology. The advancement required in the frontal, orbital and maxillary regions might be different in the same patient. For these reasons procedures have been devised to advance the various segments independently of each other, such as is the case of the “piggyback osteotomies” [16]. It is critical that during the preoperative evaluation the surgeon assesses all potential skeletal interferences and desired skeletal relations after the distraction process. The surgeon must carefully determine the vector of distraction based on the desired movement of a particular skeletal segment [17, 18]. If this is done, potential problems with the desired movements can be predicted and changing the surgical plan may become necessary or the patient and family need to be informed in advance of the possibility for additional corrective surgery such as a coronoidectomy. While complex multisection distractions can be technically more difficult than single segment movements, preoperative planning allows for anticipation of coronoid restriction, and the coronoidectomy can be planned for the time of the device removal.

The recently described technique of LeFort III osteotomy with zygomatic repositioning and subsequent LeFort II distraction offers a particularly useful solution to this problem [19]. With the fixation of the zygoma in an anterior position prior to distraction, the mandible can have an unobstructed range of motion after the procedure. This can also allow for subsequent vertical distraction, without the adverse outcome that we encountered in our patient.

Conclusions

We report on the successful postoperative treatment of a case of limited mouth opening capability that occurred after a successful Le Fort III distraction in a pediatric patient with Crouzon Syndrome. Bilateral coronoidectomy via an intraoral approach with subsequent physiotherapy appears to be an effective option for patients with iatrogenically abnormal zygomaticomandibular anatomy that restricts normal mandible function. We present this case to highlight the potential complication after midface distraction and its successful resolution. The importance of preoperative planning is highlighted to prevent or plan in advance for the treatment of postoperative mouth opening limitation after monobloc and LeFort III distraction.

Conflict of interest None.

References

1. Gruss JS et al (1990) The importance of the zygomatic arch in complex midfacial fracture repair and correction of posttraumatic orbitozygomatic deformities. *Plast Reconstr Surg* 85(6):878–890
2. Wiesenbaugh JM Jr (1970) Diagnostic evaluation of zygomatic complex fractures. *J Oral Surg* 28(3):204–208
3. Chang CC et al (2012) A quantitative three-dimensional analysis of coronoid hypertrophy in pediatric craniofacial malformations. *Plast Reconstr Surg* 129(2):312e–318e
4. Galie M et al (2010) Early surgical treatment in unilateral coronoid hyperplasia and facial asymmetry. *J Craniofac Surg* 21(1):129–133
5. Jaskolka MS, Eppley BL, van Aalst JA (2007) Mandibular coronoid hyperplasia in pediatric patients. *J Craniofac Surg* 18(4):849–854
6. Leovic D, Djanic D, Zubcic V (2006) Mandibular locking due to bilateral coronoid process hyperplasia. *Wien Klin Wochenschr* 118(19–20):594
7. Kai S et al (1997) Open-mouth locking caused by unilateral elongated coronoid process: report of case. *J Oral Maxillofac Surg* 55(11):1305–1308
8. Mano T et al (2005) Trismus due to bilateral coronoid hyperplasia in a child: case report. *J Oral Maxillofac Surg* 63(3):399–401
9. Escuder i de la Torre O et al (2001) Jacob's disease: report of two cases and review of the literature. *J Craniomaxillofac Surg* 29(6):372–376
10. Ramalho-Ferreira G et al (2011) Mandibular movement restoration through bilateral coronoidectomy by intraoral approach. *J Craniofac Surg* 22(3):988–991
11. Mavili E, Akyurek M, Kayikcioglu A (1999) Endoscopically assisted removal of unilateral coronoid process hyperplasia. *Ann Plast Surg* 42(2):211–216
12. Robiony M, Casadei M, Costa F (2012) Minimally invasive surgery for coronoid hyperplasia: endoscopically assisted intraoral coronoidectomy. *J Craniofac Surg* 23(6):1838–1840
13. Holmes AD et al (2002) LeFort III internal distraction in syndromic craniosynostosis. *J Craniofac Surg* 13(2):262–272
14. Costaras-Volarich M, Pruzansky S (1984) Is the mandible intrinsically different in apert and crouzon syndromes? *Am J Orthod* 85(6):475–487
15. Fan K et al (2012) Protection of the temporomandibular joint during syndromic neonatal mandibular distraction using condylar unloading. *Plast Reconstr Surg* 129(5):1151–1161
16. Polley JW, Figueroa AA (1995) “Piggyback” osteotomies in craniomaxillofacial surgery. *J Craniofac Surg* 6(3):199–210
17. Figueroa AA, Polley JW, Figueroa AD (2010) Biomechanical considerations for distraction of the monobloc, Le Fort III, and Le Fort I segments. *Plast Reconstr Surg* 126(3):1005–1013
18. Shetye PR et al (2009) Le Fort III distraction: part I. Controlling position and vectors of the midface segment. *Plast Reconstr Surg* 124(3):871–878
19. Hopper RA, Kapadia H, Morton T (2013) Normalizing facial ratios in apert syndrome patients with Le Fort II midface distraction and simultaneous zygomatic repositioning. *Plast Reconstr Surg* 132(1):129–140