

Zygomatic Arch Osteotomy for Open Reduction and Internal Fixation of Medially Displaced/Dislocated Condylar Head in High Condylar Fractures

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Abstract

Purpose: Open reduction and internal fixation of high condylar fractures is challenging. The difficulty gets compounded when the condylar head is medially displaced or dislocated. The surgical procedure is limited by inadequate visibility and restricted access to the fractured condyle for proper reduction and fixation. When conventional methods of reduction fail, “osteotomy-osteosynthesis” is performed to retrieve and fix the fractured condylar head. However, they are extensive surgeries and associated with morbidity. **Methods:** This article presents a novel technique “zygomatic osteotomy (ZO)” performed on a cadaver to facilitate retrieval of the displaced head and achieve ideal reduction and fixation. A comparison of the existing techniques with the proposed ZO has been done in detail. **Conclusion:** The “ZO” technique is easy to perform with less potential for complications.

Keywords: Access osteotomy, complications, High condyle fracture, medially displaced condyle

INTRODUCTION

High-level fractures of the condyle involving the head and neck constitute a specific entity, whose surgical management is contentious. Open reduction and internal fixation (ORIF) is warranted in clinical situations such as displaced or dislocated condyles that lead to reduction in posterior facial height^[1] and posttraumatic malocclusion which are not amenable to closed method of management. High condyle fractures also necessitate ORIF to prevent long-term complications including temporomandibular joint dysfunction or ankylosis.^[1] With the advent of better armamentarium and imaging techniques, ORIF of high condyle fractures is being chosen by many surgeons with predictable results and favorable clinical outcome. However, even today, these fractures are managed by closed method in many surgical units due to the complex reduction and fixation methods involved.

The ORIF of high condylar fractures is technically demanding due to (1) difficulty in localizing the displaced condylar head and (2) restricted access for manipulation. The surgical procedure is even more challenging when the fractured condylar head is medially displaced or dislocated from the

fossa.^[2] The difficulty in visualizing and localizing the fractured condylar head is due to its medial retraction by the lateral pterygoid muscle pull or due to the telescoping of the ramal component which reduces the joint space. This greatly reduces the working space for condylar reduction. Further, the constant pull of the lateral pterygoid compounds difficulty in ORIF by destabilizing condyle even after reduction.

Management of the medially displaced/dislocated condyle involves two important steps. (1) Widening of the joint space by inferior distraction of the mandible either manually or by mechanical traction using a retractor,^[3] clamp, towel clip, or traction wire at the angle^[2] which helps to locate the displaced head and gain access for instrumentation and (2) retrieval of the

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condylar head and reduction using devices such as Moule pin,^[2] elevator, hook, forceps, and screw.^[4] These procedures are still cumbersome and sometimes ineffective. Rowe proposed stripping of the lateral pterygoid muscle to facilitate reduction and prevent redisplacement of reduced condyle.^[5] However, this may result in avascular necrosis of the condylar head. Even technical advances such as application of coronary artery disease^[6] or endoscopic approach which are advocated for minimal surgical morbidity and better accuracy in localizing the fracture fragment, do not add any significant advantage for fracture reduction. Further, these techniques require special armamentarium and are technique sensitive.

In such indications where the conventional methods fail to facilitate optimal reduction, the method of choice remains the “osteotomy-osteosynthesis” techniques where an access osteotomy is performed to gain access to the fractured condyle for manipulation, reduction, and fixation. However, these are associated with many limitations^[7,8] related to osteotomy *per se* as well as principles of fixation [Table 1].

The authors of this paper have used a novel osteotomy-osteosynthesis technique, the zygomatic osteotomy (ZO) that helps to circumvent the above-mentioned limitations through its relatively direct access to the pericondylar compartment.

TECHNIQUE

The computed tomography scan of a patient with a high condylar fracture demonstrating a medially displaced and dislocated condylar head was chosen. The three-dimensional reconstruction of the scan was performed, and the exact location of the displaced condylar head relative to the other anatomical structures was identified in the superoinferior as well as mediolateral planes [Figure 1].

The joint space was exposed on a cadaver using a preauricular approach. A simulation of the patient’s fracture was performed by osteotomizing the head of the condyle and manually displacing it on to the medial side of the ramus. Once this was completed, the actual process of simulated surgery was performed. The zygomatic arch was exposed and osteotomized at 2 points; posterior osteotomy at a point

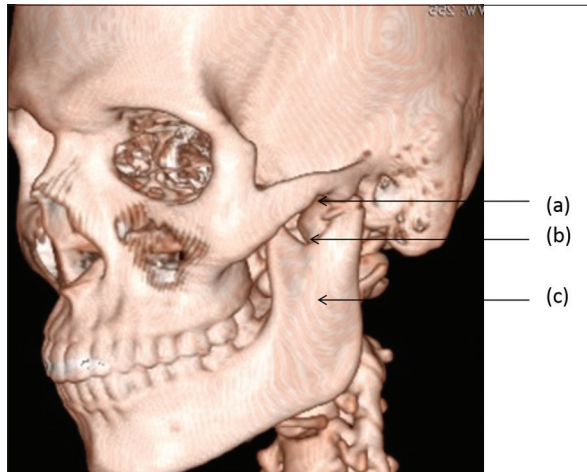


Figure 1: Computed tomography scan showing the medially displaced condyle (a) zygomatic arch, (b) medially displaced condylar head, and (c) superiorly displaced ramus

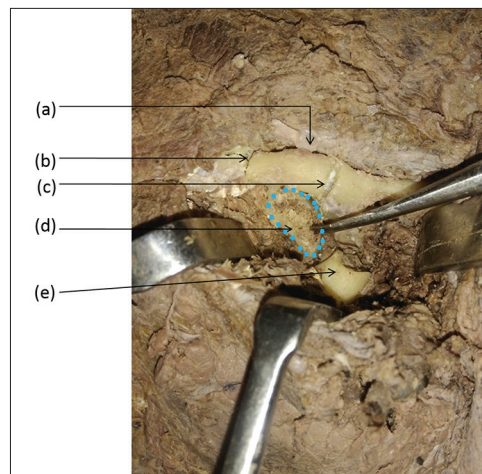


Figure 2: Cadaver dissection showing zygomatic osteotomy (a) zygomatic arch, (b) anterior limiting cut, (c) posterior limiting cut, (d) displaced condylar head, and (e) residual condylar stump

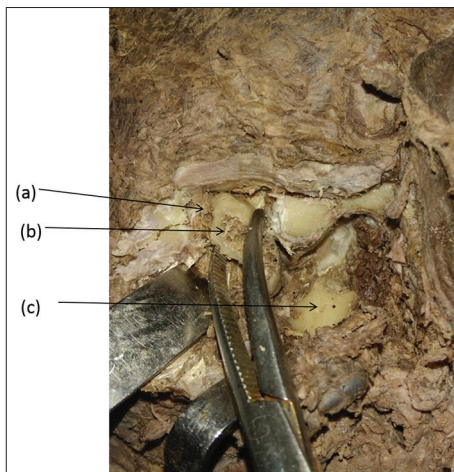


Figure 3: Retrieval of the condylar head through the osteotomy gap (a) osteotomy gap, (b) condylar head, and (c) residual condylar stump



Figure 4: Fixation of the zygomatic arch and condylar head (a) zygomatic arch fixed and (b) condyle reduced and fixed

anterior to the eminence and anterior osteotomy at 10–15 mm anterior to the first osteotomy [Figure 2]. The segmented arch was mobilized inferiorly to facilitate access to the site of medially displaced condyle [Figure 3]. The osteotomized arch may be pedicled on masseter or nonpedicled. The condylar head was uprighted and delivered through the osteotomy site without severing the attachment of the lateral pterygoid muscle. The articular disc was repositioned and secured. Reduction and fixation of the condyle fracture was done and the arch was anatomically reduced and fixed with a 1.5-mm plate [Figure 4].

DISCUSSION

Osteotomy-osteosynthesis techniques are performed when reduction of high condylar fractures is impossible by conventional methods. A related review of available literature focuses attention to one method: the vertical ramus osteotomy. This technique has been the most popularly advocated method and has been practiced with two modifications: (1) osteotomy and extracorporeal fixation of the fracture and restitution of the ramus–condyle unit (Nam and Boyne) and (2) osteotomy with preservation of the lateral pterygoid attachment and internal fixation.^[9] However, scrutiny of these techniques reveals a

few practical drawbacks which have been discussed under the following headings [Figure 5 and Table 1]:

1. Approach to the condyle: The choice of a submandibular approach for the above-mentioned techniques for ramus osteotomy may facilitate only access to condylar head but would make fixation difficult, especially in a high-level fracture, necessitating another incision (preauricular)
2. Osteotomy proper: The technique of performing a vertical ramus osteotomy involves a large anatomical area and associated morbidity. The osteotomy may also lead to instability of dental occlusion
3. Duration of surgery: The time taken to perform vertical ramus osteotomy is considerably more as compared to ZO
4. Vascularity of the osteotomized bone fragment: Osteotomy-osteosynthesis by Nam's procedure is extracorporeal and the healing of the osteotomized bone fragments is similar to that of free bone grafts and may be unpredictable. In this aspect, the internal method of Sasaki may show a small advantage by preserving the lateral pterygoid attachment.

In comparison, the ZO proposed by the authors ensures a relatively quick access to the fractured condylar head as well as facilitates fracture fixation with the same preauricular incision

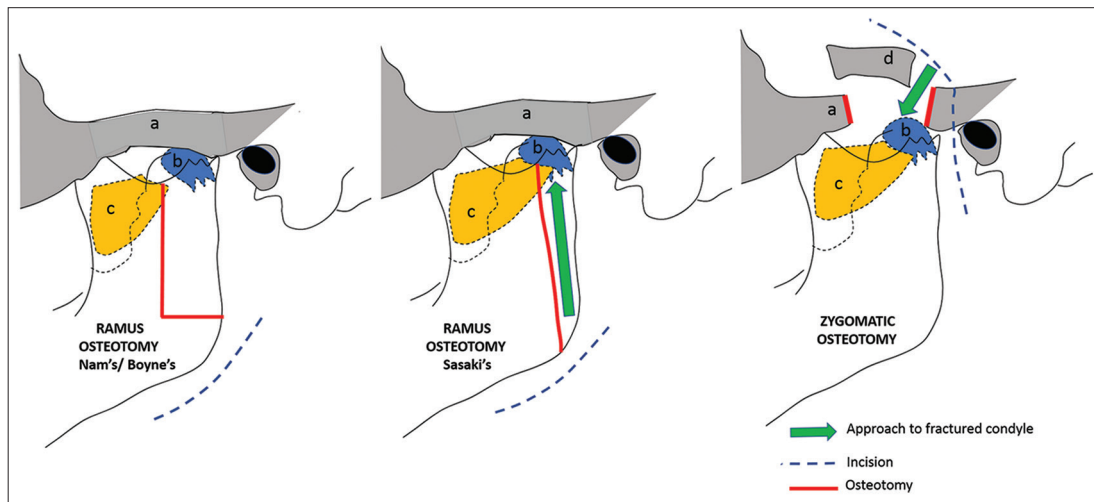


Figure 5: Ramus osteotomies versus zygomatic osteotomy (a) zygomatic arch, (b) displaced condylar head, (c) lateral pterygoid muscle, and (d) osteotomized zygomatic arch

Table 1: Ramus osteotomies versus zygomatic osteotomy			
	Ramus osteotomy Nam's/Boyne's	Ramus osteotomy Sasaki	Zygomatic osteotomy
Incision	Submandibular	Submandibular	Preauricular
Approach to condyle	Tunneled approach	Tunneled approach	Direct approach
Surgery time	More	More	Less
Access to fracture fragment	Relatively difficult	Relatively difficult	Easier
Lateral pterygoid attachment	Detached	Preserved	Preserved
Osteotomy	Complex	Complex	Simple
Surgical morbidity	More	More	Less
Fate of condyle	Like a free graft	Good vascularity	Good vascularity

used for access. Further, the technique does not compromise the attachment of lateral pterygoid to the condylar which retains its viability.

The osteotomy described in this article is technically similar to an access osteotomy for the infratemporal fossa. However, in this clinical scenario, the osteotomy does not involve the zygomatic bone in its entirety but is restricted only to the arch which is mobilized by an anterior dysjunction/osteotomy behind the incisura and a posterior dysjunction/osteotomy just anterior to the root of the zygoma. It also retains the inferolateral attachment of the masseter along the length of the arch which acts as the pedicle for the osteotomized segment.^[10] This clinical indication does not warrant a coronoid process dysjunction/osteotomy as performed for the infratemporal approach and hence spares the coronoid and the temporalis insertion.

The authors also wish to draw attention to the mechanical advantage associated with this technique (ZO) in the axis of retrieval of condylar head. The condylar head in most instances lies perpendicular to the long axis of the ramus and beneath the articular eminence/zygomatic arch [Figures 1 and 2]. For adequate reduction, the condylar head needs to be uprighted in the vertical axis. However, the traditional maneuvers of fracture reduction enable retrieval/pull of the head only in the horizontal plane (medial to lateral). Such a clinical situation produces the following surgical challenges: (1) the zygomatic arch forms a major impediment for the vertical reduction of the displaced fragment; (2) blind manipulation of the condyle along the horizontal plane may endanger the adjacent vital structures such as the maxillary artery, carotid, and jugular vessels; and (3) the excessive force delivered in manipulating the head horizontally may sometimes sever the lateral pterygoid attachment leading to avulsion or fragmentation of the condylar head. Hence, manipulation of the condylar head in the horizontal plane is not favored.^[11] The ideal arc of delivery of condyle is thus more vertical, which is provided by the ZO.

The technique thus prevents undue damage to adjacent vital structures due to direct visualization and facilitates proper reduction and fixation of the condyle. This technique may also be performed through a coronal incision with preauricular extension. This may be a helpful technique in panfacial fractures which require fixation of fractured zygomatic arch. Prospective clinical assessment of this technique involving an adequate patient sample would provide more useful data

regarding the clinical usefulness and limitations of this technique.

CONCLUSION

In comparison with the present osteotomy-osteosynthesis techniques, the ZO is a reliable option to facilitate ORIF of high-level condylar fractures which are not amenable to conventional techniques of reduction and fixation. It provides better access with minimal surgical morbidity.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Landes CA, Lipphardt R. Prospective evaluation of a pragmatic treatment rationale: Open reduction and internal fixation of displaced and dislocated condyle and condylar head fractures and closed reduction of non-displaced, non-dislocated fractures. Part I: Condyle and subcondylar fractures. *Int J Oral Maxillofac Surg* 2005;34:859-70.
- Kademani D, Rombach D, Quinn P. Trauma to the temporomandibular joint region. In: Fonseca R, editor. *Oral and Maxillofacial Trauma*. Missouri: Elsevier; 2005. p. 549.
- Sugamata A, Yoshizawa N, Jimbo Y. Open reduction of subcondylar fractures using a new retractor. *Plast Surg Int* 2011;2011:421245.
- Gerlach KL, Erle A, Eckelt U, Loukota RA, Luhr HG. Surgical management of mandibular, condylar neck and atrophic mandible fractures. *Maxillofac Surg* 2007;1:80-92.
- Bradley PF. Injuries of the condylar and coronoid process. In: Rowe NL, Williams JL, editors. *Maxillofacial Injuries*. Edinburgh, Scotland: Churchill Livingstone; 1985. p. 337-62.
- Yang ML, Zhang B, Zhou Q, Gao XB, Liu Q, Lu L, *et al.* Minimally-invasive open reduction of intracapsular condylar fractures with preoperative simulation using computer-aided design. *Br J Oral Maxillofac Surg* 2013;51:e29-33.
- Kellman RM. Endoscopic approach to subcondylar mandible fractures. *Facial Plast Surg* 2004;20:239-47.
- Park SY, Im JH, Yoon SH, Lee DK. A follow-up study on extracorporeal fixation of condylar fractures using vertical ramus osteotomy. *J Korean Assoc Oral Maxillofac Surg* 2014;40:76-82.
- Kademani D, Rombach D, Quinn P. Trauma to the temporomandibular joint region. In: Fonseca R, editor. *Oral and Maxillofacial Trauma*. Missouri: Elsevier; 2005. p. 561.
- Labbè D, Bussu F, Iodice A. A comprehensive approach to long-standing facial paralysis based on lengthening temporalis myoplasty. *Acta Otorhinolaryngol Ital* 2012;32:145-53.
- Raveh J, Vuillemin T, Ladrach K. Open reduction of the dislocated, fractured condylar process: Indications and surgical procedures. *J Oral Maxillofac Surg* 1989;47:120-7.