

*Case Report***REPAIR OF ENOPHTHALMUS IN NEGLECTED TETRAPOD ZYGOMA FRACTURE WITH DICED CARTILAGE GRAFT AND FASCIA LATA SLING GRAFT: A CASE REPORT**Kristaninta Bangun<sup>1,2\*</sup>, Jessica Halim<sup>2</sup>, & Siti Handayani<sup>1,2</sup>

1. Department of Surgery, Faculty of Medicine Universitas Indonesia, Indonesia
2. Cipto Mangunkusumo General Hospital, Jakarta, Indonesia

**ABSTRACT**

**Introduction:** Zygoma fractures with orbital involvement, are the most common midfacial traumas, which cause severe aesthetic and functional sequelae. Late reduction of orbital floor fracture may result in entrapment of orbital soft tissue, predisposing the occurrence of enophthalmos. This article aimed to report enophthalmus correction in neglected tetrapod zygoma fracture case with autologous diced cartilage graft and fascia lata graft.

**Case Presentation:** A 42-year-old female was injured in a traffic accident 8 years ago. Facial fracture was not repaired surgically, resulting in facial asymmetry and diplopia. Physical examination revealed right-sided zygoma deformity, 5mm dystopia, depressed malar eminence, gaze restriction and enophthalmus on the right eye. 3D CT scan confirmed a malunited neglected tetrapod zygoma fracture.

**Result:** Corrective osteotomy was performed to reconstruct the tetrapod zygoma fracture using combination of bicoronal, infraciliary, and maxillary vestibular approach. 4-point fixation and stepladder modification was used. 1.6 cc of cartilage-derived diced bone graft was inserted on the posterior orbital floor to repair enophthalmos. Six months follow-up revealed improved dystopia and malar prominence. Additional surgery was done to repair scleral show and smoothen and augment lower lid volume using 4.5x0.6 cm fascia lata graft hammocked from the medial canthus to lateral orbital bone.

**Discussion & Conclusion:** Long neglected zygoma fracture possessed a difficulty in reconstructing malunited zygoma articulation. Good aesthetic and functional outcome are achievable following use of diced cartilage and fascia lata graft for enophthalmus correction in neglected zygoma-orbital fracture, suggesting the role of fascia lata sling graft for treatment of scleral show and lower lid volume replacement.

**Keywords:** Neglected fracture; Orbital fracture; Diced cartilage graft; Enophthalmos; Orbital reconstruction

**Pengantar:** Fraktur zygoma dengan keterlibatan orbital adalah trauma wajah tengah yang paling umum dan menyebabkan gangguan secara estetika serta fungsional. Keterlambatan reduksi fraktur pada lantai orbita dapat menyebabkan terjepitnya jaringan lunak orbita dan meningkatkan risiko terjadinya enoftalmos. Artikel ini menggambarkan koreksi enoftalmus pada kasus fraktur zygoma tetrapod yang telah diperbaiki dengan cangkok autolog tulang rawan cacah dan cangkok fascia lata.

**Presentasi Kasus:** Seorang wanita, 42 tahun mengalami kecelakaan lalu lintas 8 tahun yang lalu. Fraktur wajah tidak segera diperbaiki melalui operasi yang mengakibatkan terjadinya asimetri wajah dan diplopia. Pemeriksaan fisik menunjukkan deformitas zygoma sisi kanan, distopia 5mm, proyeksi malar tertekan, penurunan visus, dan enoftalmus pada mata kanan. CT scan 3D mengkonfirmasi fraktur zygoma tetrapoda lama.

**Hasil:** Osteotomi korektif dilakukan untuk merekonstruksi fraktur zygoma tetrapoda dengan kombinasi insisi bikoronal, infrasilial, dan vestibulum maxilla. Fiksasi 4 titik dan modifikasi stepladder digunakan. 1,6 cc cangkok tulang autolog dari tulang rawan krista iliaka dimasukkan pada bagian posterior dasar orbita untuk memperbaiki enoftalmos. Observasi enam bulan menunjukkan perbaikan distopia dan proyeksi malar. Operasi tambahan dilakukan untuk memperbaiki scleral show dan menambah volume pada kelopak mata bawah menggunakan cangkok fascia lata sebesar 4,5x0,6 cm yang disambungkan dari kantung medial ke tulang orbita lateral.

**Kesimpulan:** Rekonstruksi artikulasi zygoma yang telah mengalami malunion merupakan kesulitan terbesar pada perbaikan fraktur zygoma lama. Luaran estetika dan fungsional yang baik dapat dicapai pada pasien ini setelah operasi dengan cangkok tulang rawan cacah autolog dan fascia lata untuk koreksi enoftalmus pada fraktur zygoma-orbital yang telah diperbaiki. Kasus ini juga menunjukkan peran cangkok fascia lata untuk memperbaiki scleral show dan penambahan volume kelopak mata bawah.

**Kata Kunci:** Fraktur lama; Fraktur orbita; Cangkok tulang rawan cacah autolog; Enoftalmus; Rekonstruksi orbita

**Conflicts of Interest Statement:**

The author(s) listed in this manuscript declare the absence of any conflict of interest on the subject matter or materials discussed.

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## INTRODUCTION

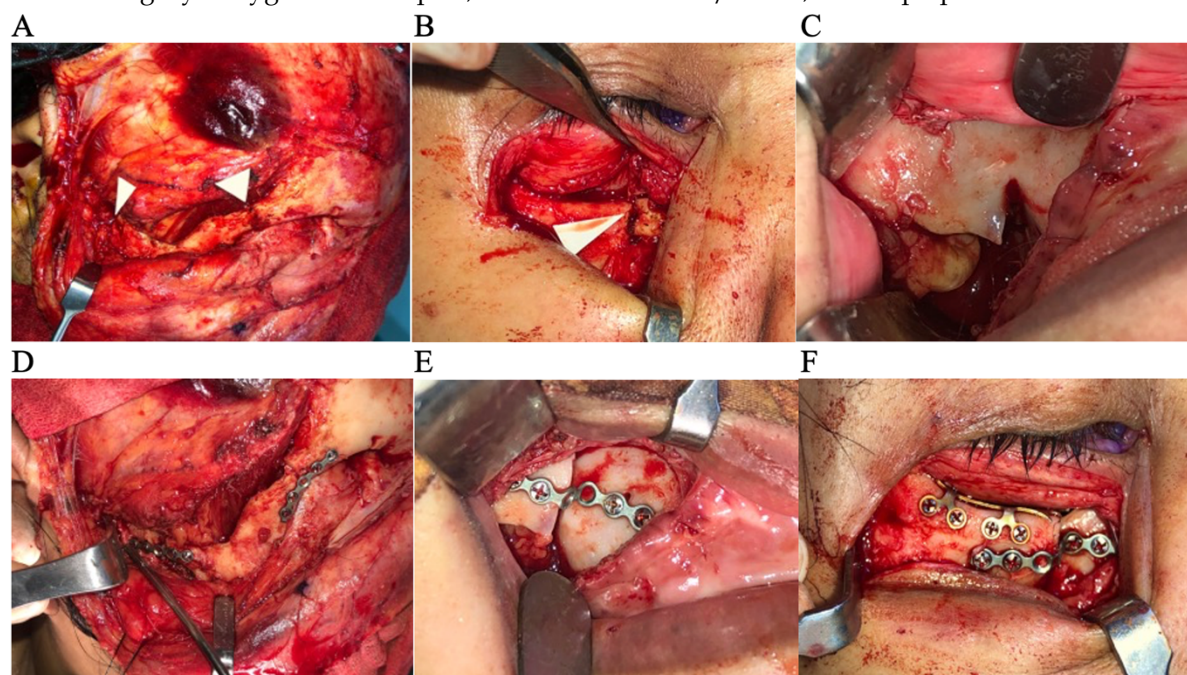
Zygoma is a complex midface structure with four articulations with the frontal, sphenoid, temporal, and maxillary bones. Facial trauma, mostly caused by non-violent traffic accidents or violent assaults, can result in zygoma fracture of only 1 articulation or a tetrapod fractures involving all 4 buttresses, depending on the velocity and direction of the traumatic force.<sup>1</sup> The vertical middle third facial fracture accounted for about 63.5% of all facial trauma.<sup>2</sup> Zygomatico-Maxillary complex (ZMC) fracture involving the inferior orbital floor is the most common case among all facial fractures (14%).<sup>3</sup> Most common presentation of zygoma fracture may include subconjunctival ecchymosis, step deformity, periorbital and buccal sulcus ecchymosis, depressed cheek, facial widening, malocclusion, enophthalmos, diplopia, and neurosensory deficit.<sup>4</sup>

Craniofacial reconstruction should apply multidisciplinary approach and consider multi-aspect outcomes, to restore function, complexion, and the integrity of zygomatic complex, without

compromising the quality of life.<sup>5</sup> Facial fractures require timely intervention to acquire optimal functional and aesthetic outcomes. However, a lot of delayed fracture intervention are encountered due to underlying medical conditions, neuro-emergency situations, or incorrect diagnosis. Neglected orbital fracture may also cause shrinkage of orbital soft tissue bulk and provoke late enophthalmos.<sup>6</sup> Depressed malar eminence and presenting diplopia should be carefully addressed in cases of old fracture. In this study we presented enophthalmos correction using rib cartilage-derived diced cartilage and fascia lata sling graft in neglected tetrapod zygoma fracture.

## CASE PRESENTATION

A 42-year-old female came to our institution with facial asymmetry caused by a traffic accident 7 years ago (2013). Physical examination revealed zygoma deformity, severe eye dystopia (5mm), depressed malar eminence, and enophthalmus on the right side.<sup>7</sup> Visual acuity was 0.5/60 OD and >3/60 OS, and diplopia was found on the



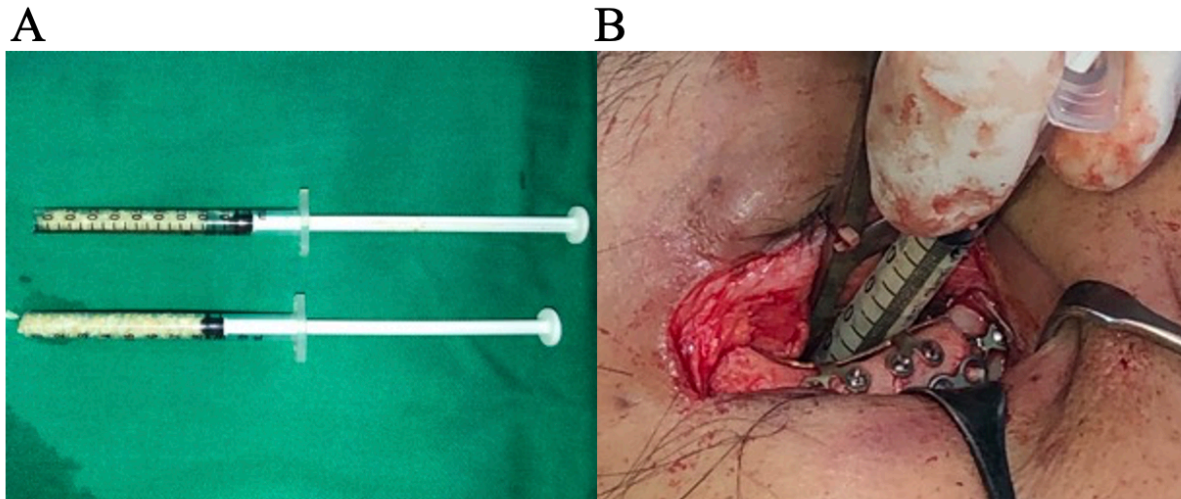
**Figure 1.** 1A) The signs pointed the malunioned fractures on the zygomaticofrontal and zygomaticotemporal suture; 1B) the sign showed neglected malunioned fracture on the infraorbital rim; 1C) malunion of previously fractured zygomaticomaxillary suture. 1D) malunion was refractured using an osteotome and Carroll-Girard T Bar was used to elevate and adjust the zygoma. 5-hole miniplate was placed on the zygomaticofrontal (4mm screw) and zygomaticotemporal suture (6mm screw) showing 5mm gap at the zygomatic arch; 1E) stepladder fixation on zygomaticomaxillary suture following osteotomy; 1F) stepladder fixation of infraorbital rim fracture and orbital floor reconstruction using titanium mesh plate.



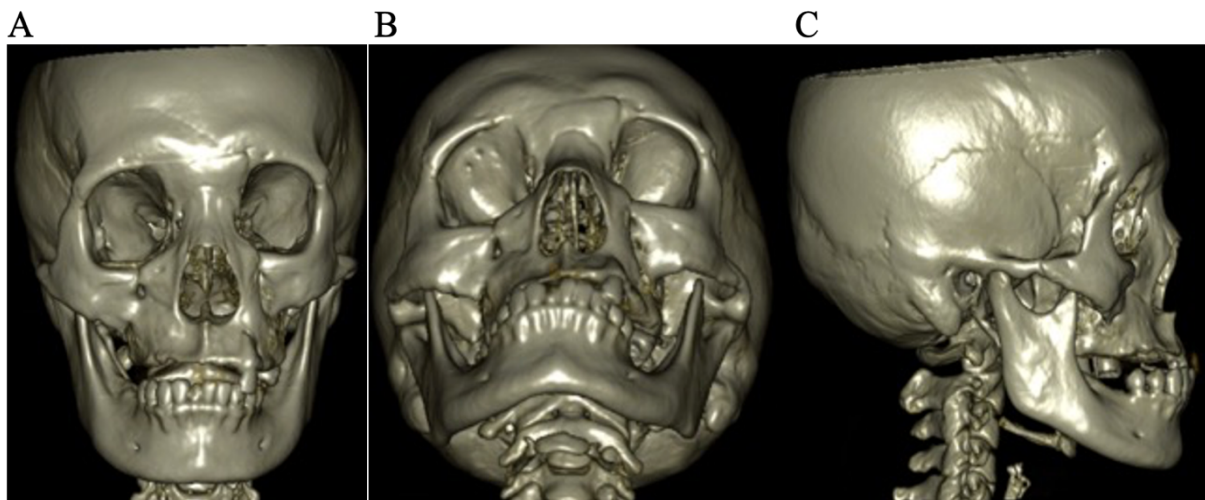
medial projection of the right eye. 3-dimensional CT scan showed malunited ZMC in all 4 branches with extended fracture line towards the left orbital rim and maxilla.

Using bicoronal, infraciliary, and maxillary vestibular approach, re-osteotomy of all ZMC articulation was commenced (Figure 1).

reconstruction was performed using the orbital plate and diced cartilage graft to fix the enophthalmus. Graft was harvested from the 8th rib cartilage with 1.5cm total length and then finely diced with a scalpel (Figure 3). 1.6 cc of diced cartilage graft was inserted into the posterior area of the orbital space.



**Figure 2.** 2A) Cartilage graft was harvested from the 8th rib cartilage on the ipsilateral side (1.5cmx1cmx0.5cm) and then diced following washing with saline solution. Total of 1.6 cc of diced cartilage stuffed into 1cc syringe; 2B) implantation of diced cartilage graft into the posterior inferior portion of orbital space.



**Figure 3.** Pre-surgical 3-dimensional CT scan imaging. 3A) AP view showed a 5mm vertical orbital dystopia and deformed zygoma articulation compared to the contralateral side; 3B) basal view showed unequal level of malar eminence and malunion of the neglected fractures at all four articulations of zygoma buttresses; 3C) lateral view revealed depressed malar eminence.

Miniplates midface system 1.5 were placed in zygomaticofrontal, sphenozygomatico (4mm screw), zygomaticotemporal (4mm screw), and zygomaticomaxillary sutures respectively (Figure 2). Stepladder fixation technique was used for infraorbital rim and ZMC fracture to elevate the zygoma process and equate the contralateral malar prominence. Orbital floor

Two weeks after, visual acuity was 2/60 OD and >3/60 OS with no gaze restriction and strabismus. Patient no longer complained of maxillary movement restriction. Five months follow-up revealed a persistent moderate dystopia (3mm) with scleral show. Depressed malar eminence, although improved, was still observed. Six months following the first surgery,

patient underwent lower lid reconstruction using free fascia lata graft as suspension sling to reduce the scleral show. 3.5cm longitudinal incision on

smoothened contour. The patient achieved equal malar projection on both sides (Figure 4).



**Figure 4.** Pre-surgical appearance (A-D) and post-operative results (E-J). 4A) AP view showing severe dystopia (5mm) (see the level difference showed by red dotted line); 4B) basal view showing depressed malar eminence on the right side; 4C) right lateral view showing enophthalmus of the right eye; 4D) close up anterior view showing exotropia of the right eye and gaze restriction. 4E) on 6 months follow up, AP view showed improved eye level. Moderate degree of dystopia (3mm) is still observed (Inter Canthal Distance of 30mm); 4F) basal view showing improved malar eminence; 4G) right lateral view showed improved enophthalmus of the right eye; 4H) Patient on 1 month follow-up following secondary scleral show repair; 4I) malar eminence on both sides looked equal and comparable with no scleral show; 4J) lateral view revealed improved volume and smoothened contour on lower lid with resolved enophthalmus.

the thigh was made and 4x1.5cm fragment of fascia lata was obtained. The graft was then sutured to the medial inferior part of the eyelid to the tarsus, and fixed on the lateral canthal periosteum in upper-lateral direction. Two months after, scleral show was resolved and the right lower lid showed improved volume and

## DISCUSSION

Orbito-zygomatic (OZ) fracture are the most commonly presented facial fractures due to its close proximity to the zygomatic bone<sup>1</sup>. Neglected orbital fracture without proper reduction often experience soft tissue atrophy,



contributing to enophthalmus. Moreover, relative deficiency of orbital tissue caused by bony volume expansion from the loss of tissue and fat content may worsen post-traumatic enophthalmus. Our patient was indicated for corrective zygoma and orbital surgery due to presenting diplopia, enophthalmos, dystopia, and aesthetic considerations. We performed osteotomy on all four zygoma articulations and placed 4-point fixation according to the AOCMF principle, which is based on the least damaged rule. Orbital graft implantation was incorporated to increase orbital tissue volume and restore pre-traumatic appearance.

Lee et al calculated the graft volume needed for orbital augmentation based on vertical orbital shift, where he proposed additional 1.37-1.5ml of graft material for every 1mm advancement of eyeball position.<sup>8</sup> The indicator of adequate volume replacement was eyelid tension and eyeball protrusion. In our case, we liberally inserted 1.6 of diced cartilage graft into the retrobulbar space above the titanium mesh until the lid tensed, indicating maximum volume the orbit can contain. However, in this patient, dystopia persisted on follow ups, suggesting that graft volume approximation based on clinical judgment was inadequate. According to Kreshanti and colleagues, the graft volume can be quantified using computer-aided modality OsiriX® for enophthalmos correction.<sup>9</sup> They measured bilateral eyeball volumes and calculated the volume discrepancy, which equals to the graft volume needed for augmentation.

On follow-ups, our patient showed small degree of residual enophthalmus and scleral show caused by lower lid retraction. Lower lid was successfully repositioned using two-finger test, necessitating lateral canthal tendon tightening and spacer graft insertion.<sup>10</sup> We used autologous ellipse-shaped fascia lata graft to enhance volume and smoothen the lower eyelid contour. Satisfactory functional and aesthetic outcome were achieved two months after. Fascia lata used as hammock suspension is commonly used to suspend lower eyelid in lagophthalmos, lower lid ptosis, lower lid retraction, or ectropion following facial paralysis or facial injury. Crawford first used fascia for volume replacement in enucleated orbit and more studies afterward confirmed that fascia lata graft had good retention rate and was resistant to necrosis with minimal local inflammatory reaction.<sup>11</sup> In our patient, 6mm vertical fascia lata graft was

used for 3mm lid retraction as proposed by Flanagan who calculated a 2mm graft needed for every 1 mm lid retraction.<sup>12</sup>

After the second surgery, the patient showed improved orbital dystopia, balanced malar eminence, and resolved enophthalmus, which might contribute to her improved post-operative visual acuity. The neglected zygoma fracture posed a difficulty in reconstructing malunited zygoma structure into initial anatomy, limiting the extent of ZMC repositioning. We concluded that 1.6 cc diced cartilage graft was not sufficient to correct dystopia in patients with 5 mm advancement, and tensed lid was not an accurate indicator of graft volume sufficiency. Measurement of the exact volume discrepancy between both orbits should be done using computerized pre-surgical planning. We encouraged the use of fascia lata sling graft for scleral show and lower eyelid volume advancement to mask the enophthalmus, dystopia, and augment malar eminence.

## CONCLUSION

Improved malar eminence, improved dystopia, and resolved enophthalmus were achieved in our patient with neglected tetrapod zygoma-orbital fracture incorporating osteotomy, titanium mesh plate for orbital reconstruction, and diced cartilage graft for residual enophthalmus correction. 3D CT scan analysis should be utilized to measure the orbital volume deficit pre-operatively. We considered diced cartilage graft as reliable intervention for correction of enophthalmus. All combined approach discussed above should be applied judiciously as a reference in dealing with similar cases.

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### Correspondence regarding this article should be addressed to:

Kristaninta Bangun, MD, Ph.D  
Plastic Surgeon, Consultant of Cleft and Craniofacial  
Cipto Mangunkusumo General Hospital, Jakarta, Indonesia  
Division of Plastic Reconstructive and Aesthetic Surgery,  
Department of Surgery, Faculty of Medicine, Universitas  
Indonesia,  
Jl. Pangeran Diponegoro no. 71, Jakarta Pusat, DKI Jakarta,  
Indonesia 10430  
E-Mail: [kristaninta@yahoo.com](mailto:kristaninta@yahoo.com)

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## SUBMISSION VERIFICATION

All authors acknowledged that this work has not previously been published or presented in any conferences nor under consideration for publication in other journals. All authors shared similar amount of work throughout the designing, conceiving, actuating, analysing, and revisions. The content of this study was approved by all authors and we guarantee its novelty and originality.

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The patient involved in this study has given her consent for her past history and photographs published with a purpose of education. We hereby declared that all authors disclosed no financial or personal conflict of interest related with other party or organization that could possibly influence our work.

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