

The Role of Computed Tomography in Zygomatic Bone Fracture - A Case Report

Luiza Roberta Bin, Eleonor Álvaro Garbin, Natasha Magro-Érnica, Geraldo Luiz Griza, Ricardo Augusto Conci, Leticia Nadal

Department of Oral and Maxillofacial Surgery in Biology and Health Science Department, Western Parana State University, Cascavel, Brazil

Abstract

Introduction: The zygomatic complex is integral to the facial contour, protection of the eye and other facial structures, and dental occlusion. Its importance in facial function and aesthetics requires high quality outcomes of the treatment. **Case presentation:** This paper reports the case of a 46-year-old man who had an occupational accident resulting in extensive facial trauma and zygomatic fractures. The patient presented with hyposphagma, palpable step in the area of the infraorbital rim, paresthesia of the right infraorbital nerve, flattening of zygomatic prominence, abrasion of the chin and nose, a 7-cm laceration in the midface region, ecchymosis in the palate, and alteration in the dental occlusion without limitation of mouth opening. Computed tomography (CT) confirmed the zygomatic complex fractures. The treatment was reduction and fixation with plates and screws. CT was used throughout the treatment period as an essential diagnostic tool for accurate fracture assessment and classification, formulation of the surgical plan, and postoperative evaluation. **Conclusion:** This case study illustrated the correct use of CT for improved and efficient treatment of traumatic injury of the zygoma, an anatomical area where restoration of function and aesthetics is challenging. The patient signed a written informed consent statement for publication.

Keywords: Computed tomography, facial buttress, zygomatic bone, zygomatic fracture

INTRODUCTION

The face is vulnerable to trauma due to the prominent position.^[1-6] The position and form of the zygoma, one of the facial bones, predispose the area to trauma; 40% of facial bone fractures occur in the zygoma^[2,5,7] Fracture etiology is variable and includes motor vehicle accidents, assaults, falls, and sports-related injuries.^[2,5,7-9]

The zygoma constitutes the primary structure of the midface,^[1,3,6,10] bridging the temporal, orbital, maxillary, and frontal processes. The zygoma is crucial for facial contour.^[1,6,10] and plays an important role in protecting the eye, orbital floor, maxillary sinus, temporal fossa, and zygomatic arch.^[1,10] Facial buttresses provide support, stability, resistance to force, and transmission of force to the cranium.^[1] The fundamental goals of facial trauma treatment are the reconstruction of facial buttresses, restoration of the dental occlusion, and improvement of the facial aesthetic.^[5,6,8]

This paper aimed to report a case of fractures of the zygomatic complex in which computed tomography (CT) was utilized to plan and evaluate the surgical treatment.

CASE REPORT

A 46-year-old man had an occupational accident resulting in facial trauma and was seen in the emergency room of a university hospital. Clinically, he presented with generalized edema, periorbital ecchymosis, and hematoma on the right side of the face. Vision and mobility eye examinations revealed no impaired vision or impaired eye movement. However, the patient exhibited hyposphagma, palpable step in the area of the infraorbital rim, paresthesia of the right infraorbital nerve, flattening of the zygomatic prominence, abrasion of the chin and nose, and a 7-cm laceration in the midface region [Figure 1a and c]. Intraorally [Figure 1b], the patient presented as partially dentate, with ecchymosis

Address for correspondence: Dr. Luiza Roberta Bin, 2069 Universitaria, Universitario, Cascavel-Parana ZIP CODE 85819-355, Brazil. E-mail: luizarbin@gmail.com

Received: 08-01-2020

Revised: 09-08-2020

Accepted: 19-08-2020

Published: 23-12-2020

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Bin LR, Garbin EÁ, Magro-Érnica N, Griza GL, Conci RA, Nadal L. The role of computed tomography in zygomatic bone fracture - A case report. *Ann Maxillofac Surg* 2020;10:491-4.

Access this article online

Quick Response Code:



Website:
www.amsjournal.com

DOI:
10.4103/ams.ams_9_20

in the palate, and alteration in the dental occlusion without limitation of mouth opening. CT was performed. Each view was thoroughly analyzed to identify all fractures. Fractures of the zygomatic complex were noted involving the nasomaxillary [Figures 2a-c and 3a and c], zygomaticomaxillary [Figures 2a-c and 3a and c], and pterygomaxillary buttresses [Figures 2a-c and 3a and c], frontozygomatic sutures [Figures 2d and 3a and c], zygomatic arch [Figures 2b and 3a-c], orbital floor [Figure 2c and e], and transversal palate [Figure 2a]. The body of the zygoma had a comminuted fracture [Figures 2b and c and 3a-c]. Using the clinical signs, symptoms, and imaging, a surgical treatment plan was developed. The treatment plan was explained, and the patient signed the consent form for surgery.

Under general anesthesia, supraorbital eyebrow and upper buccal sulcus approaches were performed. The extensive laceration was also used to access the fractures. The facial bones were reduced and fixed with titanium mini-screws and mini-plates (system 1.5) [Figure 4a and b]. Facial buttress restoration was postoperatively evaluated using CT [Figure 5a-f]. At a week follow-up, ptosis of the right eyelid and paresthesia of the right infraorbital nerve were observed. These complications resolved at the 30-day follow-up. Facial

contour, function, and aesthetics were also restored at the 30-day follow-up [Figure 6a and b]. At the 1-year follow-up visit, all positive surgical outcomes documented at the 30-day follow-up were maintained, and there were no apparent complications. The facial laceration facilitated the surgical treatment by providing additional access to the fractures. Despite the severity of the trauma, the surgical method resulted in a smooth scar that did not compromise facial aesthetics. The patient signed a written informed consent statement for publication of this manuscript.

DISCUSSION

Diagnosis of zygomatic fractures should be made using both clinical findings and imaging.^[4,5] Clinical findings may include flattening of the zygomatic prominence, periorbital ecchymosis and hematoma, buccal swelling, epistaxis, palpable step of the infraorbital rim, impaired eye movement, diplopia, enophthalmos, impaired vision, impaired mouth opening, hypoesthesia, paresthesia or anesthesia of the infraorbital nerve, or referred pain.^[11] Most of these signs were observed in our patient.

With conventional radiography, important anatomical sites are visualized with overlapping of adjacent tissues such



Figure 1: (a) Facial clinical signs in a frontal view. (b) Intraoral clinical signs. (c) Facial clinical signs in an axial view

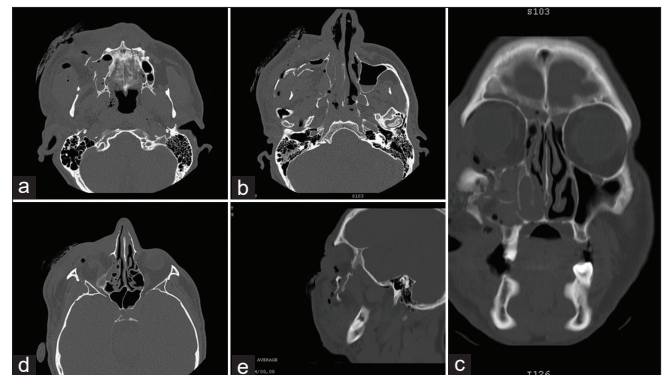


Figure 2: Preoperative computed tomography. (a) Axial view at palate level. (b) Axial view at zygomatic level. (c) Preoperative computed tomography in a coronal view. (d) Axial view at frontozygomatic suture level. (e) Sagittal view

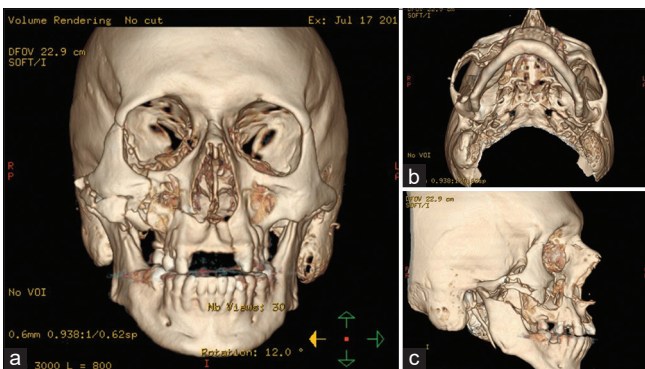


Figure 3: Preoperative computed tomography in three-dimensional reconstruction. (a) Frontal view. (b) Axial view. (c) Right face view

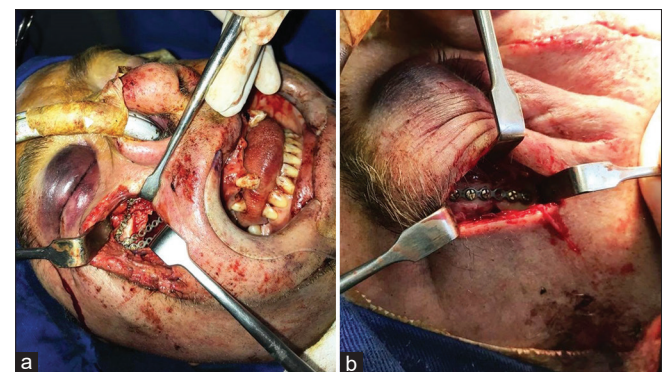


Figure 4: Intraoperative period. (a) Fixation of infraorbital rim, nasomaxillary buttress, and zygomaticomaxillary buttress. (b) Fixation of frontozygomatic suture

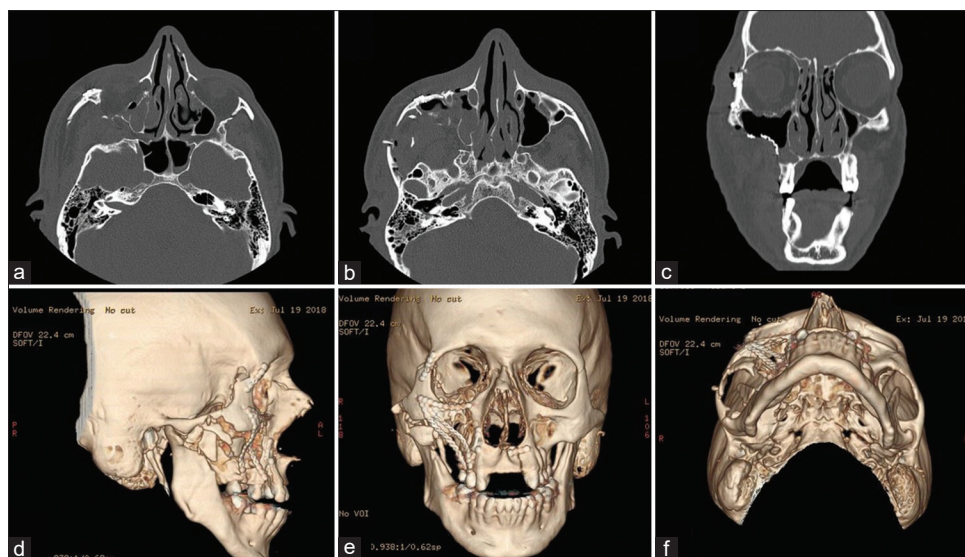


Figure 5: Postoperative computed tomography. (a) Axial view at frontozygomatic level. (b) Axial view at zygomatic level. (c) Coronal view. (d) Three-dimensional reconstruction in a frontal view. (e) Three-dimensional reconstruction in an axial view. (f) Three-dimensional reconstruction in a lateral view



Figure 6: Clinical condition at 30-day follow-up. (a) Frontal view. (b) Axial view

as bony structures, making interpretation of radiographic findings difficult.^[12] With the development of multi-slice CT, accurate detection of injuries and outcomes of maxillofacial trauma have improved.^[12,13] Using CT to assess mandibular, zygomaticomaxillary complex, and comminuted fractures of the middle third of the face is particularly advantageous because no additional scanning time or radiation is required.^[13] Ricci *et al.* (2018) found that facial CT is preferred over head CT to assess facial trauma; however, head CT is more commonly used in emergencies. CT can be used to evaluate bone, foreign bodies, hematoma, hernia, or emphysema.^[11] In this case, CT revealed blood in the right maxillary sinus with herniation and extensive emphysema on the right side of the face. Additionally, CT facilitates detailed planning for treatment and postoperative assessment.^[12] All sections (axial, sagittal, and coronal) must be evaluated.^[11] Following this recommendation, we carefully analyzed the three sections via CT to identify each fracture [Figures 2 and 3]. Adequate visualization of fracture extent and displacement of fracture fragments can be seen in rendered three-dimensional (3D)

CT images, which are the best imaging modalities for the assessment of zygomatic fractures.^[13] However, when focusing on the orbit, 3D image reconstruction is not the standard.^[13] For orbital fractures, reformatted coronal images are preferred.^[13] In our case, reformatted coronal images revealed the orbital floor fracture.

After diagnosis, a fracture may be classified to facilitate treatment.^[3] The position and displacement of fracture fragments on the CT are evaluated to determine the fracture classification. The Zingg,^[3] Rowe and Killey, and Knight and North classifications^[11] are used to classify fractures. The fractures in this case would be classified as C type using the Zingg classification, type 8 using the Rowe and Killey classification, and group 6 using the Knight and North classification.

The surgical approach chosen is dependent upon which part of the zygomatic bone is fractured.^[1,3,5,7] Different regions involved in fractures are accessed by different surgical approaches.^[7,11] The infraorbital rim and the orbit floor can be explored by the subciliary, subtarsal, or transconjunctival approaches.^[1,3,5,7] However, in our case an approach in this region was not required; the facial laceration afforded an approach for reduction and fixation. The frontozygomatic suture line can be accessed using the supraorbital eyebrow or coronal approach.^[3,7] We used the supraorbital eyebrow approach in our case. The zygomaticomaxillary buttress can be accessed using the buccal sulcus or coronal approach.^[3,7] In this case, the buccal sulcus approach was modified to access and repair the lanelong fracture. The buccal sulcus approach can also provide access to the infraorbital rim to avoid an eyelid approach;^[1,7] however, in this case regional laceration was used for access. When there are multiple facial bone fractures, as in our case, the coronal approach is indicated.^[1,5,7,11] However, the coronal approach was not necessary in this case. Access

was obtained using the regional laceration, thereby minimizing the number of surgical approaches to minimize aesthetic defects. Fracture treatment depends, in part, on the type of energy involved in trauma.^[8,10] When trauma is characterized as low energy and the fractures are noncomminuted or minimally displaced, only closed reduction is required.^[8,10] However, in cases of enophthalmos and/or displacement of the zygomatic bone, open reduction and fixation are necessary to reestablish facial buttresses.^[7,8,11] In this case, due to the comminution of the zygoma and involved buttress fractures, the restoration of the facial contour was achieved by open reduction and rigid internal fixation of the facial buttresses. The stability of a fixation is not necessarily proportional to the number of points to be fixed, although in complex fractures, the ideal standard is the fixation of four points.^[3,5,7,10] In the present case, the treatment followed the ideal standard with fixation of the frontozygomatic suture, infraorbital rim, nasomaxillary buttress, and zygomaticomaxillary buttress. Once the zygomaticomaxillary buttress is restored, there is better stabilization of the fixation^[7] because the vertical buttresses spread the forces vertically.^[1] Therefore, the buttresses maintain the spatial position of the maxilla in relation to the cranium and mandible.^[1] According to this case's postoperative CT [Figure 5], the zygomaticomaxillary buttress was restored, giving the patient a favorable prognosis. Generally, the reduction of fractures of the orbital floor is not mandatory.^[4,5] However, such fractures require reduction and fixation when more than 50% of the orbital floor is involved or if the defects measure 1 cm–2 cm.^[4] In the present case, the defects in the orbital floor were <1 cm–2 cm and were not repaired.

There are potential surgical complications that should be considered when planning treatment. Some of these complications include scars, ectropion and entropion, ptosis, nerve injury, temporal fat pad injury, alopecia, and scalp necrosis.^[5,7] Moreover, fractures of the zygomatic complex are challenging and complicate the balance between fixation and the potential sequelae caused by surgical approaches.^[4,5,7] It is essential to correlate the clinical signs and imaging to formulate a diagnosis and appropriate treatment plan.^[4] The CT was an essential tool in our case. Each clinical sign was examined on images such as the dislocation of bone fragments and the presence of air or blood in unusual regions. Having CT imaging enabled discussion and planning of the best approaches for surgery. The CT also showed the correct placement of fixation, reestablishing the format of the face.

CONCLUSION

This case study illustrated a clinical condition in a facial area where restoration of function and aesthetics can be challenging.

The information afforded by using 3D CT in our case was integral to the precise identification of the extent of facial trauma, classification of fractures, and successful planning and efficient execution of surgical treatment. CT imaging is an accurate, readily available, and noninvasive technique to assess zygomatic fractures. Finally, in our case of a complicated zygomatic fracture, the use of CT contributed significantly to improved implementation and outcomes of surgical treatment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Fonseca RJ, Barber HD, Powers MP, Frost DE. Trauma Buccomaxillofacial. 4th ed. Rio de Janeiro – RJ: Elsevier Editora Ltda; 2015. p. 862-985.
- Yamsani B, Gaddipati R, Vura N, Ramiseti S, Yamsani R. Zygomaticomaxillary complex fractures: A review of 101 cases. *J Maxillofac Oral Surg* 2016;15:417-24.
- Strong EB, Gary C. Management of zygomaticomaxillary complex fractures. *Facial Plast Surg Clin North Am* 2017;25:547-62.
- Padmanavam A, Mishra S. Patient perspective in the management of zygomatic fractures. *Ann Maxillofac Surg* 2018;8:239-46.
- Starch-Jensen T, Linnebjerg LB, Jensen JD. Treatment of zygomatic complex fractures with surgical or nonsurgical intervention: A retrospective study. *Open Dent J* 2018;12:377-87.
- Cinal H, Barin EZ, Çakmak MA, Kara M, Yilmaz K, Tan O. Novel surgical technique for repair of zygomatic fractures: Lever technique. *Plast Surg (Oakov)* 2019;27:135-40.
- Farber SJ, Nguyen DC, Skolnick GB, Woo AS, Patel KB. Current management of zygomaticomaxillary complex fractures: A multidisciplinary survey and literature review. *Craniofac Trauma Reconstr* 2016;9:313-22.
- Chaudhry O, Isakson M, Franklin A, Maqusi S, El Amm C. Facial fractures: Pearls and perspectives. *Plast Reconstr Surg* 2018;141:742e-58.
- Chukwulebe S, Hogrefe C. The diagnosis and management of facial bone fractures. *Emerg Med Clin North Am* 2019;37:137-51.
- Michael Ehrenfeld JP, Manson PN. Principles of Internal Fixation of the Craniomaxillofacial Skeleton. 1st ed. New York, US: Thieme Publishers Inc/Maple Press; 2012.
- Malaviya P, Choudhary S. Zygomaticomaxillary buttress and its dilemma. *J Korean Assoc Oral Maxillofac Surg* 2018;44:151-8.
- Ricci JA, Tran BN, Ruan QZ, Lin SJ, Singhal D, Lee BT. Comparing head and facial computed tomographic imaging in identifying operative facial fractures. *Ann Plast Surg* 2018;80:S219-22.
- Raju N, Ishwar P, Banerjee R. Role of multislice computed tomography and three-dimensional rendering in the evaluation of maxillofacial injuries. *J Oral Maxillofac Radiol* 2017;5:67.