Incidence and Management of Zygomatic Fractures at a Level I Trauma Center

Larry A. Sargent, MD, and John G. Fernandez, MD

Purpose: The purpose of this study is to evaluate current treatment of zygomatic fractures presenting at a level I trauma center.

Methods: Radiology records over a 1-year period were retrospectively reviewed to determine all patients diagnosed with fractures through the zygoma. A total of 1049 computed tomography maxillofacial scans were reviewed which identified 243 patients with fractures through the zygoma. Of these, 200 patients were identified as clinically relevant zygomatic fractures defined as having 3 or more major buttress fractures.

Results: Among the 200 patients identified with zygomatic fractures, 132 patients were treated nonoperatively and 68 patients required operative management. In the operative group 31% were treated with a limited (one-buttress) approach.

Conclusions: Review of our management of zygomatic fractures at a level I trauma center found a high incidence of zygomatic fractures (66%) that can be managed nonoperatively without significant complications. There is a select group of zygomatic fractures that can be successfully managed by the experienced surgeon with a limited one-buttress approach.

Key Words: zygoma, zygomatic fractures, orbitozygomatic fractures, orbital fractures

(*Ann Plast Surg* 2012;68: 472–476)

The zygomatic fracture is one of the most common fractures evaluated at level I trauma centers. Various terms have been used to describe this fracture but perhaps the term most descriptive of the injury is orbitozygomatic fracture. The 2 key anatomic areas in treating this injury are accurate reduction of the zygoma and restoration of orbital volume. Aligning the major zygomatic buttresses with reduction of the orbital rim, as well as the internal walls, is crucial to restore preinjury appearance and function. Appropriate evaluation is necessary to determine the extent and degree of the fracture sites as well as the amount of displacement. The surgical approach should be individualized based on this thorough preoperative assessment. Zygomatic fractures vary in severity from nondisplacement to extreme comminution and displacement of both zygomatic body and orbital components. In the past, the standard of treatment has been wide exposure and anatomic reduction of the major buttresses with rigid fixation of each. At the present time, the authors feel there is a select subgroup of zygomatic fractures that can be successfully managed with less invasive techniques and equivalent results. Equally important is identifying the subgroup with more extensive fracture patterns prone to complications that mandate more aggressive wide exposure and rigid fixation of multiple buttresses. With the approach chosen, accurate anatomic reduction of the malar area and orbital anatomy (volume) is the key to restoring preinjury appearance and avoiding the need for very difficult secondary reconstructions. Our current treatment recommendations are outlined.

PATIENTS AND METHODS

A retrospective study was performed on 1049 patients evaluated at our level I trauma center who had a maxillofacial computed tomography (CT) scan over a 1-year period. A review of all CT scans was performed to identify patients with fractures through the zygoma. Using these criteria, 243 patients were identified as having fractures through the zygoma based on careful review of the maxillofacial CT scans by the radiologists and authors. Isolated fracture lines through the zygoma, which demonstrated no displacement, were excluded (43 patients). The age range varied from 5 to 89 years, with a mean of 40 years. There were 155 male patients and 45 female patients. The most common cause of zygomatic fractures in our series was motor vehicle accidents 40%, followed by assault 22%, motorcycle accidents 12%, and all-terrain vehicles 7%. Orbital floor defects requiring repair were present in 28 patients (41% operative patients). Associated head injuries, including intracranial hemorrhage or skull fractures, were present in 49% of operative patients and 47% of nonoperative patients.

Follow-up was established from date of initial assessment to the last clinical evaluation by the authors. Two-hundred patients had adequate follow-up for analysis of results. The range of follow-up was from 3 to 36 months, with a mean of 6 months. Eighty percent of operative patients were evaluated 6 months or longer. All operative notes were reviewed to classify the extent and type of operative treatment used.

All patients were assessed by the authors with careful clinical evaluation of malar symmetry, contour abnormalities (soft tissue and bone), orbit/globe position and movement, incisions, as well as other symptoms (paresthesia, diplopia). At follow-up visits, patients were questioned about changes in appearance of cheeks, eyelids, and eyes. Any enophthalmos was evaluated with Hertel exophthalmometry measurements on both globes.

RESULTS

Sixty-eight patients required operative treatment, and 132 patients were treated nonoperatively (Table 1). All operative patients underwent open reduction and rigid plate fixation of between 1 to 4 buttresses. Twenty-eight patients required orbital floor reconstruction with titanium mesh (41% of operative patients). The most common operative plan was the anterior approach which involves 2 to 3 incisions including the gingivobuccal sulcus, lateral upper eyelid, and lower eyelid (49%). The lower eyelid incision was used only if an orbital floor defect or a comminuted rim was present. The limited or select one-buttress approach (gingivobuccal sulcus incision) was used in 31%. The coronal incision combined with the gingivobuccal sulcus incision and lower eyelid incision was used in 20% of the operative cases (Table 2).

The group of nonoperative patients with zygomatic fractures had 1 complication (0.7%). This was a case of minimal enophthal-

Received October 6, 2011, and accepted for publication, after revision, October 14, 2011.

From the Department of Plastic Surgery, University of Tennessee College of Medicine Chattanooga, Chattanooga, TN.

Conflicts of interest and sources of funding: none declared.

Reprints: Larry A. Sargent, MD, Department of Plastic Surgery, University of Tennessee College of Medicine Chattanooga, 979 East Third Street, Suite C-920, Chattanooga, TN 37403. E-mail: utplastics@thepsg.org.

ISSN: 0148-7043/12/6805-0472
DOI: 10.1097/SAP.0b013e31823d2c6b

TABLE 1. 200 Patients With Zygomatic Fractures

Nonoperative cases	66%
Operative cases	34%

TABLE 2. Zygomatic Fractures Requiring Open Rigid Fixation 68 Patients

Approach	Patients
Limited (1 buttress)	31.0%
Anterior (2–3 buttresses)	48.5%
Coronal (with gingivobuccal and lower eyelid)	20.5%

TABLE 3. Zygomatic Fracture Classifications

1. No significant displacement
2. Isolated arch
3. Displaced body (single-segment) with or without floor defect
4. Lateral displacement of body/orbit with displacement of multiple buttresses
5. Complex comminuted zygomas with associated fractures (NOE, LeFort)

mos noted on follow-up examination by the authors in which the patient declined to have operative correction. Complaints of transient paresthesia and diplopia that completely resolved on follow-up visits were not uncommon.

Complications in the operative group included 2 enophthalmos, 1 ectropion, and 2 minimal contour deformity/asymmetry. There were no complications in the group of patients that had the limited one-buttress approach. The complications reported are felt to be more related to surgical technique and experience rather than the approach that was used. The senior author with >30 years of experience had 1 complication (enophthalmos, 1.4%) in a patient with comminuted panfacial fractures and extensive orbital injuries.

A high incidence of associated head injuries was noted in both the nonoperative patients (47%) as well as the operative patients (49%). This is felt to be characteristic of the more complex injuries seen at level I trauma centers.

DISCUSSION

In a major level I trauma center, a large number of zygomatic fractures are seen each year.[1] Many of these fractures will not display enough displacement to warrant operative reduction. The goal of any operative plan should be to restore anatomic position of the zygoma and orbit with rigid fixation of the buttresses.[2–4] The debate has always been how much exposure or open reduction and internal fixation is needed. The key issue in establishing an operative plan is to correctly assess the severity and extent of the orbitozygomatic fracture. The degree of displacement, the presence of comminution, the extent of internal orbital wall involvement, and the associated fractures are all important factors assessed on CT scans in deciding on the operative approach needed.[5] The operative technique is individualized based on a careful assessment of these factors. Once these assessments are made, then the decision of the surgical approach, number of buttresses to expose and to reduce can be made, as well as the type of fixation. In general, zygomatic fractures can be classified as shown in Table 3. The standard of comparison in orbitozygomatic fracture treatment is exploration and alignment of the zygomaticofrontal articulation, the infraorbital rim, and the zygomaticomaxillary buttress. Most zygomatic fractures can be reduced by alignment and stabilization of these 3 buttresses. Exploration and repair of orbital floor are indicated when a defect is identified by CT scan. In the past, the senior author has advocated wide exposure and visualization with rigid fixation of multiple buttresses on all operative zygomatic fractures. However, with experience, a subgroup of single-segment zygomatic fractures can be identified, which can be successfully treated with limited (1–2 buttresses) exposure and fixation. The advantage of this technique is the avoidance of soft-tissue morbidity associated with multiple incisions and wide exposure of the orbital region. It must be emphasized that only with experience and judgment can selective buttress treatment be used with success. Our single-buttress technique is exposure and rigid plate fixation of the zygomaticomaxil-

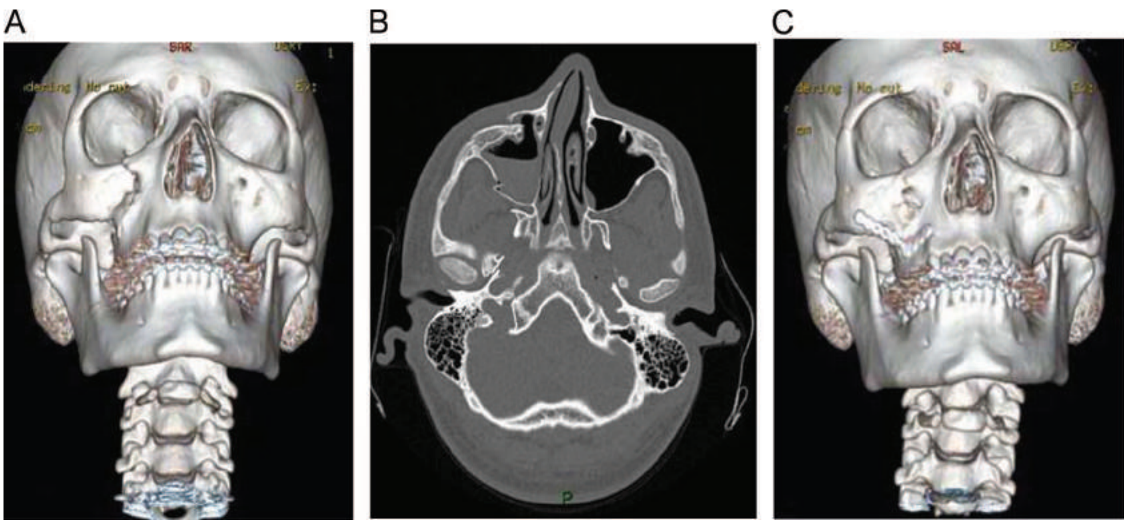

FIGURE 1. A–C, Select one-buttress approach. Preoperative 3-dimensional (3D) CT scan shows depressed single-segment zygomatic fracture with no separation of zygomaticofrontal suture (A). Transverse CT scan shows depressed body with arch intact (B). Postoperative 3D CT scan shows anatomic reduction of zygoma gingivobuccal sulcus incision with L-shaped 2.0-mm plate on zygomaticomaxillary buttress (C).

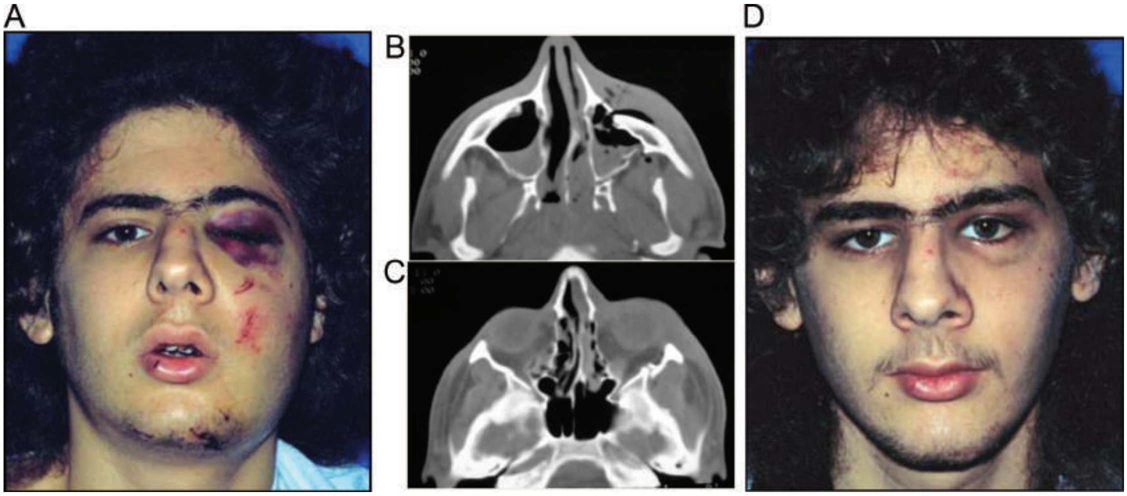

FIGURE 2. A–C, an 18-year-old boy with isolated displaced zygomatic fracture (A). CT scans show displaced body and lateral orbital wall (B, C). Postoperative result after anterior two-buttress approach using a gingivobuccal and lateral upper eyelid incision (D).

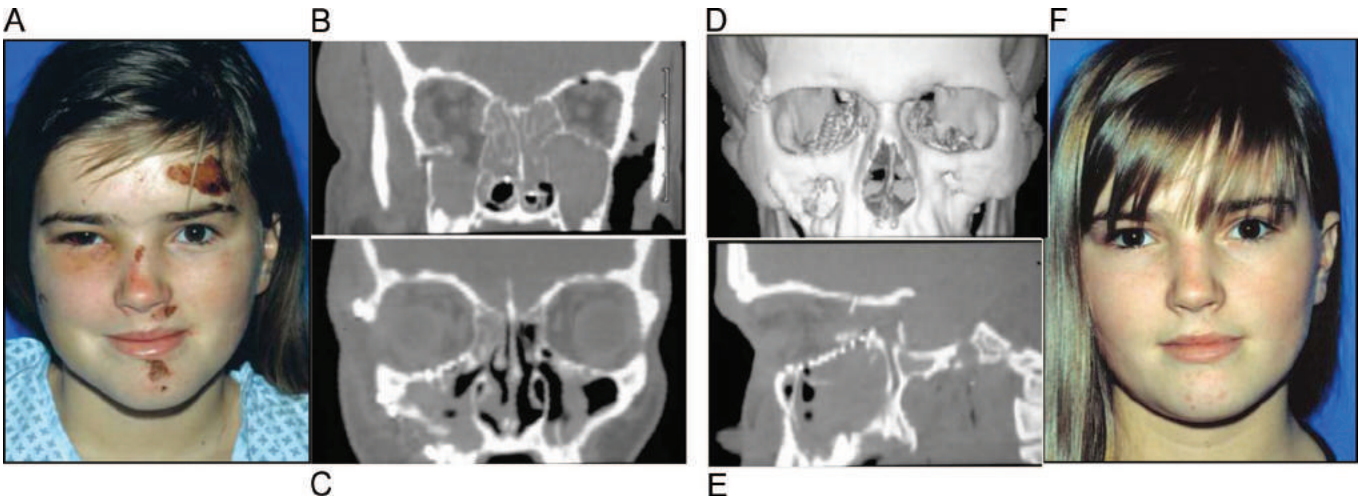

FIGURE 3. A–F, Preoperative photograph of patient with displaced single-segment zygomatic fracture (A) with large orbital floor defect (B). This was approached with 3 incisions: gingivobuccal sulcus, lateral upper eyelid, and subciliary. Postoperative scans (C, D) show anatomic reconstruction of orbital floor defect with titanium mesh back to posterior bony ledge (E). Plates can be seen on zygomaticofrontal and zygomaticomaxillary buttresses. Postoperative results shown (F).

lary buttress through an upper gingivobuccal sulcus incision. The larger 2.0-cm right angle titanium plate is usually used on the zygomaticomaxillary buttress after elevation and reduction of the body through the intraoral approach (Fig. 1). If needed, the infraorbital rim can be visualized to help assess reduction; however, experience is needed to correctly assess reduction through this limited exposure. In similar type of depressed single segment fractures where there is separation of the zygomaticofrontal articulation, a lateral upper eyelid incision is then added to reduce and stabilize this buttress (Fig. 2). We prefer a small incision that is an extension of the supratarsal fold laterally and stabilization with a small (1.3 or 1.5 mm) plate. When there is comminution of the infraorbital rim and/or an orbital floor defect, a lower eyelid incision is used. The senior author prefers a subciliary incision; however, this approach is a very sensitive technique and demands a precise dissection to avoid complications. If you do not have extensive experience with this approach, a midlower eyelid incision just below the tarsal plate is recommended. All orbital floor defects were repaired with radial designed titanium mesh (Fig. 3). The senior author has repaired >600 traumatic orbital defects with titanium mesh, with minimal complications as previously reported.[6–10] Orbital plates on the inferior rim are generally avoided unless there is comminution with a contour or stability problem. A microplate (1.0 mm) is usually used here as this buttress adds the least to stability.

In the comminuted zygomatic fracture or the fracture laterally displaced with orbital enlargement, more extensive exposure is needed with exposure and alignment of the zygomatic arch to restore facial width and projection. In our trauma center, 21% of the operative zygomatic fractures required a coronal incision for more extensive exposure. This is a relatively high incidence due to the concentrated number of complex fractures seen at a busy level I trauma center. The coronal incision provides excellent exposure of the arch, zygomaticofrontal area,

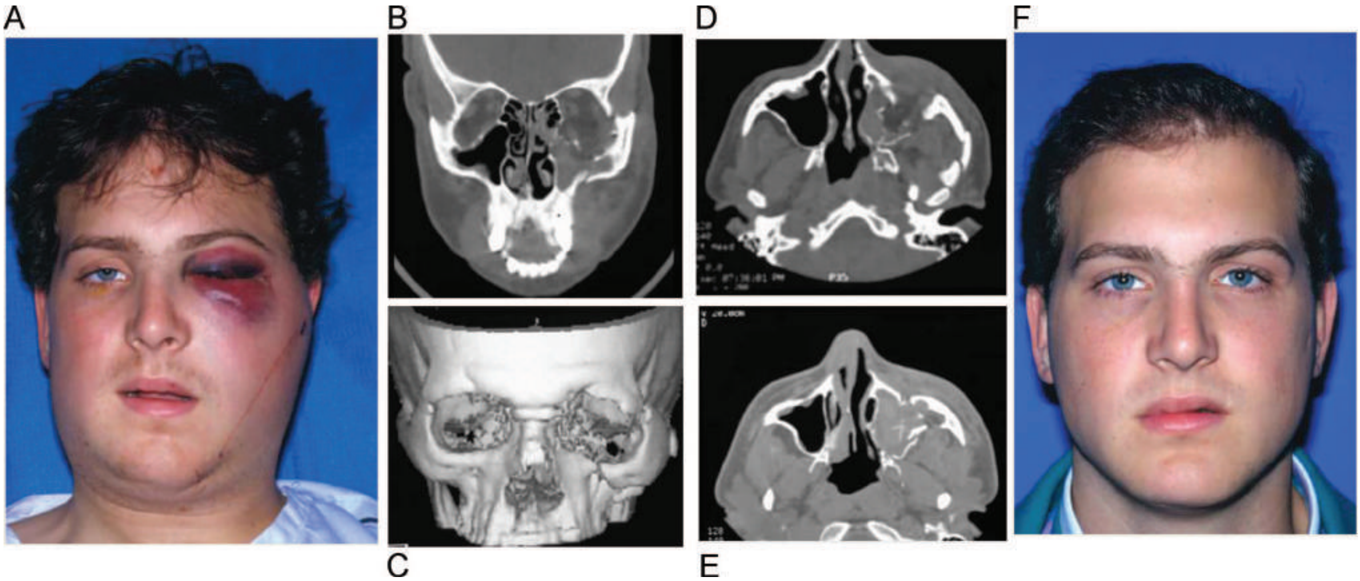

FIGURE 4. A–F, Preoperative photograph of patient with comminuted laterally displaced zygoma (A). These fractures are prone to complications. CT scans (B–E) show marked enlargement of orbit, increased facial width, and comminuted zygomatic arch. A coronal approach combined with gingivobuccal sulcus and subciliary incision was used to expose arch and buttresses. Postoperative result after 4 buttress reduction and stabilization (F).

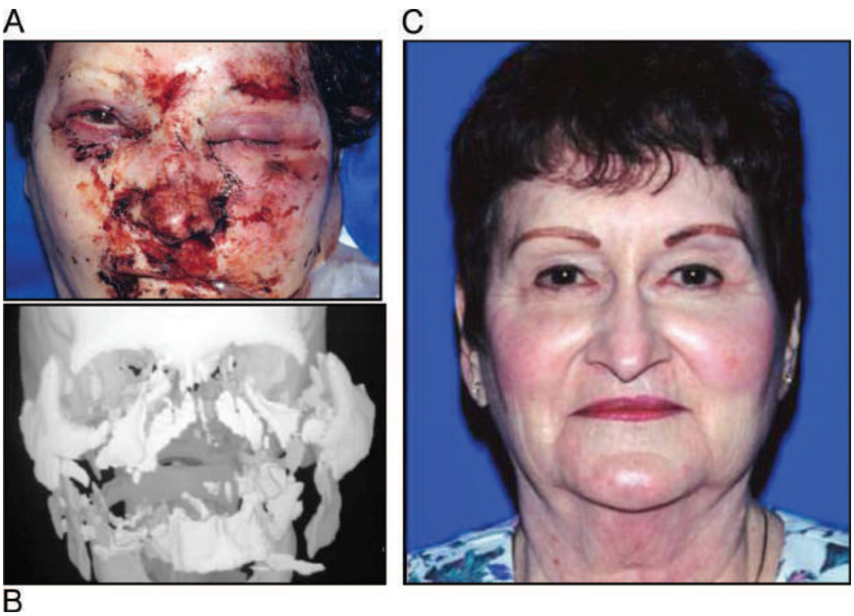

FIGURE 5. A–C, Preoperative photograph of patient with severely displaced and comminuted bilateral zygomatic fractures (A). 3D scan shows bilateral nasoethmoid orbital fractures associated with panfacial fractures (B). Extensive wide exposure was needed using coronal, lower eyelid, and gingivobuccal sulcus incisions with 4 buttress rigid fixation. Postoperative result with 1-stage procedure (C).

lateral wall, and body of the zygoma with 4 buttress stabilization. Of course, the coronal incision was combined with a gingivobuccal sulcus and lower eyelid incision (Fig. 4). This type of exposure is particularly helpful in fractures prone to complications such as the comminuted body, laterally displaced orbit and arch, and the comminuted multiple buttress fracture (Fig. 5). The associated nasoethmoid orbital fracture is prone to complications also if anatomic reduction is not obtained of the medial inferior rim with restoration of internal orbital volume.[11–14] The last step in treatment is to close periosteum and resuspension of soft tissue. This is a key step to restore soft-tissue contour particularly when wide exposure and dissection are used.[14]

CONCLUSIONS

There are a large number of zygomatic fractures seen at major level I trauma centers, with a high incidence of nondisplaced fractures (66%) that can be managed nonoperatively.

In the operative patient, accurate anatomic reduction of the zygoma and orbit is key to restoring preinjury appearance and contour of the orbitozygomatic region. This should always be the goal of any good operative treatment plan. A careful preoperative assessment must be performed to determine the extent and type of fracture of the zygomatic complex as well as associated injuries. We advocated an individualized approach to these fractures based on a thorough evaluation of these factors, as well as consideration of the surgeon's experience. Less experienced surgeons should err on the side of more exposure and anatomic reduction/stabilization as opposed to less. More experienced surgeons can identify a subset of zygomatic fractures that can successfully be treated with a limited approach. However, the comminuted complex fractures in this area that are prone to complications require a more aggressive wide exposure with complete anatomic reduction and rigid fixation of multiple buttresses.

ACKNOWLEDGMENT

Informed consent was obtained for publication of the figures in this article.

REFERENCES

1. Lee KH, Antoun J. Zygomatic fractures presenting to a tertiary trauma center, 1996–2006. *N Z Dent J*. 2009;105:4–7.
2. Hollier LH, Thorton J, Pazmino P, et al. The management of orbitozygomatic fractures. *Plast Reconstr Surg.* 2003;111.
3. Kelley P, Hopper R, Gruss J. Evaluation and treatment of zygomatic fractures. *Plast Reconstr Surg.* 2007;120(suppl 2).
4. Kauffman Y, Stal D, Cole P, et al. Orbitozygomatic fracture management. *Plast Reconstr Surg*. 2008;121:1370.
5. Evans RD, Daniels M, Hewell L. An evidence-based approach to zygomatic fractures. *Plast Reconstr Surg*. 2011;127:891.
6. Sargent LA, Fulks KD. Reconstruction of internal orbital fractures with vitallium mesh. *Plast Reconstr Surg*. 1991;88:31.
7. Sargent LA. Safety of titanium mesh for orbital reconstruction (Discussion). *Ann Plast Surg*. 2002;48:7.
8. Sargent LA. Reconstruction of internal orbit fractures with internal mesh. *Plast Reconstr Surg*. 1992;89:1177.
9. Sargent LA, Kennedy JW. Long-term evaluation of metallic mesh in acute internal orbital reconstruction. *Plast Surg Forum*. 1996;19:63.
10. Sargent LA. Orbital floor repair with titanium mesh screen (Discussion). *J Craniomaxillofac Trauma*. 1999;5:17.
11. Sargent LA. Nasoethmoid orbital fractures. *Probl Plast Reconstr Surg*. 1991;1:426.
12. Sargent LA. Acute management of nasoethmoid orbital fractures. *Oper Tech Plast Reconstr Surg*. 1998;5:213.
13. Sargent LA, Rogers GF. Nasoethmoid orbital fractures: Diagnosis and management. *J Craniomaxillofac Trauma*. 1999;5:19.
14. Sargent LA. Nasoethmoid orbital fractures: diagnosis and treatment. *Plast Reconstr Surg.* 2007;120(suppl 2).

