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Clinical Paper
Trauma

Recovery from orbital floor fractures: a prospective study of patients' and doctors' experiences

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Abstract. This study aimed at investigating the extent to which remaining symptoms and signs troubled patients in the year after suffering from zygomatico-orbital fractures, and whether there was any discrepancy between patients' and doctors' opinions as to the presence of symptoms and signs. Over the course of 1 year, 46 patients were included. Symptoms and clinical findings were registered in a 'doctor's protocol', and patients described self-reported symptoms and signs using a visual analogue scales (VAS) in a questionnaire administered 5 times during the year after injury. The VAS proved to be a useful instrument for evaluating patient discomfort and indicating differences between patients' and doctors' opinions regarding the presence of symptoms and signs. Agreement between the two was good regarding the presence of objective and measurable signs, such as facial asymmetry and diplopia. When it came to sensibility and mouth-opening ability, however, discrepancies were evident. It is desirable that reliable methods for measuring sensibility and evaluating mouth opening are included in follow-up routines. This would increase our knowledge of the course of healing, prognosis and possibilities for the prevention and active treatment of these problems.

Key words: orbital floor fracture; sequelae; patients' experience; visual analogue scale (VAS).

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Sequelae after zygomatico-orbital fractures are common, despite the range of treatment options available[5,16,19,22]. The injury itself, as well as surgery for fractures involving the orbit, can potentially cause long-term sequelae[5]. A previous retrospective study revealed a high incidence of long-term sequelae after zygomatico-orbital fractures, some of which had developed or worsened several months after final assessment 1 month postoperatively[12].

The potential benefits and risks of surgical intervention must be carefully evaluated. To ensure optimal handling and outcome it is important to obtain knowledge of the outcome from the patient's as well as the doctor's point of view. Studies of patient experience in this context are sparse[9,13,20,23]. To the authors' knowledge, no previous studies of this category of patients have repeatedly registered symptoms and signs from both the doctor's and the patient's viewpoints.

To increase knowledge and in the interest of improved future treatment results, patients who had suffered from a zygomatico-orbital fracture were monitored for a year following their injury. Symptoms and signs related to the trauma and treatment

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Table 1. Surgical treatment and number of patients

Surgical treatment	Number of patients ($N = 46$)	Number lost to follow-up ($N = 5$)
Open reduction (including orbital exploration)	35 (36 orbits)	4
Closed reduction (Gillies)	7	1
Orbital implant (percent of explored orbits)	27/36 (75%)	4/5 (80%)
Rigid fixation (percent of operated)	27/43 (62%)	4/5 (80%)
No surgery	4	0

were registered at each follow-up. In addition, doctor and patient assessments of the symptoms and signs were compared.

Patients and methods

Since much information concerning the trauma and surgery has already been presented[11], only an outline is given here. A summary of the number of patients in relation to the various surgical methods used appears in Table 1. Fractures were predominantly caused by assaults and falls. Eight patients had an isolated blow-out fracture (1 bilateral). The indications for surgery were a dislocated fracture verified by computerized tomography (CT) scan and clinical signs/symptoms such as facial asymmetry, diplopia and/or trismus.

Table 2 illustrates the subgroups constituting the 'orbital floor fractures'. An orbital exploration (using the subciliary approach) was performed if the orbital floor was dislocated and in each case of microplate fixation of the orbital rim. A defect of the orbital floor exceeding 200 mm^2 was generally covered by a 0.85-mm porous polyethylene sheet (Medpor®; Promeduc/Porex Surgical Inc., USA), and a single fracture line or 'egg-shell' fracture was often covered with Lyoplant® (Braun Aesculap, Tutsingen, Germany). Microplates were used for stabilization at the inferior orbital rim and sometimes also at the frontozygomatic suture. Only in 4 cases was miniplating used at the buttress.

Ethical considerations

The study was approved by the Ethics Committee at Göteborg University. All patients were informed of the study and provided their written consent.

Patients

Fifty-one consecutive patients consulting the Otorhinolaryngology Department regarding zygomatico-orbital fractures over the course of 1 year were recruited for the study. On 5 stipulated occasions in the year following the trauma, clinical findings were registered on a protocol by an otorhinolaryngologist and a questionnaire was completed by the patient.

The inclusion criteria were as follows: patients having had a recent zygomatico-orbital fracture, i.e. a zygomatico-maxillary fracture involving the orbital floor (tetrapod zygomatic fractures were included by definition) or a pure blow-out fracture of the orbit. Consequently, isolated zygomatic arch fractures were not taken into account. Patients incapable of completing the questionnaire were excluded from participation.

Thirty-two patients followed the stipulated arrangements of the study. In another 14 cases the initial VAS values were missing; the medical records, available protocols and questionnaires of these patients were therefore analysed separately. Five patients were lost to follow-up.

Questionnaire and protocol

An identical questionnaire was completed on each of the 5 follow-up occasions: preoperatively, and 1 week, 1 month, 6 months and 1 year following surgery. In the questionnaire, patients indicated whether or not particular symptoms were present and estimated the severity of any related discomfort on a 0–100-mm visual analogue scale (VAS)[8]. Patient ratings of discomfort due to affected sensibility, eye function, physical appearance and/or jaw function were then measured in millimetres. In the analysis the VAS was subdivided into 5 categories, 0–IV, according to the legend to Fig. 1. Correspondingly, the examiner completed a protocol at each appointment so as to produce uniform documentation of the clinical findings. This protocol is also described in Fig. 1.

Clinical examination and definitions

Fractures were surveyed by means of a CT scan. Sensibility was tested by comparing a patient's perception of sharp and blunt touch stimuli in the distribution area of the infraorbital nerve on the injured side of the face with that on the uninjured side. Inspection was also carried out from behind, with the patient's head bent back to establish any asymmetry between the 2 sides of the face[18]. Only clinically detectable enophthalmos known to be 2 mm or more was considered relevant[18,24,25].

Patients were questioned about any differences in visual acuity experienced since trauma/surgery. Eye motility was examined by asking the patient to focus the eyes on and follow the movement of the examiner's finger without moving the head. If there was any uncertainty over eye function an ophthalmologist was consulted.

Maximal mouth opening was measured in millimetres with a ruler as the distance between the upper and lower rows of teeth; 40 mm was considered to be functionally acceptable. Patients were questioned regarding any reported experience of altered bite. Incidence of malocclusion and/or affected mouth opening resulted in referral to the oral surgeon for assessment.

Statistics

Data management and analysis were done using the SPSS™ program, version 11.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics such as frequencies, means, ranges and standard deviations were computed. Tests of statistical significance were carried out with an alpha level of 0.05. Categorical variables in cross-tabs were examined using Pearson's χ^2 or Fisher's exact test, whereas *t*-tests were used to compare means of VAS variables[8].

Results

The male-to-female ratio was 2.2:1 and the median age was 43 years (range 16–90). The overall response rate for the separate questions in the questionnaire was a minimum of 70%. In cases where initial VAS values were missing, the available data were analysed. The results thus obtained did not differ significantly from the corresponding results for the remainder of the patients. The initial and final occurrences of the various symptoms/signs in relation to the type of fracture are listed in Table 2.

Sensibility

Disturbed sensibility was generally the symptom given the highest mean VAS score at all times. Significant improvement ($P < 0.05$) of sensibility generally occurred during the first month postoperatively, and only to a minor extent after that.

The presence of sensibility disturbances, even within the VAS III and VAS IV ranges, in some cases went completely unnoticed by the examiner. At the final appointment, however, 53% of the patients reported permanent sensibility disorders rated VAS > 0, while the doctors assessed the occurrence to be 63%. The mean VAS scores for the first and last occasions are shown in Table 3a.

Table 2. Symptoms/signs in relation to type of fracture/surgical treatment

Type of fracture (number of patients)	Surgical technique (%)	Implant (%)	Fixation (%)	Affected sensibility (%) preoperative	After 1 year	Affected physical appear-ance (%) After 1 year	Diplopia (%) preoperative	After 1 year	Mouth opening/occlusion (%) preoperative	After 1 year
Blow-out ($N = 8$)[1]	Exploration[a] (100)	In 100%: Medpor® (67); Lyoplant® (33)	–	75	71	25	43	14	–	–
Zygomatico-orbital, multi-fractured ($N = 22$)[2]	Exploration[a] (100) (including Gillies in 62%)	In 81%: Medpor® (35); Lyoplant® (65)	In 90%: Titanium plates (100)	74	57	50	43	9.5	62	24
Tetrapod fracture ($N = 16$)[3]	Exploration[a] (56) Closed reduction (44)	In 38%: Lyoplant® (100)	In 47%: Titanium plates (100)	93	69	50	25	8	75	23
$N = 46$	$N = 42$	$N = 26$	$N = 26$							

No surgery in [1]2 cases; [2]1 case; [3]1 case.
[a] Subciliary approach.

Physical appearance

Twenty-five percent of patients rated their facial aesthetics highly dissatisfying (VAS IV) preoperatively; 16% kept scoring VAS IV for this item until the final postoperative assessment, when 6% still reported themselves distressed by altered looks. The mean VAS values for the group on the first and last occasions are shown in Table 3b.

The main complaint at the final check up was dissatisfaction with the operation scar. In such cases the examining doctor could verify a permanent scleral show due to vertical lower eyelid shortening. The occurrence of scleral show found in the present study was at its peak 1 month postoperatively (41%). No cases of scleral show improved further after 6 months postoperatively, resulting in a final occurrence of 29%. A maximum of 14% had ectropion at the 1-month assessment; ectropion became a prolonged and serious problem in 4% of patients.

Enophthalmos was found in 19% of the examined patients. One of these had a tetrapod fracture subjected to closed reduction only. Notably, the degree of agreement between patient experience and doctor assessment of enophthalmos was low. Only 3 of 6 patients had noted this change in facial appearance. Enophthalmos was not recognized by the examiner until 6 months after the trauma. Interestingly, 3 patients ending up with this sequela had reported a 'sunken eye' 1 week and/or 1 month after surgery, at which time the condition had not been registered by the examiner. Two patients experienced a 'sunken eye' during follow-up, which could not be verified by clinical examination.

Seventeen percent of patients ended up with a clinically verified malar flattening in spite of surgery. The majority of these (67%) represented simple tetrapod zygo-

Table 3a. Sensitivity

	Mean		SD		Range	
Symptom	Preoperative	1-year postoperative	Preoperative	1-year postoperative	Preoperative	1-year postoperative
Numbness	58.4	31.9*	42.6	41.7	0–100	0–100
Pain	39.0	12.6*	45.4	24.9	0–100	0–90
Paraesthesia	16.1	18.6	29.1	31.2	0–100	0–100

VAS scores in mm.
* $P < 0.05$.

Table 3b. Physical appearance

	Mean		SD		Range	
Symptom/sign	Preoperative	1-year postoperative	Preoperative	1-year postoperative	Preoperative	1-year postoperative
Incision scar	37.9[a]	10.5**	27.2	23.8	0–100	0–99
Enophthalmos	7.3	5.9	25.4	17.9	0–100	0–81
Malar flattening	29.8	6.8*	44.6	21.0	0–100	0–92

VAS scores in mm.
[a] 1 week after surgery.
* $P < 0.05$.
** $P < 0.01$.

matic fractures treated by closed reduction (Gillies' procedure) only.

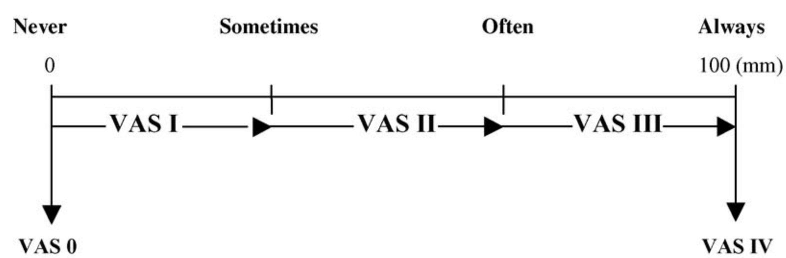
Eye symptoms

Due to a previously blind eye in the traumatized orbit, 1 patient was excluded from the estimation of visual status. Thirty-three percent experienced diplopia prior to the operation; 40% of these scored VAS III or VAS IV before surgery. Double vision gradually subsided with time and had largely resolved by 1 month after surgery. The occurrence of diplopia at the final check-up was 9.5%. Diplopia, however, was not experienced as a major problem (being rated VAS II at most), as double vision was present only at the extreme vertical gaze (Table 3c). One patient having suffered a multifractured zygomatico-orbital fracture had, by 6 months after surgery, developed diplopia co-existing with enophthalmos.

Mouth opening and occlusion

Only occurrences of these symptoms that were rated VAS III and IV before surgery were recognized by the doctor. This corresponds to the gap between the 2 graphs

The participant indicated the presence of each symptom with 'Yes' or 'No'.The severity of each existing symptom was marked on a separate visual analogue scale (VAS); 'How often does the symptom bother you?'



Symptoms asked about:

Eyesight affected
• Double vision
• Other: ....

Physical appearance affected
• Visible operation scar
• Sunken eye
• Flattened cheek
• Other: ....

Sensitivity affected (area of affected sensitivity marked in picture of a face)
• Numbness
• Sense of pricking
• Pain
• Other: ....

Fig. 1. Participant's questionnaire.

• Normal sensitivity of gum/teeth

Mouth opening/bite affected
• Reduced mouth opening
• Altered bite
• Other: ....

Are you pleased with the outcome?

Comments: ……

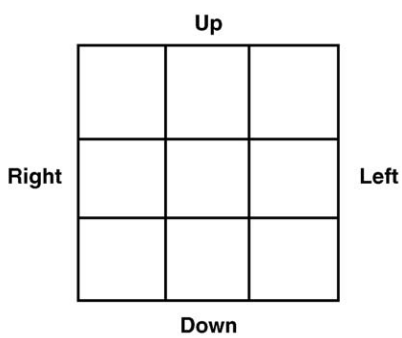
Doctor's Protocol (registration of clinical findings)

Presence of findings indicated by marking 'Yes'or 'No':

Influence of alcohol/drugs on the occasion of injury(ask the patient).
Enophthalmos/exophthalmos
Palpable fracture in inferior orbital rim
Malar flattening
Reduced mouth opening
Malocclusion
Sensitivity disorder (infraorbital nerve) regarding sharp/blunt stimuli
Haematoma:

Periorbital swelling (VAS (mm): 0–100; Eye can only be opened manually)

Restricted vertical eye movement:
Diplopia (gaze marked in figure):



Postoperatively
Visible scar
Permanent scleral show
Ectropion

Fig. 1. (*Continued*).

in Fig. 2. Forty-two percent of patients were considered to have an objective trismus preoperatively, but almost double this proportion of patients self-reported compromised mouth opening. The doctors estimated that this had largely resolved at 1 month following surgical repositioning; however, patients did not experience resolution until after 6 months. All patients experiencing limited mouth opening postoperatively had suffered from this complaint prior to the operation also.

Patient and doctor satisfaction with the outcome

The final result was satisfactory to 80% of the patients, but in only 23% of cases was the outcome completely satisfactory from the doctor's point of view. Unsatisfactory outcomes were primarily due to malar flattening or a visible scar. An altered bite, double vision and sensibility disturbances were other reasons for complaints. Provision of sufficient information prior to surgery usually made patients aware of the risk of persisting hypo- or hyperaesthesia, and this symptom was largely tolerated in spite of being frequent (Table 2).

Discussion

A remaining sign or symptom following a zygomatico-orbital fracture does not necessarily mean that the patient suffers from it. It is noteworthy, however, that what are regarded as 'light' problems by a doctor may be experienced as severe by the affected individual. In the present study, use of a VAS made it possible to follow the course of healing after a zygomatico-orbital fracture, even from the patient's viewpoint.

One month after surgery seemed to be the decisive point up to which most symptoms steadily improved. Thereafter, scar manifestation, jaw function and some aspects of sensibility still showed potential for further improvement. A notable exception was enophthalmos, no cases of which were observed before or by 1 month after surgery, but it was diagnosed 6 months after surgery.

The VAS rating revealed an otherwise unexposed discrepancy between patients' and doctors' opinions regarding mainly sensibility and jaw function. Jungell and Lindqvist experienced difficulties in achieving a reliable grading of patients' sensibility function. Many patients in their study complained of numbness, although objective evaluation did not show clear deficits[16]. In a study of postoperative infra-orbital nerve function conducted by Vriens et al., 54% of patients reported severely affected sensibility, while objective testing indicated abnormalities in only 34%[23]. In the present study, some cases of pronounced sensibility disturbance (VAS III and IV) were not detected by the doctor during follow-up. On the other hand, the doctor reported a higher occurrence of sensibility disturbances than the patients themselves did at the final appointment. The latter finding might be explained by

Table 3c. Eye symptoms

	Mean		SD		Range	
Symptom/sign	Preoperative	1-year postoperative	Preoperative	1-year postoperative	Preoperative	1-year postoperative
Diplopia	19.6	2.8*	34.0	10.9	0–100	0–50

VAS scores in mm.
* $P < 0.05$.

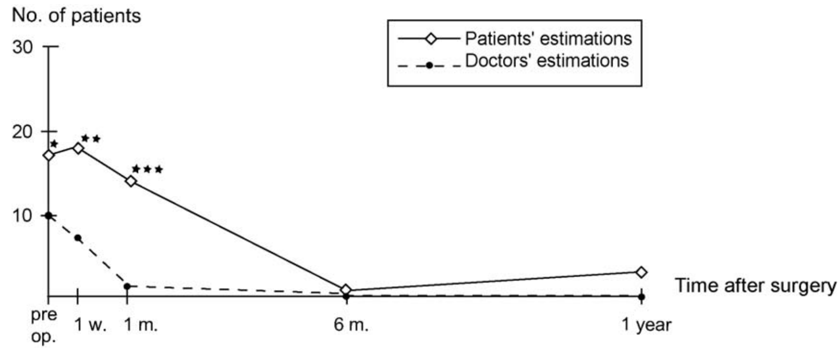


Fig. 2. Number of patients reporting mouth-opening capacity and the corresponding number of patients assessed by the doctor as having these jaw related problems (blow-out fractures excluded). $*P < 0.05$; $**P < 0.01$; $***P < 0.001$.

the symptom, although present at examination, not being regarded as a problem by the patients and hence being marked as absent in the questionnaires. De Man and Bax[7] noted that persistent hypo- or hyperaesthesia, even in small areas such as the nostril, lip or gum, could be experienced as troublesome; this was also reported by patients in the present study. Not feeling one's nose running or food remnants stuck under one's lip was experienced as very embarrassing, and thus may have constituted a considerably greater problem than understood by the doctor.

In 1970, Hötte[15] wrote that sensibility disorders due to an orbital fracture were a 'minor complaint', 'never disabling' and thus 'never an indication for surgery'. Twenty years later, however, progressive infra-orbital nerve hypaesthesia was discussed as a primary indication for surgical repair[4]. Other authors do not favour decompression because of this indication, since the technique itself may be responsible for damaging the nerve[7]. Vriens et al.[23] have suggested treatment of some cases of sensibility dysfunction with corticosteroids.

The decision whether or not to operate must be based on objective, reliable data. When progressive hypaesthesia is the major indication, obtaining such data is a problem. Perhaps follow-up with a combination of repeated VAS scoring and 2-point discrimination tests would reveal impairing of sensibility and thus support active treatment of this sole indication.

The main reason for patient dissatisfaction with the outcome was affected physical appearance. Facial deformity was mainly due to a decision to confine surgical treatment to closed reduction and to forgo fixation. A study by Tadj and Kimble[22] established that closed reduction was followed by a higher incidence of postoperative facial deformity than were open reduction and fixation. To prevent re-dislocation, De Man and Bax[7] considered it justifiable to apply rigid plate fixation even in cases in which the fracture was stable after elevation. Likewise, Vriens et al.[23] suggested fixation at the frontozygomatic suture in favour of closed reduction only.

What patients reported as a 'showing scar' was recognized as a scleral show on clinical examination. The occurrence of permanent scleral show (29%) found in the present study correlates well with the results reported in other studies[2,22]. Appling et al.[2] reported a 28% rate of permanent scleral show using the subciliary skin–muscle flap technique, and emphasized the importance of instructing patients to perform vertical massage of the lower eyelid postoperatively to prevent ectropion and scleral show. The 4% occurrence of persistent ectropion found in the present study can be compared to the findings of other studies[2,3,17], which reported a 6–12% incidence with the subciliary approach. It seems obvious that orbital explorations in the present study were performed on rather wide indications. The necessity of exploring the orbit in 56% of the simple tetrapod fractures is questionable, and stabilization at the frontozygomatic suture and at the buttress may be a better alternative to minimize risks and sequelae.

Enophthalmos developed over time and was not diagnosed until 6 months' postoperatively. At final check up, this symptom had a high frequency of 19%, compared to 7% as found in the authors' previous retrospective study (determined by questionnaire), and 2.0% (questionnaire) and 1.2% (computerized search) as found by other studies[1,22]. The fact that some patients in the present study overlooked clinically detectable enophthalmos has also been noted previously. Dietz et al.[9] reported in a study of 28 patients that none of 9 patients with pathological Hertel measurements 6 months' postoperatively were concerned by this cosmetic disturbance. A few patients, moreover, in the present study reported a 'sunken eye' without manifesting any clinical signs of it. This indicates the possibility of a number of unrecorded cases as well as false positive responses in studies based on questionnaire data only. The timing of the final postoperative check up is also important in detecting this sequela, because of the timing of its appearance.

At termination of the present study, 9.5% patients had diplopia, present only at extreme vertical gaze. By comparison, Afzelius and Rosen[1] reported a 6.6% occurrence of diplopia, while Tadj and Kimble[22] reported 4.7%. It is not evident, however, from these articles how diplopia was defined. Perhaps double vision in vertical gaze exceeding a certain angle of eye elevation, easily compensated for by head position and without decisive clinical significance, should not be categorized as 'diplopia' in this context, as also argued by Helveston[14]. The VAS was useful in evaluating the patient's experience of this problem in daily life. Requirements regarding eye motility seem to vary between patients. Even if some degree of diplopia is present the distress due to this might differ. Factors such as profession and lifestyle might determine the extent of suffering rather than a specific limit of eye elevation common to all injured[5].

Regarding comprised mouth opening there were marked differences between patients' experiences of symptoms and doctors' assessments. This may be due to a more individual range of mouth-opening spans than expected. Even measures within the clinically 'normal' range could be perceived as restricted by an individual patient[6]. How to determine the normal span for a specific patient experiencing trismus owing to a fracture is a challenge. Again, a VAS is useful in obtaining information regarding patients' perceptions of whether mouth opening is restricted. It has been suggested that jaw exercises could enhance improvement in cases of trismus due to muscular restriction; in some cases, the period of compromised mouth opening could possibly be shortened by this means, and as a result the agony of this dysfunction decreased[10,21].

In conclusion, the VAS proved to be a useful instrument for evaluating patient discomfort and indicating differences between patients' and doctors' opinions regarding the presence of symptoms and signs after orbital floor fractures. Agreement between the two was good regarding the presence of objective, measurable signs such as facial asymmetry and diplopia. When it came to sensibility and mouth-opening ability, discrepancies were evident. It is desirable that reliable methods for measuring sensibility and evaluating mouth opening are included in follow-up routines. This would increase our knowledge of the course of healing, prognosis and possibilities for the prevention and active treatment of these problems.

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References

1. Afzelius LE, Rosen C. Fractures of the malar bone. Follow-up study based upon a questionnaire. ORL J Otorhinolaryngol Relat Spec 1979: **41**: 227–233.
2. Appling WD, Patrinely JR, Salzer TA. Transconjunctival approach vs subciliary skin–muscle flap approach for orbital fracture repair. Arch Otolaryngol Head Neck Surg 1993: **119**: 1000–1007.
3. Bahr W, Bagambisa FB, Schlegel G, Schilli W. Comparison of transcutaneous incisions used for exposure of the infraorbital rim and orbital floor: a retrospective study. Plast Reconstr Surg 1992: **90**: 585–591.
4. Boush GA, Lemke BN. Progressive infraorbital nerve hypesthesia as a primary indication for blow-out fracture repair. Ophthal Plast Reconstr Surg 1994: **10**: 271–275.
5. Burnstine MA. Clinical recommendations for repair of isolated orbital floor fractures: an evidence-based analysis. Ophthalmology 2002: **109**: 1207–1210 discussion 1210–1211; quiz 1212–1213.
6. Celic R, Jerolimov V, Knezovic Zlataric D, Klaic B. Measurement of mandibular movements in patients with temporomandibular disorders and in asymptomatic subjects. Coll Antropol 2003: **27**(Suppl 2):43–49.
7. De Man K, Bax WA. The influence of the mode of treatment of zygomatic bone fractures on the healing process of the infraorbital nerve. Br J Oral Maxillofac Surg 1988: **26**: 419–425.
8. Dexter F, Chestnut DH. Analysis of statistical tests to compare visual analog scale measurements among groups. Anesthesiology 1995: **82**: 896–902.
9. Dietz A, Ziegler CM, Dacho A, Althof F, Conradt C, Kolling G, von Boehmer H, Steffen H. Effectiveness of a new perforated 0.15 mm poly-p-dioxanon-foil versus titanium-dynamic mesh in reconstruction of the orbital floor. J Craniomaxillofac Surg 2001: **29**: 82–88.
10. Fagade OO, Obilade TO. Therapeutic effect of TENS on post-IMF trismus and pain. Afr J Med Med Sci 2003: **32**: 391–394.
11. Folkestad L, Granstrom G. A prospective study of orbital fracture sequelae after change of surgical routines. J Oral Maxillofac Surg 2003: **61**: 1038–1044.
12. Folkestad L, Westin T. Long-term sequelae after surgery for orbital floor fractures. Otolaryngol Head Neck Surg 1999: **120**: 914–921.
13. Gewalli F, Sahlin P, Guimaraes-Ferreira J, Lauritzen C. Orbital fractures in craniofacial trauma in Goteborg: trauma scoring, operative techniques, and outcome. Scand J Plast Reconstr Surg Hand Surg 2003: **37**: 69–74.
14. Helveston EM. The relationship of extraocular muscle problems to orbital floor fractures: early and late management. Trans Sect Ophthalmol Am Acad Ophthalmol Otolaryngol 1977: **83**: 660–662.
15. Hötte HH. *Orbital Fractures*. Assen, The Netherlands: Royal VanGorcum Ltd 1970: 329–349.
16. Jungell P, Lindqvist C. Paraesthesia of the infraorbital nerve following fracture of the zygomatic complex. Int J Oral Maxillofac Surg 1987: **16**: 363–367.
17. Manson PN, Ruas E, Illiff N, Yaremchuk M. Single eyelid incision for exposure of the zygomatic bone and orbital reconstruction. Plast Reconstr Surg 1987: **79**: 120–126.
18. Mathog RH. Management of orbital blow-out fractures. Otolaryngol Clin North Am 1991: **24**: 79–91.
19. Putterman AM, Stevens T, Urist MJ. Nonsurgical management of blow-out fractures of the orbital floor. Am J Ophthalmol 1974: **77**: 232–239.
20. Shaw GY, Khan J. Precise repair of orbital maxillary zygomatic fractures. Arch Otolaryngol Head Neck Surg 1994: **120**: 613–619.
21. Stone J, Kaban LB. Trismus after injection of local anaesthetic. Oral Surg Oral Med Oral Pathol 1979: **48**: 29–32.
22. Tadj A, Kimble FW. Fractured zygomas. ANZ J Surg 2003: **73**: 49–54.
23. Vriens JP, van der Glas HW, Moos KF, Koole R. Infraorbital nerve function following treatment of orbitozygomatic complex fractures. A multitest approach. Int J Oral Maxillofac Surg 1998: **27**: 27–32.
24. Wilkins RB, Havins WE. Current treatment of blow-out fractures. Ophthalmology 1982: **89**: 464–466.
25. Wojno TH. The incidence of extraocular muscle and cranial nerve palsy in orbital floor blow-out fractures. Ophthalmology 1987: **94**: 682–687.

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