# Long-term sequelae after surgery for orbital floor fractures

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**A surgical technique involving exact repositioning and rigid fixation is required for the reduction of fractures of the orbital floor. Even then, sequelae may be present long after the trauma. The aim of this study was to establish the frequency and type of sequelae after surgery for orbital floor fractures and to investigate the extent to which the method of surgery had any impact on the severity of the sequelae. A questionnaire was sent to all 107 patients (response rate 77%) 1 to 5 years after the injury. Further clinical data were obtained from the patients' charts. Eighty-three percent of the patients were affected by some kind of permanent sequelae in terms of sensibility, vision, and/or physical appearance. A high frequency of diplopia (36%) was related to the reconstruction of the orbital floor with a temporary "supporting" antral packing in the maxillary sinus, a technique which has now been abandoned at our department in favor of orbital restoration with sheets of porous polyethylene. Our conclusion is that, because long-term sequelae are common, the surgical technique must be subjected to continuous quality control to minimize future problems for this group of patients.**
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An increasing body of evidence during the last decade emphasizes the importance of the exact repositioning and rigid fixation of facial fractures.[1-7] A successful outcome is essential for functional and cosmetic reasons. This is especially true of fractures involving the orbit, which require precise reconstruction volumetrically and anatomically to prevent late complications, first and foremost in terms of eye function. Sequelae such as diplopia, enophthalmos, hypophthalmos, and sensibility disturbances within the distribution of the infraorbital nerve are well known to all surgeons dealing with orbitozygomatic fractures.[1-4,6,7]

The Department of Otorhinolaryngology–Head and Neck Surgery at Sahlgren's University Hospital in Göteborg receives most of the facial traumas in the area, which has 500,000 inhabitants. Of just under 300 facial fractures a year, only 20 to 25 involve the orbit. The cases present irregularly and are often operated on outside the planned operation schedule. As a result, a number of different surgeons have been involved in facial fracture surgery, some of whom were at the department as part of their residency training.

Patients with suspected orbital fractures will usually be seen by an otorhinolaryngologist within 3 days. A plain x-ray film is often taken initially, and the subsequent examination usually involves a CT scan and an assessment by an ophthalmologist. In cases with defective dental occlusion, an odontologist is consulted. There have not been any strict indications for surgery.

In this study 2 main groups were distinguished according to fracture type: (1) pure "blow-out" fractures comprising the floor and sometimes the adjacent walls of the orbit with no involvement of orbital rims, and (2) orbitozygomatic fractures involving the orbital floor as well as the zygomatic complex including the infraorbital rim.

Usually surgery is performed within the first week after the trauma. Despite early surgical intervention, the occurrence of a permanent sequela is still a fact for many patients. During and after the years in which this study was conducted, however, new methods and materials have been introduced. At our department, the biocompatible synthetic material porous polyethylene (Medpor, Promeduc/Porex Surgical Inc) was introduced in late 1995 for restorations of the orbital floor.

The aim of the study was to assess the cause and prevalence of orbital floor fractures requiring surgery in Göteborg during a 5-year period in the 1990s and to establish the relationship between the surgical methods that were used and the late complications encountered by patients 1 or more years (1 to 5 years, mean 3 years) after trauma and surgery.

## METHODS AND PATIENTS

The department registered 107 inpatients with orbital floor fractures between 1991 and 1995, an average of 21 patients per year (range 19 to 23). All 107 patients were included in the study.

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**Table 1.** Cause of the trauma

| Cause | No. of cases (%) | No. of males (%) | No. of females (%) |
|---|---|---|---|
| Personal altercations/assaults | 59 (55) | 46 (62) | 13 (39) |
| Falls* | 19 (18) | 6 (8) | 13 (39) |
| Vehicle accidents | 14 (13) | 9 (12) | 5 (15) |
| Sports injuries | 12 (11) | 11 (15) | 1 (3) |
| Accidental blow by an object | 3 (3) | 2 (3) | 1 (3) |
| TOTAL | 107 (100) | 74 (100) | 33 (100) |

*Falls include stumbling and slipping.

**Table 2.** Types of fracture

| Type of fracture | No. of cases (%) | No. of males (%) | No. of females (%) |
|---|---|---|---|
| Blow-out fracture | 46 (44) | 30 (40) | 16 (48) |
| Orbital floor fracture + simple zygoma fracture | 54 (50) | 37 (50) | 17 (52) |
| Complicated orbital floor and zygoma fracture | 7 (6) | 7 (10) | 0 (0) |
| TOTAL | 107 (100) | 74 (100) | 33 (100) |

Distribution of the 107 orbital floor fractures in this study. Complicated fractures are part of a Le Fort fracture or involve a coexisting fracture of the skull or mandible.

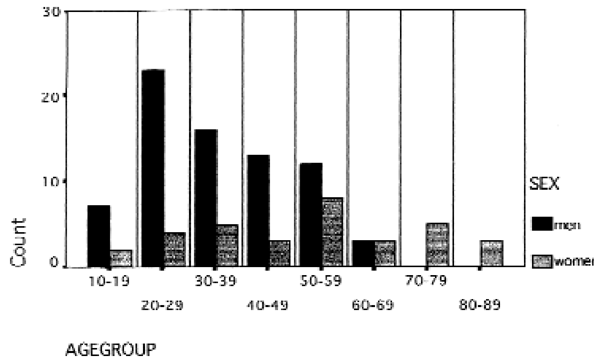


**Fig 1.** Age span among 107 patients (74 men, 33 women; age range, 10 to 88 years) illustrates the 2 main groups affected: young men and middle-aged or elderly women.

**Fig 2.** CT scan of pure blow-out fracture with herniated inferior rectus muscle *(arrow).*

A questionnaire consisting of 10 questions was designed after a study of 10 patients' charts to identify problems registered after the trauma and the treatment. The 10 patients were then sent the preliminary questionnaire and were also telephoned for a supplementary interview. Because the questionnaire was considered to be easy to read and answer and the questions were found to be representative of the problems encountered by the patients, it was sent by mail to the remaining 97 patients included in the study. Patients who did not answer the questionnaire were interviewed by telephone. Those who were not reached by telephone were sent a second questionnaire. The response rate was 77% (men 78%, women 73%). Further clinical data for all patients were obtained from the patients' charts. An answered questionnaire was considered to be informed consent. The study was approved by the local ethics committee.

Surgery was considered to be necessary for 103 patients. A plain x-ray film or CT scan and an estimation of eye motility and visual acuity by an ophthalmologist were routinely performed before surgery. Postoperative follow-up included an examination by the surgeon 1 week and 1 month after surgery to make it possible to detect any delayed displacement or deformity, and if indicated, further consultation took place with an ophthalmologist.

No seasonal patterns were noted because the cases were spread throughout the year (1 to 5 cases a month) and the patients' home addresses did not indicate any geographic concentration. The age span extended from 10 to 88 years, but almost half the patients (45%) were aged 20 to 39 years, and most of them were men (69%) (Fig 1). Most patients were laborers or craftsmen, 18% were retired because of old age or physical/mental illness, 8% were students, and 6% were unemployed. The majority (91%) of the injuries had occurred during leisure time.

## RESULTS

### Cause of the Trauma

Fifty-nine patients' (55%) traumas resulted from domestic or street violence, 18% from accidental falls,

**Table 3.** Materials used for orbital floor reconstruction

| Year | No. of cases* | None (%) | Lyodura (%) | Cartilage (%) | Bone (%) | Balloon catheter/ gauze tampon (%) | Surgicel (Ethicon/ Johnson & Johnson) (%) | Medpor (%) |
|---|---|---|---|---|---|---|---|---|
| 1991 | 20 (2) | 8 (40) | 1 (5) | 1 (5) | 2 (10) | 8 (40) | 0 (0) | 0 (0) |
| 1992 | 20 (1) | 8 (40) | 6 (30) | 0 (0) | 1 (5) | 5 (25) | 0 (0) | 0 (0) |
| 1993 | 19 | 10 (53) | 4 (21) | 1 (5) | 3 (16) | 1 (5) | 0 (0) | 0 (0) |
| 1994 | 21 (1) | 7 (33) | 5 (24) | 2 (9.5) | 5 (24) | 2 (9.5) | 0 (0) | 0 (0) |
| 1995 | 23 | 4 (17) | 11 (48) | 0 (0) | 1 (4) | 3 (13) | 2 (9) | 2 (9) |
| TOTAL | 103 (4) | 37 (36) | 27 (26) | 4 (4) | 12 (12) | 19 (18) | 2 (2) | 2 (2) |

List of the different materials used for orbital floor reconstruction during the 5-year period. Inflation catheters or gauze tampons as support for the orbital floor (ie, antral packing) were frequently used during the first few years. Porous polyethylene sheets, Medpor, were introduced in the department as an alternative implant material in late 1995. Microplates and/or wire ligatures were used for the fixation of orbital rim fractures in 60% of the 60 orbitozygomatic fractures.
*Data in parentheses indicate the number of patients not operated on (n = 4), which was subtracted from the total.

13% from vehicle accidents while traveling by bicycle or car, and 11% from accidents during sports activity, mainly football and karate. The cause of the trauma tended to differ depending on the sex of the patient. Men had more personal altercations/assaults (62%) than women (39%) (Table 1). It was not possible to establish the extent to which alcohol was involved in the violence because no alcohol tests were carried out.

The diagnosis was confirmed by a CT scan in 56% (preceded by an ordinary x-ray film in 42%) and by a plain x-ray film alone in the rest of the cases. An ophthalmologist was consulted to estimate eye function before surgery in 85% of the cases. A forced duction test was performed peroperatively in 30%, according to the patients' charts.

## Types of Fracture

Pure blow-out fractures were noted in 44% (Fig 2). More often, the orbital floor fractures were combined with a zygomaticomaxillary fracture (50%), and the remaining 6% were considered to be complicated because they were part of a Le Fort fracture or coexisted with a mandibular fracture or a skull fracture (Table 2). A fracture of the nose coexisted with 17% of the orbital fractures. Most fractures, 63% (67 of 107), occurred on the left side, and 2% (2/107) were bilateral.

## Surgical Methods

Four of the 107 patients had symptoms estimated as mild, such as a moderate sensibility disturbance in the distribution of the infraorbital nerve, and because the x-ray/CT scan revealed merely discrete or uncertain findings, surgery was considered unnecessary. For the remaining 103 patients, surgery was performed within 1 week of the trauma in 60% (62) of cases and within 2 weeks in 92% (95). In 5 (5%) cases, the operation was delayed until 21 days or more after the trauma (see case reports).

The surgical technique that was used involved exposing the orbital floor through a subciliary incision in 95 cases (92%), 36 of which were combined with an open reduction of the zygomatic complex according to the Gillies procedure (35%).[4] Some cases underwent an antrotomy of the maxillary sinus anterior wall (28%), and a few cases were reduced by a Gillies procedure alone (6%).

**Materials for reconstruction of the orbital floor.** Different kinds of material such as autogenous and alloplastic grafts, wire ligatures, and microplates were used in 69% of the operated cases for the reconstruction and stabilization of the orbital floor and fixation of the orbital rim (Table 3). During the years of the study, the reconstructive technique changed. In 1991 a Foley balloon catheter (inflation catheter) or a gauze tampon was still frequently placed in the maxillary sinus as support for the orbital floor. In recent years the support and restoration of the orbit has been accomplished with implants on the orbital floor and the rigid fixation of the zygomaticomaxillary and/or zygomaticofrontal fractures with microplates (Table 3). In Table 3, it is shown that lyophilized dura (Lyodura; Sherwood/Davis & Geck) was the material of choice, often in combination with pieces of membranous bone from the anterior maxillary sinus wall. Despite the different techniques, the frequency of sequelae during the first 4 years was much the same, on average 85%. The last year of the study is an exception, with a frequency of 75%.

Prophylactic antibiotic treatment was given to 70% of the patients treated with some kind of foreign material support or fixation. Only 1 patient (fixation of infraorbital rim with a wire ligature, no orbital implant), who was not given antibiotics prophylactically, actually had a postoperative infection.

**Delayed cases.** It is a commonly held opinion that facial fracture surgery preferably should be accomplished within 2 to 3 weeks of the trauma.[6,8,9] Five cases in our study underwent surgical intervention later than 3 weeks after the injury, 4 of which still have permanent diplopia. We have chosen to present these cases and the circumstances causing the delay to surgery.

*Case 1 (1991):* A 28-year-old man was injured through assault and thereby incurred diplopia, which was verified ophthalmologically. Because the CT findings were discrete, a decision was made to wait and follow the progress of the visual status. Because of persistent diplopia, he was operated on 38 days after the trauma. Lyodura was used to reconstruct the orbital floor. The operation did not succeed, and the patient still has severe diplopia.

*Case 2 (1992):* A 64-year-old man fell from a ladder and was brought to a general surgery department. He reported diplopia and was examined by an ophthalmologist, who suggested awaiting further development. After 3 weeks, he was referred to the ENT clinic for the first time and was finally operated on 56 days after the trauma because of persisting diplopia. No reconstruction or fixation material was used. The patient has permanent diplopia.

*Case 3 (1993):* A 10-year-old boy, a car passenger in a traffic accident, was admitted for hospital care because of a head trauma. A facial fracture was neglected for several days at the intensive care unit, and as a result, diplopia present in this case was not noticed. The boy was finally operated on 29 days after the trauma with a reduction of the fracture. Neither microplates nor any orbital implant material was considered necessary for stability. At the first checkup 1 week afterwards, eye motility was not completely satisfactory, and since then the boy has unfortunately not been reached for a further follow-up.

*Case 4 (1993):* A 33-year-old man was accidentally hit by a sledgehammer on the same side of the face as a previously blind eye. No action was taken because the patient was already blind in the eye in the traumatized orbit. However, cosmetically disturbing enophthalmos developed, and the patient was admitted for surgery 2.5 years after the trauma. Rib cartilage was used to restore the orbital volume. Despite this attempt at surgical correction, the patient still has permanent, severe enophthalmos and hyperesthesia of the cheek.

*Case 5 (1993):* A 33-year-old man incurred diplopia and slight enophthalmos after a fall. He did not seek medical treatment for 3 weeks and was operated on 30 days after the trauma. Rib cartilage was then used to reestablish the orbital floor and the orbital volume. The operation was successful; the patient does not have any complications and is very pleased with the result.

**Table 4.** Sequelae: Permanent effects on sensibility

| Type of sequela | No. of cases (%) |
|---|---|
| None | 37 (45) |
| Numbness | 33 (40) |
| Sense of pricking | 6 (7) |
| Hyperesthesia | 6 (7) |
| Pain | 4 (5) |

Patients' reports about the effects of injury and/or surgery on sensibility. Questionnaire response rate: 82 of 107 (77%). Some patients reported as many as 2 types of sensibility disturbance. As a result the percentage sum exceeds 100%.

**Table 5.** Sequelae: Permanent effects on vision

| Type of sequela | No. of cases (%) |
|---|---|
| None | 43 (52) |
| Blurred vision | 22 (27) |
| Diplopia | 14 (17) |
| Increased tear flow | 6 (7) |
| Sensitivity to light | 3 (4) |
| Blindness* | 3 (4) |

Patients' reports about the effects of injury and/or surgery on vision. Questionnaire response rate: 82 of 107 (77%). Each patient may report more than 1 type of sequelae. As a result, the percentage sum exceeds 100%.
*Blindness in all 3 cases was a direct effect of the trauma.

**Table 6.** Sequelae: Permanent effects on physical appearance

| Type of sequela | No. of cases (%) |
|---|---|
| None | 47 (56) |
| Scar | 16 (19) |
| Enophthalmos | 6 (7) |
| Ectropion* | 3 (4) |
| Tics (eye) | 2 (2) |
| Loss of zygomatic prominence/ cheek contour | 8 (10) |
| Not specified | 3 (4) |

Patients' reports about the effects of injury and/or surgery on physical appearance. Questionnaire response rate: 84 of 107 (78%). Each patient may report more than 1 type of sequelae. As a result the percentage sum exceeds 100%.
*Cases with "permanent scleral show" unknown.

## Sequelae

Irrespective of the surgical method, the frequency of sequelae was high. There were no obvious differences in the occurrence of sequelae in terms of the number of days between trauma and surgical intervention. Six patients who underwent surgery as late as the 10th to the 30th day after the trauma had no reported symptoms.

Permanent sequelae were found in 83% of the

**Table 7.** Postoperative permanent effects on vision related to implant material

| Material used to support orbital floor | No. of patients | No. of patients answering the questionnaire | Permanent diplopia (%) | Permanent blurred vision (%) |
|---|---|---|---|---|
| None | 37 | 27 | 4/27 (15) | 8/27 (29) |
| Lyodura | 27 | 22 | 4/22 (18) | 9/22 (41) |
| Bone (maxillary sinus) | 12 | 9 | 1/9 (11) | 2/9 (22) |
| Cartilage (rib) | 4 | 4 | 0/4 (0) | 0/4 (0) |
| Balloon catheter/gauze tampon | 19 | 14 | 5/14 (36) | 2/14 (14) |
| Surgicel | 2 | 2 | 0/2 (0) | 0/2 (0) |
| Medpor | 2 | 1 | 0/1 (0) | 0/1 (0) |
| (No surgery) | 4 | 3 | 0/3 (0) | 1/3 (33) |
| TOTAL | 107 | 82 | 14/82 (17) | 22/82 (27) |

Frequency of permanent diplopia and blurred vision related to implant materials used in surgery. Diplopia was overrepresented in connection with the use of a balloon/inflation catheter or a gauze tampon in the maxillary sinus as a temporary support for the orbital floor. For uncertain reasons, permanently blurred vision was similarly overrepresented after surgery with Lyodura.

patients. The most common sequelae were sensibility disturbances (55%), vision symptoms (48%), and cosmetic problems (44%) (Tables 4-6). Of 20 patients in whom no supporting material had been used for reconstruction, 18 have sequelae. Patients in the 20- to 29-year age group had relatively more cosmetic problems than the other age groups. The complicated fractures defined above were all associated with some kind of permanent sequelae.

The patients in this study had no sinus problems after the facial trauma and subsequent surgery.

**Sensibility disturbances.** Sequelae in general and sensibility disturbances in particular are more common in connection with orbitozygomatic fractures (62%) than with pure blow-out fractures (43%).

Numbness within the distribution of the ipsilateral infraorbital nerve was a common symptom (40%), even though there was a mean follow-up time of 3 years (Table 4). The sensibility disturbances usually comprise the ipsilateral cheek and lip, and in the case of a few patients, sensibility impairments of the teeth have become permanent. Four patients (5%) have pain in the area. Some have noticed that cold and/or windy weather accentuates the symptoms. Of the 4 patients who did not undergo surgery, it is known that 2 of 3 are still affected by dysesthesia 4 to 5 years after the trauma.

**Vision disturbances.** Almost half the patients reported visual defects and/or other eye symptoms such as blurred vision, diplopia, increased tear flow, and increased sensitivity to light (Table 5). Three patients became blind in direct connection with the trauma, but there was no case of blindness caused by surgery. Permanently blurred vision was mentioned by 27% of the patients.

Forty-three (40%) patients (65% blow-out fractures, 36% orbitozygomatic fractures) had preoperative diplopia that was verified by an ophthalmologist (Fig 3). Fourteen (17%) patients had postoperative permanent diplopia of varying degrees (Table 7), 3 of whom had no such symptoms before the operation. Two of these 3 were surgically treated with an antral packing (gauze tampon in the maxillary sinus), and the third had undergone repositioning with the Gillies procedure only, with no exploration of the orbital floor.

Nineteen (18%) of the cases operated on from 1991 to 1995 were treated with an inflatable Foley (balloon) catheter (n = 10) or gauze packing (n = 9) in the maxillary sinus as a temporary support for the orbital floor. The gauze tampon was usually left in place for 1 to 2 weeks, whereas the Foley catheter remained for 2 to 6 weeks. Of these patients 36% still have permanent diplopia 1 or more years after surgery, compared with an overall frequency of 12% if these cases are excluded from the analysis.

Six patients (7%) reported increased tear flow, but none of them had an orbital fracture involving the medial wall including the lacrimal duct or had a postoperative ectropion.

A few patients had increased sensitivity to light, although none of them was known to have posttraumatic mydriasis or a tonic pupil caused by injury of the ciliary ganglion.[10]

**Cosmetic consequences.** Enophthalmos was present in 6 (7%) of the patients (Table 6 and Fig 4). Three of these patients had blow-out fractures, 2 had orbitozygomatic fractures, and 1 had a Le Fort fracture. On average, they underwent surgery on the 11th day after trauma. In 2 of these patients, the orbital floor was not reinforced, 2 received Lyodura to cover the defect, 1 had an autogenous graft of rib cartilage, and 1 was provided with an inflation catheter in the maxillary sinus for 3 weeks.

A cosmetically disturbing scar after subciliary incision was present in 19%, and permanent ectropion was present in 4% (Table 6). However, the incidence of per-

**Fig 3.** Disability elevating the right eye in a patient with diplopia.

**Fig 4.** Enophthalmos of the right eye.

manent scleral show (ie, sclera visible between the iris and the lower eye lid at primary eye position; Fig 5) is unknown because this information was not registered in the patients' charts.

No other major differences were seen when surgical methods and sequelae were compared, except in the 6 patients in whom the fracture had been repositioned with the Gillies procedure alone. Four of these 6 had symptoms—2 had fairly severe sensibility disorders and loss of cheek prominence and 1 had diplopia after surgery.

**Social consequences.** The majority of the patients (74%) stayed in the hospital for only a few days (2 to 4 days), but as many as 32% were on sick leave for more than 3 weeks. Eight patients stayed in the hospital for more than 10 days, mainly because of social problems or an intercurrent disease.

Of the 59 patients injured through assault, it is known that 34 reported the incident to the police, but the perpetrator was found in only 13 of these cases. Seven victims answered that they had not reported the perpetrator at all.

Twenty-one persons did not report the injury to an insurance company, some because they were not insured. Thirty-eight of the injured people received some financial compensation. This sum was generally very low in the opinion of the affected individuals because it often covered only expenses for transport to the hospital and the fee for consulting a doctor.

## DISCUSSION

It is difficult to obtain data on traumas because no complete registers can be found at any institution or authority other than hospital records. Police records could be a supplementary alternative, but they would still be incomplete because the frequency of personal altercations and vehicle accidents, in which the police

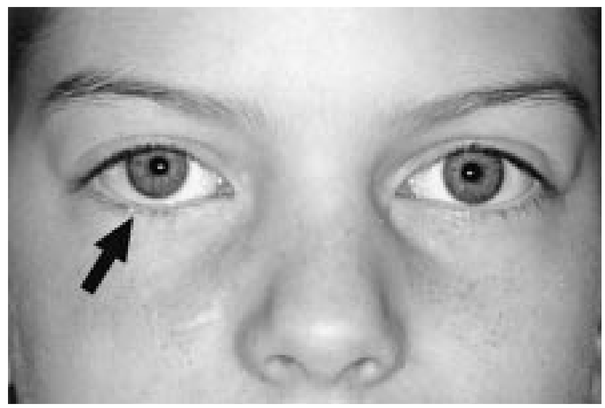

**Fig 5.** No visible scar and no ectropion, but permanent scleral show is nonetheless present *(arrow).*

are generally informed, is 55% and 13%, respectively. Furthermore, despite having been the victim of a personal altercation, only 57% reported the incident to the police. Another database could be obtained by searching the records of insurance companies, but in this study 21 subjects (20%) did not report the injury to any insurance company. The most reliable source of information is therefore the hospital records.

In this context, it is discouraging to note that, in the case of the reported assaults, only 22% of the perpetrators who deliberately caused a trauma of this scope were found by the police. It is also disappointing to find that the insurance companies compensate very little, even though this study indicates that the social and economic consequences for the victims are not negligible.

The importance of the surgical technique[3,4] in the reduction of orbital fractures is emphasized here because the cases in which the surgeon supported the orbital floor with an antral packing clearly demonstrate

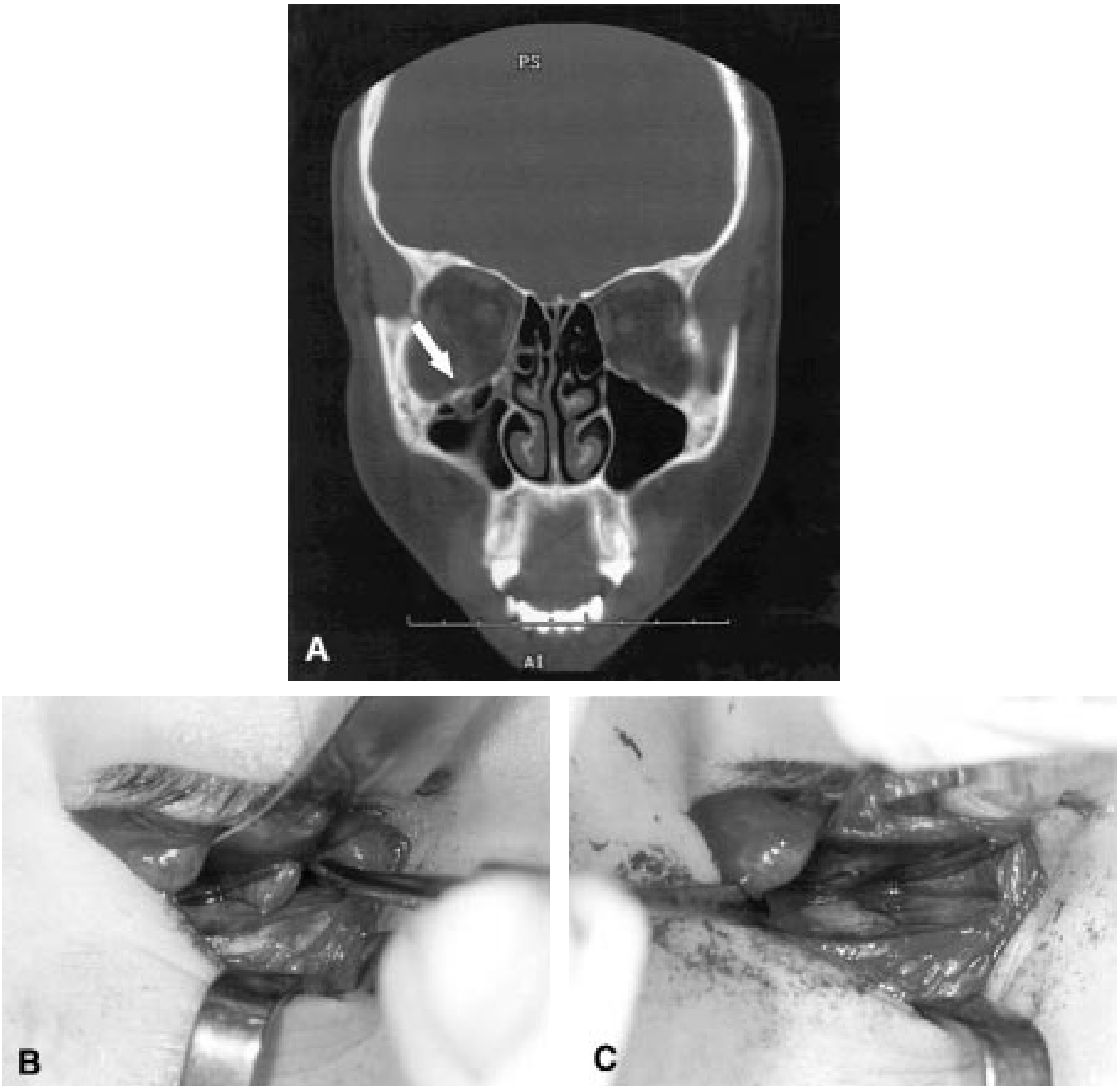


**Fig 6. A,** CT scan of undislocated orbital floor fracture *(arrow)* in a 17-year-old girl injured during figure skating who had severe eye pain at presentation. Surgery within 24 hours revealed a trapdoor fracture in the orbital floor before **(B)** and after **(C)** the incarcerated soft tissue was released.

a higher degree of long-term sequelae (Table 7). We have abandoned this technique and now use biocompatible synthetic materials such as porous polyethylene (Medpor)[11-13] or autologous transplants (eg, rib cartilage)[3,14] to reconstruct the orbit. The surgical skill and experience could be another factor with an impact on the outcome, but this could not be shown in this study. The timing of the surgery did not have any consequence, as long as the surgery was performed within 2 weeks of the trauma. Only 5 cases were operated on after 3 weeks or more because of unfortunate circumstances, and all but 1 of them had problems at follow-up.

One exception is, of course, the "trapdoor" fracture, which presents itself as an injury with soft tissue incarcerated in an orbital floor fracture—where the undislocated floor gives the impression of being intact on a CT scan—in combination with intensive pain on eye movement, which is severely restricted (Fig 6). This type of orbital fracture is mainly seen among younger individuals[15] and should be explored surgically within 24 hours.

The overall frequency of 83% of patients reporting some kind of long-term sequela must be regarded as too high for satisfaction. Some symptoms may seem less important such as numbness of the cheek and teeth. However, in many cases disturbed sensibility is a considerable problem for the patient, and our aim must be to restore the function completely. Whether loss of sensibility after orbital trauma should be an indication for orbital surgery has been discussed.[16]

Affected eye function is a problem for the patient. In this study, we noted diplopia in 17% and blurred vision in 27% of cases. We ascribe the high frequency of diplopia to the use of antral packing. If the patients in whom this technique was used are excluded, the frequency of diplopia is 12%, which is equal to results in other studies; however, these studies include only blow-out fractures.[17] Blurred vision[18] could be caused by a deformity of the bulb.[2]

The most common cosmetic problem related to the scar itself (19%), but the frequency of ectropion (4%) and enophthalmos (7%) seemed to be low.[17,19,20] In many instances, enophthalmos is reported as a difference between the 2 eyes of more than 2 mm (measured with Hertel's instrument),[17,21] but in this study we have considered only those cases reported by patients. Enophthalmos is most often the result of a failure to restore the exact volume of the orbit rather than fibrosis and loss of soft tissue volume.[22,23] There are probably a number of cases with permanent scleral show[19,20] (Fig 6), which is not reported here, because the patients may not be fully aware of the symptom and its possible connection to the trauma.

## CONCLUSION

Because 83% of patients with orbital floor fractures are affected by some kind of permanent sequela, the surgical technique must be subjected to continuous quality control to minimize future problems for this group of patients.

### REFERENCES

1. Shumrick KA, Kersten RC, Kulwin DR, et al. Criteria for selective management of the orbital rim and floor in zygomatic complex and midface fractures. Arch Otolaryngol Head Neck Surg 1997;123:378-84.
2. Mathog RH, Hillstrom RP, Nesi FA. Surgical correction of enophthalmos and diplopia. Arch Otolaryngol Head Neck Surg 1989;115:169-78.
3. Nguyen PN, Sullivan P. Advances in the management of Orbital Fractures. Clin Plast Surg 1992;19:87-98.
4. Rohrich RJ, Hollier LH, Watumull D. Optimizing the management of Orbitozygomatic Fractures. Clin Plast Surg 1992;19: 149-65.
5. Zingg M, Chowdhury K, Lädrach K, et al. Treatment of 813 zygoma-lateral orbital complex fractures. New aspects. Arch Otolaryngol Head Neck Surg 1991;117:611-20.
6. Yaremchuk MJ. Changing concepts in the management of secondary orbital deformities. Clin Plast Surg 1992;19:113-23.
7. Gruss JS, Van Wyck L, Phillips JH, et al. The importance of the zygomatic arch in complex midfacial fracture repair and correction of posttraumatic orbitozygomatic deformities. Plast Reconstr Surg 1990;85:878-90.
8. Manson PN. Facial injuries. In: McCarthy JG, editor. Plastic surgery: the face. Philadelphia: WB Saunders; Vol 2:1. 1990. p. 1070-81.
9. Chen JM, Zingg M, Laedrach K, et al. Early surgical intervention for orbital floor fractures: a clinical evaluation of lyophilized dura and cartilage reconstruction. J Oral Maxillofac Surg 1992; 50:935-41.
10. Bodker FS, Cytryn AS, Putterman AM, et al. Postoperative mydriasis after repair of orbital floor fracture. Am J Ophthalmol 1993;115:372-5.
11. Romano JJ, Iliff NT, Manson PN. The use of MEDPOR porous polyethylene implants in 140 patients with facial fractures. J Craniofac Surg 1993;4:142-7.
12. Rubin PA, Popham JK, Bilyk JR, et al. Comparison of fibrovascular ingrowth into hydroxyapatite and porous polyethylene orbital implants. Ophthal Plast Reconstr Surg 1994;10:96-103.
13. Rubin PA, Bilyk JR, Shore JW. Orbital reconstruction using porous polyethylene sheets. Ophthalmology 1994;101:1697-708.
14. Goldberg RA, Garbutt M, Shorr N. Oculoplastic uses of cranial bone grafts. Ophthalmic Surg 1993;24:190-6.
15. de Man K, Wijngarde R, Hes J, et al. Influence of age on the management of blow-out fractures of the orbital floor. Int J Oral Maxillofac Surg 1991;20:330-6.
16. Boush GA, Lemke BN. Progressive infraorbital nerve hypesthesia as a primary indication for blow-out fracture repair. Ophthal Plast Reconstr Surg 1994;10:271-5.
17. Elsås H. Orbitale "blow-out"-frakturer. Tidsskr Nor Laegeforen 1989;109:1177-8.
18. al-Qurainy IA. Convergence insufficiency and failure of accommodation following midfacial trauma. Br J Oral Maxillofac Surg 1995;33:71-5.
19. Appling WD, Patrinely JR, Salzer TA. Transconjunctival approach vs subciliary skin-muscle flap approach for orbital fracture repair. Arch Otolaryngology Head Neck Surg 1993; 119:1000-7.
20. Yaremchuk MJ, Kim WK. Soft-tissue alterations associated with acute, extended open reduction and internal fixation of orbital fractures. J Craniofac Surg 1992;3:134-40.
21. Yeatts RP. Measurement of globe position in complex orbital fractures. II. Patient evaluation utilizing a modified exophthalmometer. Ophthalmol Plast Reconstr Surg 1992;8:119-25.
22. Whitehouse RW, Batterbury M, Jackson A, et al. Prediction of enophthalmos by computed tomography after 'blow-out' orbital fracture. Br J Ophthalmol 1994;78:618-20.
23. Lee JW, Chiu HY. Quantitative computed tomography for evaluation of orbital volume change in blow-out fractures. J Formos Med Assoc 1993;92:349-55.