

Loss of Lower Eyelid Bulge after the Reconstruction of Zygomatic Complex Fractures

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Background: Surgery for zygomatic complex fractures primarily aims to obtain facial symmetry. We investigated facial symmetry specific to lower eyelid bulges following zygomatic complex fractures approached through the lower eyelid.

Methods: Forty-one consecutive patients underwent treatment of zygomatic complex fractures by swinging eyelid approach or subciliary approach. In both approaches, the periosteum was incised 2mm caudal to the inferior orbital rim and the orbicularis retaining ligament (ORL) was released. The orbital rim periosteum was interruptedly sutured and reconstruction of the orbital septum or ORL was not performed at the time of closure. In cases with a lower eyelid bulge on the nonfractured side, in a frontal photograph 6 months after the operation, the degree of loss of the lower eyelid bulge on the fractured side was classified as either “none,” “mild,” or “severe.”

Results: Lower eyelid bulge was present on the nonfractured side in 19 of 41 patients, all of whom were over 50 years old. Loss of lower eyelid bulge was observed on the fractured side in all cases: 15 cases following the swinging eyelid approach (mild/severe; 6/9) and four cases following the subciliary approach (mild/severe; 2/2).

Conclusions: In reconstruction after zygomatic complex fractures, lower eyelid bulges were lost in both the swinging eyelid and subciliary approaches in patients over 50 years old. The cause was thought to be an ORL release or an unintended septal reset-like effect. (*Plast Reconstr Surg Glob Open* 2022;10:e4398; doi: 10.1097/GOX.0000000000004398; Published online 21 June 2022.)

INTRODUCTION

The aging process of the lower eyelid is a combination of elongation of the orbital septum and the Lockwood ligament with protrusion of the orbital fat, resulting in the appearance of a lower eyelid bulge and the growing prominence of the palpebromalar groove and the tear trough (Fig. 1).¹⁻³ Lower eyelid bulge is an age-related change that can be treated by corrective cosmetic surgery for rejuvenation. Fat removal, orbicularis retaining

ligament (ORL) release, and septal reset are well-established procedures.¹⁻⁶ Meanwhile, after reconstruction of the orbital floor fracture, there is reported loss of the lower eyelid bulge, and thus, symmetry of the lower eyelid cannot be obtained.^{7,8}

The primary purpose of surgery after zygomatic complex fracture (ZCF) is to obtain symmetry of the face. Postoperative facial asymmetry is an important issue that may lead to patient dissatisfaction due to the recent increase in patient's aesthetic awareness. Although evaluations have been made for bone reduction asymmetry,⁹ soft tissues have not been widely evaluated. This study focuses upon facial symmetry from the viewpoint of postoperative lower lid bulge in patients with ZCF that underwent either the swinging eyelid approach or subciliary approach.

METHODS

This study was approved by the Wakayama Medical University Ethical Committee (reference number 3093), and all patients provided written informed consent.

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Authorization and release consent were obtained from the patients for the intended publication of their photographs. We reviewed records of patients at Wakayama Medical University Hospital between 2015 and 2020. Included in the study were 41 patients aged over 20 at the time of injury and who had undergone surgical intervention for ZCF using either the swinging eyelid approach or subciliary approach.

The swinging eyelid approach and subciliary approach were performed by the previously reported methods.¹⁰⁻¹² The swinging eyelid approach reached the inferior orbital rim through the retroseptal plane after conjunctival incision and 1.5 cm lateral canthotomy, whereas the subciliary approach reached it through the preseptal plane after skin incision (Fig. 2). The periosteum was incised 2 mm caudal to the inferior orbital rim in both approaches. Also, the ORL was released along the inferior orbital rim at the time of periosteal incision in both approaches, and the zygomatic process of the maxilla was sufficiently exposed to reveal the fracture site. After reduction, the bone was fixed with absorbable plates (Lactosorb, Medical U & A Co., Ltd. Osaka, Japan). The inferior orbital rim was fixed in all cases, whereas fixation of the zygomaticofrontal suture and zygomaticomaxillary buttress were performed depending on each individual case. The orbital rim periosteum was then interruptedly sutured with 5-0 PDS (Johnson & Johnson KK, Tokyo, Japan). No reconstruction of the orbital septum or ORL was performed.

The presence of a lower eyelid bulge on the nonfractured side was evaluated by frontal photograph 6 months after the operation. In cases with a lower eyelid bulge on the nonfractured side, the degree of loss of the lower lid bulge on the fractured side was classified as either “none,” “mild,” or “severe” (Fig. 3). When asymmetry was not evident, the case was defined as “none.” “Mild asymmetry” was defined as that when the difference in the palpebromalar groove and tear trough was inconspicuous but perceptible on close inspection. “Severe” was defined as asymmetry of lower eyelid bulge that was visible without

Takeaways

Question: Is there loss of the lower eyelid bulge after treatment of a zygomatic complex fracture by a swinging eyelid or subciliary approach?

Findings: Lower eyelid bulges were lost in all cases, all of whom were over 50 years old, with approximately half being mild and half severe degree of loss.

Meaning: There is a high risk of loss of lower eyelid bulge regardless of the swinging eyelid approach or subciliary approach in patients over 50 years old.

effort. Furthermore, regarding bone reduction, based on computed tomographic (CT) images 6 months after surgery, the displacement of the frontal zygomatic suture and the infraorbital margin was evaluated.¹³ The examination of postoperative photographs was performed by two plastic surgeons.

Continuous variables were presented as the mean ± SD. In statistical analysis, normality was assessed by the Kolmogorov–Smirnov test, and nonparametric tests for assessment of the significance of difference were the Fisher exact test and Mann–Whitney U test. A *P* value less than 0.05 was considered statistically significant. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan).¹⁴

RESULTS

The swinging eyelid approach was performed for 33 patients, whereas the subciliary approach was performed for eight patients for zygomaticomaxillary complex (ZMC) fracture reconstruction. In all cases, the displacement of the frontal zygomatic suture and the infraorbital margin was 0.26 ± 0.53 mm.

Lower eyelid bulge was present on the nonfractured side in 19 of 41 patients, all of whom were over 50 years old (Table 1). There was no significant relation between

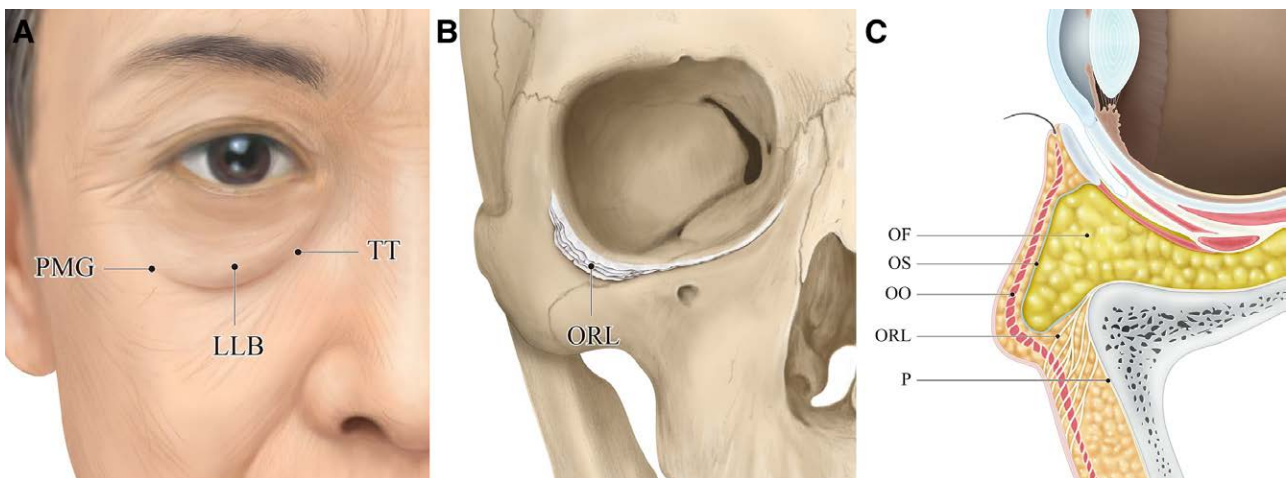


Fig. 1. Lower eyelid bulge anatomy. A, Lower border of lower eyelid bulge, called palpebromalar groove, laterally and tear trough medially. B, Anteroposterior view demonstrating the orbicularis retaining ligament. C, Sagittal diagram of the lower lid bulge. LLB, lower eyelid bulge; OF, orbital fat; OO, orbicularis oculi; OS, orbital septum; P, periosteum; PMG, palpebromalar groove; TT, tear trough.

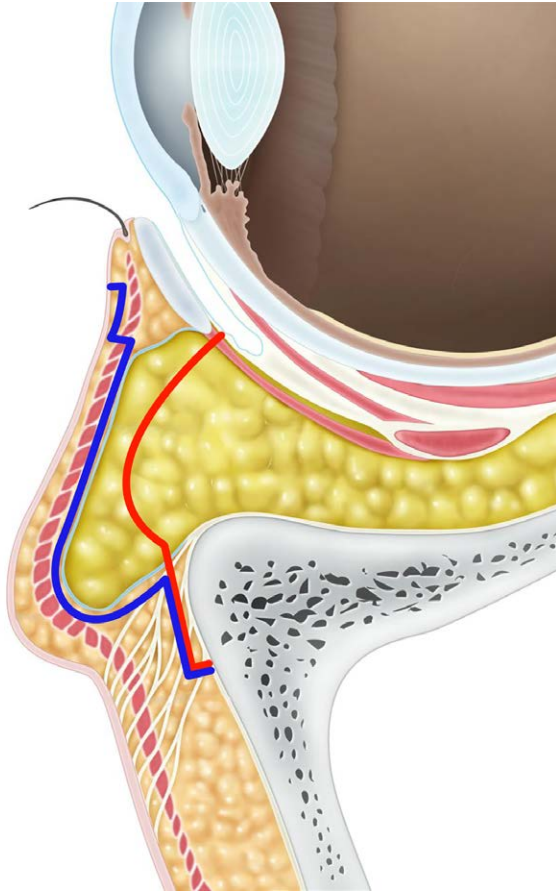


Fig. 2. Diagrams of the dissection planes entailed in both the swinging eyelid approach (red) and subciliary approach (blue) to the zygomatic bone.

gender and the presence of lower eyelid bulge on the non-fractured side.

Lower eyelid bulge was observed on the nonfractured side in 15 patients that underwent the swinging eyelid approach, and four patients that underwent the subciliary approach. Loss of the lower eyelid bulge on the affected side was observed in all patients (Table 2); no cases corresponded to the degree of “none.” The degree of loss of lower eyelid bulge was mild in six patients who underwent the swinging eyelid approach and severe in nine patients; it was mild in two patients who underwent the subciliary approach and severe in two patients. The degree of loss was therefore not significantly different between the swinging eyelid and the subciliary approaches. (See figure, Supplemental Digital Content 1, which shows a swinging eyelid approach in a 55-year-old woman, <http://links.lww.com/PRSGO/C72>.) (See figure, Supplemental Digital Content 2, which shows a swinging eyelid approach in a 64-year-old woman, <http://links.lww.com/PRSGO/C73>.) (See figure, Supplemental Digital Content 3, which shows a subciliary approach in a 54-year-old woman, <http://links.lww.com/PRSGO/C74>.) (See figure, Supplemental Digital Content 4, which shows a subciliary approach in a 72-year-old man, <http://links.lww.com/PRSGO/C75>.)

DISCUSSION

Postoperative evaluation of ZMC has been limited to studies that examined changes in soft tissue of the cheek by CT and reports on nasojugal grooves^{15,16}; there have been no reports on lower eyelid bulge. Bone reduction is important, but it is also important not to damage soft tissues. This is, therefore, the first report on facial symmetry

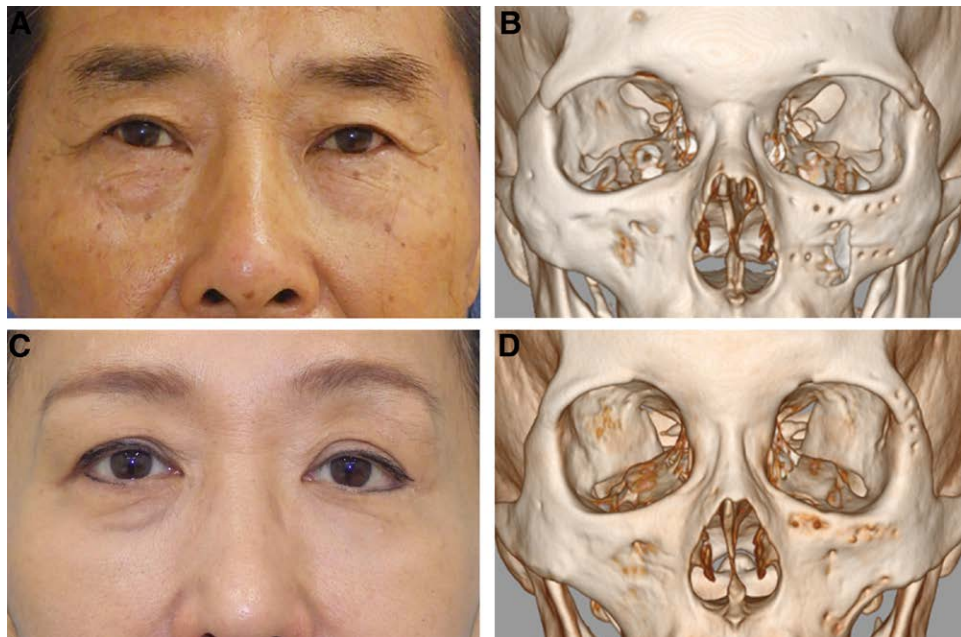


Fig. 3. Grading of lower lid bulge in the lower eyelid after zygomatic body fracture reconstruction of the left eyelid. A, Mild: the difference of the palpebromalar groove and tear trough was perceptible upon close inspection. B, Postoperative CT image. Reduction is good. C, Severe: the asymmetry was visible without effort. D, Postoperative CT image. Reduction is good.

Table 1. Statistical Relations between Age, Gender, Surgical Approach, and the Presence of Lower Eyelid Bulge at Nonfractured Side

	Lower Eyelid Bulge + (n = 19)	Lower Eyelid Bulge - (n = 22)	Total (n = 41)	P
Age, y				
<50	0	8	8	0.004*
>50	19	14	33	
Gender				
Male	10	12	22	1†
Female	9	10	19	
Approach				
Swinging eyelid	15	18	33	1†
Subciliary	4	4	8	

Lower lid bulge +: the presence of lower eyelid bulge on the nonfractured side.

Lower lid bulge -: the absence of lower eyelid bulge on the nonfractured side.

*Statistical significance using the Fisher exact test.

†No statistical significance using the Fisher exact test.

Table 2. Characteristics of Patients with Lower Eyelid Bulge at Nonfractured Side and Degree of Loss of Lower Eyelid Bulge at Fractured Side

	ZCF		P
	Swinging Eyelid	Subciliary	
Lower eyelid bulge at nonfractured side, No	15	4	0.27*
Age, y	63(55-75)	70(54-80)	
Gender, female/male	8/7	3/1	0.582†
Complications (entropion, ectropion, scleral show)	0	0	
Loss of lower eyelid bulge at fractured side, no	15	4	
Degree			
None	0	0	1†
Mild	6	2	
Severe	9	2	

*No statistical significance using the Mann-Whitney U test.

†No statistical significance using the Fisher exact test.

in patients with ZMC with a focus on postoperative lower eyelid bulge.

For the approach to ZCF at our institution, the swinging eyelid approach (which does not require lateral eyebrow incision) is selected in cases where preoperative CT shows zygomaticofrontal suture displacement, and bone fixation of the zygomaticofrontal suture is required. The subciliary approach is used in all other cases where it is judged that the fixation is not necessary. The swinging eyelid approach reaches the periosteum by the retroseptal plane and the subciliary approach by the preseptal plane.¹⁰ There is no consensus on whether the best position to incise periosteum in the retroseptal plane is caudal or posterior to the inferior orbital rim, but the periosteal incision should be caudal to the inferior orbital rim in the preseptal plane to prevent herniation of the periorbital fat.^{10,17}

The ORL originating from the periosteum is localized at the junction of the periosteum and the orbital septum,¹⁸ so the ORL is inevitably released when the periosteum is incised 2 mm caudal to the inferior orbital rim. In all cases in the current cohort, the periosteum was incised 2 mm caudal to the inferior orbital rim, and there was loss of lower eyelid bulge in addition to palpebromalar groove and tear trough. As a countermeasure, if the periosteum is incised posterior to the inferior orbital rim using the swinging eyelid approach and enters under the periosteum, the ORL is preserved and loss of the lower eyelid bulge can be avoided.⁸ The effect may be limited, however,

because there may be septal reset-like effect when the scar is scarred on the arcus marginalis. For a similar reason, we do not recommend reattachment of the orbital septum and ORL.

Other causes of lower eyelid bulge loss include atrophy of orbital fat and skin and subcutaneous tissues of the infra orbital region due to trauma, surgical procedures causing blood flow insufficiency and scarring,⁷ and the effect of augmentation of the plate itself. According to a report by Rahbin et al,⁸ no loss of lower eyelid bulge was observed in patients who underwent conservative treatment for orbital floor fractures. On the other hand, in the surgery group, loss of lower eyelid bulge was observed in all cases. Therefore, even in the case of zygomatic fracture, the effect of strong trauma itself is limited if good bone reduction is performed, and it is considered that the effect of surgery is large. We use absorbable plates that do not require plate removal, but they may exacerbate scar formation around the arcus marginalis compared with titanium plates, and they promote a septum reset-like effect. Septum reset is a procedure to reposition the orbital septum in front of the maxilla,⁶ and it is highly possible that a similar phenomenon could be caused by scarring. It is difficult to narrow down to one cause, however, and we suggest that further imaging inspection is necessary. We suggest that the cases in which the ORL was reattached due to postoperative scarring or mild septal reset were of mild loss and the cases in which the ORL was not reattached, those in which septal reset was severe, and those

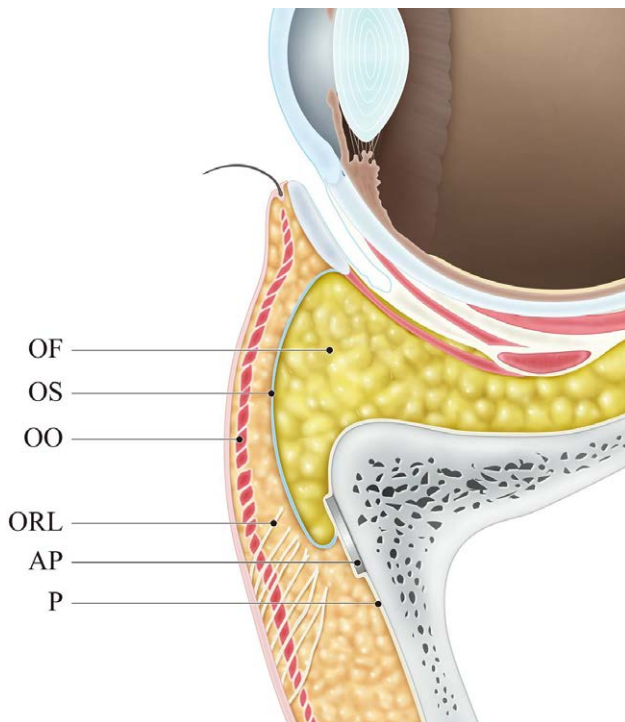


Fig. 4. Cases in which the orbicularis retaining ligament is not reattached and fat atrophy or downward movement of orbital fat (septal reset-like effect) occurs are considered to have “severe loss.” AP, absorbable plate; OF, orbital fat; OO, orbicularis oculi; OS, orbital septum; P, periosteum.

that had fat atrophy and downward movement of orbital fat, were of severe loss (Fig. 4).

There is clearly a risk of loss of lower eyelid bulge regardless of the preseptal or retroseptal approach. To avoid invasion of the lower eyelid, if possible, surgeons should consider treating ZCF only from an intraoral incision.^{13,19} According to Knight and North classification, in groups 3–5, the displacement of the zygomaticofrontal suture is within 5 mm, and if it is within 1 week after the injury, it can be treated only from the oral cavity.¹³ Alternatively, loss of lower eyelid bulge is a cosmetologically favorable change. If patients complain of postoperative laterality, another option is to propose a corrective technique on the healthy side.

In this study, postoperative facial asymmetry was not obtained in patients with ZCF in whom the approach was made through the lower eyelid. Although the evaluation period of this study was 6 months, Sanjuan et al⁷ reported flattening of the eyelid fat in the long-term postoperative evaluation of orbital floor fractures, so we plan to perform long-term follow-up in the future. It is also necessary to compare the affected eyelid before the injury with the affected eyelid after the injury. Furthermore, patient satisfaction is also an important factor, and will be evaluated in future studies. For ZCF, there is a tendency to focus on reduction and fixation, but craniomaxillofacial surgeons should treat facial fractures with due consideration of the soft tissues of the face.

CONCLUSIONS

In surgery for ZCF, lower eyelid bulge was lost in both the swinging eyelid approach and the subciliary approach in patients over 50 years old. ORL release and septal reset seem to be the main causes, but further research is needed.

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