

Ectropion Following Subciliary and Subtarsal (Lower Eyelid) Surgical Incisions: A Cross-Sectional Investigation

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Abstract

Background and objectives: This study evaluated the incidence of ectropion in two methods, the subciliary and subtarsal (lower eyelid), to assess the floor and rim of the orbit.

Materials and methods: In this cross-sectional study, 40 patients referred to university and private hospitals in Babol city from 2011 to 2024 with trauma to the zygomaticomaxillary complex and orbital floor who underwent lower eyelid (subtarsal) and subciliary incisions to access the lower rim and floor of the eye were selected. Chi-square and independent t-test were used to compare outcomes between groups with a significance level of P -value < 0.05 .

Results: The subciliary technique was used for half of the patients (20 patients), and the subtarsal technique was used for the other patients. The occurrence or absence of ectropion in the patients was examined, and if present, its grade was recorded. The results showed that the ectropion occurred in 1 case (5.0%) of the lower eyelid group and in 2 cases (10.0%) of the subciliary group. No significant relationship was observed between the incidence of ectropion and the type of surgical incision ($P = 0.548$).

Conclusion: This study indicates that the incidence of ectropion has been generally low, and no statistically significant difference was observed between the subciliary and lower eyelid approaches.

Keywords: Ectropion, Floor fractures, Lower eyelid, Subciliary.

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1. Introduction

Orbital fractures, particularly those involving the orbital floor and infraorbital rim, account for 30 - 40% of facial fractures. (1). These injuries may occur separately or as part of other facial fractures, and mostly in the zygomaticomaxillary complex (ZMC). Assaults, motor vehicle accidents, occupational injuries, or sports-related incidents may cause physical injury, including trauma to the ZMC (2). While orbital fractures rarely cause direct eyelid deformities, surgical repair can lead to complications, including lower eyelid malposition, with reported rates of contour changes ranging from 5-30% (3). Lower eyelid malposition, including ectropion and entropion, may result from surgical approaches such as subciliary or subtarsal incisions (4).

The subciliary incision, introduced by Converse in 1944, is incision made a few millimeters below and parallel to the lash line, extending medially from the punctum to 15 mm beyond the lateral canthus (5). The subtarsal (lower eyelid) incision, popularized by Converse in 1981, is placed along the inferior edge of the tarsal plate within the subtarsal fold, approximately 5-7 mm below the eyelid margin if edema obscures the fold (6). Each approach has distinct advantages and disadvantages, which may influence their suitability based on patient condition and fracture severity (7).

Vertical shortening of the lower eyelid may occur due to scar contraction between the tarsal plate and periosteum, leading to orbital septum shortening. This complication can be mitigated by providing temporary superior support to the lower eyelid post-surgery, such as through the Frost suture

technique (8). The Frost suture, described by Albert Frost in 1934, supports the lower eyelid, reduces edema, and counteracts scar-induced forces, potentially reducing the risk of ectropion (9). However, its limitations include restricted eye opening, inability to apply eye drops, and potential corneal or upper eyelid skin abrasion if improperly placed (10). Ectropion, defined as the eversion of the eyelid margin, is classified as mild (slight ciliary deviation with or without scleral show), moderate (eversion with vertical eyelid shortening and scleral show), or severe (pronounced eversion) (8). Mild to moderate cases often resolve with gentle massage, while severe cases may require surgical correction (8). Ectropion can cause corneal abrasion and chronic tearing, leading to aesthetic and functional concerns (9).

Despite the widespread use of subciliary and subtarsal incisions, limited studies have compared their complications, and existing research often lacks robust design (11,12). Furthermore, while the Frost suture is commonly employed, empirical evidence supporting its efficacy remains insufficient (11,12). The reported incidence of ectropion varies across studies, contributing to reluctance among maxillofacial surgeons to use these approaches due to potential aesthetic and functional complications (13). This study aims to compare the incidence of ectropion following subciliary and subtarsal incisions for orbital floor and rim fracture repair, providing evidence-based guidance for surgeons to select the optimal approach.

2. Materials and Methods

This retrospective cross-sectional study reviewed medical records of patients treated for ZMC fractures involving the orbital floor and infraorbital rim by oral and maxillofacial surgeons at Shahid beheshti hospital in Babol, Iran, from 21 March 2010 to 21 November 2024. Due to changes in hospital archiving systems, records before 2010 were inaccessible. Approximately 40 cases (20 per surgical approach) were available for analysis.

2.1. Inclusion Criteria

Patients who underwent surgery for ZMC fractures caused by physical altercations, motor vehicle accident, motorcycle accident, and falls, with involvement of the infraorbital rim and orbital floor, were included.

2.2. Exclusion Criteria

Patients with a history of periorbital trauma, prior lower eyelid surgery or scarring, pre-existing ectropion, additional periorbital treatments during the study period, wound healing disorders, or those lost to follow-up were excluded. Patients were divided into two groups based on the surgical approach: subciliary or subtarsal. Two experienced oral and maxillofacial surgeons performed the procedures, with one using the subciliary approach and the other the subtarsal approach. Both techniques employed a stepped dissection method, involving initial subcutaneous dissection toward the

rim, followed by muscle incision to create a stepped incision, and subsequent dissection along the orbital septum to the rim. Demographic data, including age and sex, were extracted from medical records. Patients were recalled for follow-up examinations conducted by a maxillofacial surgery assistant.

2.3. Study groups

Ectropion was assessed at least six months post-surgery and graded as follows (14):

- 1) Grade 0: Normal eyelid appearance and function.
- 2) Grade 1: Normal appearance but symptomatic with palpable laxity.
- 3) Grade 2: Scleral show without eyelid eversion.
- 4) Grade 3: Ectropion without lacrimal punctum eversion.
- 5) Grade 4: Severe ectropion with lacrimal punctum eversion relative to the lacrimal lake.
- 6) Grade 5: Ectropion with complications (e.g., conjunctival metaplasia, anterior lamellar retraction, or lacrimal system stenosis).

Surgical scars usually improve within the first 3 to 6 months. If the scar remains thick, red or elevated after this period, it is considered abnormal.

2.3. Statistical analysis

Data were analyzed using SPSS version 22. Descriptive statistics were presented in tables and charts. Chi-square and independent t-test were used to compare outcomes between groups, with a significance level of P -value < 0.05 .

3. Results

This study evaluated the incidence of ectropion following subciliary and subtarsal incisions for orbital floor and rim fracture repair in 40 patients (20 per group). The mean age was 27.13 ± 6.87 years (range: 18 - 43 years). Of the 40 patients, 33 (82.5%) were male, and 7 (17.5%) were female. No significant differences in age or sex distribution were observed between the two groups ($P > 0.05$), indicating comparable demographic characteristics. The overall incidence of ectropion, regardless of incision type, was 7.5% (3 cases). Ectropion was observed in 1 case (5%) in the subtarsal group and 2 cases (10%) in the subciliary group, with no statistically significant association between ectropion incidence and incision type ($P = 0.548$) (Table 1).

No statistically significant difference in ectropion grade was found between the subciliary and subtarsal groups ($P = 0.598$). Grade II ectropion was observed in one patient (50%) in each group, while Grade IV ectropion was reported in one patient (100%) in the subciliary group.

The results showed that there was no significant difference in the presence of scar between the two incisions ($P > 0.05$) (Table 2).

4. Discussion

This study is among the first in Iran to compare the incidence

Table 1. Comparison of the incidence of ectropion incidence between subciliary and lower eyelid incisions.

Ectropion Incidence	Type of surgical incision		P-value*
	lower eyelid frequencies(percentage)	subciliary frequencies(percentage)	
No	19(95.0)	18(90.0)	0.548
Yes	1(5.0)	2(10.0)	

*Using the chi-square and Fisher's exact test.

Table 2: Comparison of clinical variables between subciliary and lower eyelid incisions.

Ectropion Incidence	Type of surgical incision		P-value*
	lower eyelid frequencies(percentage)	subciliary frequencies(percentage)	
No	17(85.0)	18(90.0)	0.633
Yes	3(15.0)	2(10.0)	

*Using the chi-square and Fisher's exact test.

of ectropion following subciliary and sub tarsal incisions for orbital fracture repair. Studies conducted in other countries have reported varying outcomes when comparing the sub tarsal approaches. The key finding is that the sub tarsal incision was associated with a lower incidence of ectropion (4.51%) compared to the subciliary incision (6.48%), although the difference was not statistically significant ($P = 0.598$).

These results align with previous studies suggesting that the sub tarsal approach may yield better aesthetic outcomes and improve patient satisfaction. A meta-analysis by Ridgway et al. reported ectropion rates of 14% for subciliary and 3.8% for sub tarsal incisions (15). Similarly, Manzar et al. found a lower, though not statistically significant, ectropion incidence with the sub tarsal approach (16). Mohamed et al. also found the sub tarsal incision as minimally invasive, providing adequate exposure with minimal postoperative complications (17). These findings are consistent with studies by Mahajan et al. and Haghighat et al. who support the sub tarsal approach in reducing ectropion incidence (18,19).

However, conflicting results exist. For example, Crosara et al. reported a 0% ectropion rate with subciliary incisions and 18% with sub tarsal incisions, (20) while Al-Moraissi et al. found no difference between the two approaches (21). Kumar et al. reported significantly lower ectropion rates with the sub tarsal approach (13). The lack of statistical significance in our study may be attributed to the small sample size, as a larger cohort could potentially reveal significant differences. The overall ectropion incidence in this study (7.5%) is comparable to previous reports, which range from 2.5% to 7.4% (15,16). However, according to De Riu et al. and Salgarelli et al., lower eyelid deformities such as ectropion and entropion are the most common complications following orbital floor surgeries, with reported incidence rates ranging from 0% to 42%, making our results reliable (22,23). Factors such as dissection technique, timing of ectropion assessment after surgery, and Frost suture use, may explain these

variations.

Several factors may explain the lower incidence of ectropion in our study. First, the stepped dissection technique was used in this study. Initially, a skin-only flap was raised, followed by a composite flap including skin and the orbicularis oculi muscle below the tarsus. This method preserves the pre-tarsal portion of the orbicularis oculi muscle fibers, preventing vertical eyelid shortening, scleral show, and ectropion (24). Secondly, Frost sutures were not used in the sub tarsal group, yet ectropion incidence remained lower, suggesting that this technique may not be essential for ectropion prevention, as supported by some studies (25). However, Frost sutures are associated with limitations, including restricted eye movement, decreased vision, inability to apply eye drops, and stress due to the suture itself (10,26). Both subciliary and sub tarsal incisions meet the visual and functional requirements of orbital trauma surgery but differ in technical simplicity, operative time, and cosmetic outcomes (17). The sub tarsal approach is often recommended for its lower ectropion risk, but the choice of incision ultimately depends on the surgeon's preference and required exposure (27).

The rationale behind this study was to evaluate the difference in ectropion frequency between sub tarsal and subciliary incisions for accessing the orbital rim and floor, given the heterogeneity in the reported incidence rates. Notably, no previous studies have assessed the frequency of ectropion in this context. Our findings may contribute to the recommendation of a better surgical approach that ensures aesthetic results while reducing the incidence of ectropion.

Given the potential complications associated with fractures of the infraorbital rim and orbital floor, timely diagnosis and appropriate treatment planning are crucial in minimizing complications. In managing facial fractures, especially orbital trauma, surgeons must not only aim for cosmetic restoration but also focus on functional recovery of the involved structures, particularly the eye, to maintain proper vision and ocular performance.

5. Limitations

In an ideal setting, all surgeries would have been performed by the same surgeon. One limitation of our study is that variations in surgeon experience may have influenced outcomes. Although strict inclusion and exclusion criteria were applied to ensure comparability between incision groups, the influence of individual anatomical variations cannot be excluded. Additionally, we did not evaluate other postoperative complications or aesthetic outcomes between the two approaches, which we recommend as areas for future research.

6. Conclusion

This study demonstrates that the overall incidence of ectropion is relatively low. No statistically significant difference was observed between the subciliary and subtarsal approaches in terms of ectropion occurrence.

Acknowledgements

Data supporting the findings of this study are available on request from the corresponding author. Data are not publicly available due to privacy or ethical restrictions.

Ethics

Informed consent was obtained, and patients could withdraw from the study at any time. Data were kept confidential, and the study was approved by the Ethics Committee of Babol University of Medical Sciences. (IR.MUBABOL.REC.1403.076).

Using artificial intelligence (AI)

It is declared by the authors of this manuscript that no generative artificial intelligence (AI) or AI-assisted technologies were used to generate content, ideas, or theories during the writing process of this work.

Author contributions

Moein Jamshidi: Conceptualization, Methodology, Investigation, Data curation, Writing - Original draft, Project administration

Ramin Foroughi: Conceptualization, Methodology, Validation, Resources, Writing - Review & editing, Supervision

Hemmat Qolinia Ahangar: Methodology, Software, Formal analysis, Data curation, Writing - Review & editing

Conflict of interest

The authors declare no conflicts of interest.

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