

Post-Operative Lower Eyelid Massage Versus Standard Care for Prevention of the Lower Eyelid Scar Contracture after Subciliary Approach in Traumatic Facial Fracture Repair: A Randomized Controlled Trial

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Background: Subciliary incision, a common technique for traumatic facial repair, associates with lower eyelid scar contracture and malpositioning. Despite proposed management techniques like eyelid massage, the efficacy of post-operative massage remains unexplored in preventing and treating these issues.

Objective: To assess the effectiveness of lower eyelid massage in preventing lower eyelid scar contracture and malposition following the subciliary approach for traumatic facial repair, compared to standard care without massage.

Materials and Methods: A randomized controlled trial enrolled patients with traumatic facial fractures slated for subciliary approach repair. Patients were randomly allocated to the lower eyelid massage as the experimental group or standard care as the control group. The massage group received post-operative instructions. Data on demographics, injury profiles, lower eyelid scar contracture as graded by the grading of lower eyelid scar contracture (GLESCO) criteria, eyelid malpositioning, comfort scores, and complications were gathered over a 6-month follow-up.

Results: The present study included 59 patients, with 30 in the massage group and 29 in the control group. There were no significant differences in demographic characteristics, injury profiles, or complications between the two groups. Post-operative assessments revealed the massage group exhibited a trend towards lower GLESCO grades with an average decrease of 0.72 grade per week (95% CI -1.46 to 0.02, $p=0.058$) and lower eyelid malpositioning grades with an average decrease of 0.49 grade per week (95% CI -1.03 to 0.05, $p=0.073$) compared to the control group. However, there was no significant difference in comfort scores between the two groups with an average difference of 0.18 score per week (95% CI -1.08 to 1.45, $p=0.775$).

Conclusion: Lower eyelid massage demonstrated potential benefits in preventing lower eyelid scar contracture following traumatic facial repair. However, its impact on eyelid malpositioning and comfort scores was not statistically significant in the present study. Further study with larger sample sizes is warranted to validate these findings.

Trial registration: ClinicalTrials.gov, NCT06311318

Keywords: Subciliary incision; Subciliary approach; Lower eyelid massage; Facial fracture; Scar contracture; Eyelid malposition; Ectropion

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Various surgical techniques are utilized for traumatic facial repair, including subciliary, sub tarsal, transconjunctival incisions, and traumatic wound management^(1,2). Since 1990, the subciliary incision

has gained popularity due to its concealed scar, optimal fracture site exposure, and capacity to extend wounds without lateral canthotomy, similar to the transconjunctival approach. However, it still poses complications such as lower eyelid scar contracture for 2.5%, hypertrophic or visible scarring for 0.9% to 3.6%, and lower eyelid malposition for 0.5% to 42% ranging from scleral show at 2.5% to ectropion at 0.5% to 37%⁽¹⁻⁶⁾.

Normal lower eyelid position covers the lower limbus by at least 1 mm. Lower eyelid scar contracture, lower eyelid malposition, and ectropion can all lead to aesthetic problems, dry eye, conjunctivitis, and epiphora^(1,7).

Transconjunctival and extended trans-

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conjunctival incision were developed to avoid the subciliary approach complications⁽²⁾. However, the transconjunctival approach presents additional complications, including entropion and lacrimal canaliculus transaction.

Previous studies have indicated that complications associated with the subciliary approach can be managed conservatively through observation, lower eyelid massage, and steroid injection. However, in some instances, complications persist, necessitating surgical intervention. This escalation in care complexity may induce patient discomfort and potentially result in further consequences^(2,6).

No previous research has investigated the efficacy of post-operative lower eyelid massage in preventing and treating lower eyelid scar contracture and malposition. Additionally, some surgeons omit lower eyelid massage from post-operative care regimens, and consensus guidelines for managing complications following the subciliary approach are lacking in the medical literature.

The authors aimed to investigate the effectiveness of lower eyelid massage in preventing lower eyelid scar contracture and malposition following the subciliary approach in traumatic facial repair, compared to standard care without massage. Both the incidence and severity of complications were assessed. It was anticipated that the study findings would contribute to the development of guidelines for preventing post-operative lower eyelid scar contracture and malposition, thereby enhancing outcomes, reducing complications, and informing future surgical interventions.

The authors developed a preliminary guideline for managing lower eyelid scar contracture and malposition, serving as a pilot guideline. Additionally, they formulated a novel grading system for lower eyelid scar contracture, intended for incorporation as a parameter in patient evaluations.

Materials and Methods

The present study was ethically reviewed and approved by the research ethics committee, Faculty of Medicine, Chiang Mai University, bearing the certificate of approval number 490/2016. Patients diagnosed with zygomatic and Lefort II fractures necessitating infraorbital rim fixation following motorcycle accidents, and presenting without external lower eyelid wounds, were recruited from the plastic surgery unit at Chiang Mai University Hospital, Faculty of Medicine, Chiang Mai University, between November 2016 and November 2019. Informed



Figure 1. Massage technique.

consent was obtained from all participants. Exclusion criteria included pre-existing lower eyelid retraction from previous scar, neurogenic cause, myogenic cause or Graves' disease, incision alteration, communication barriers, inability to perform daily activities or lower eyelid massage of ECOG of 2 or more, PPS Adult Suandok of 60 or less, inability to attend follow-up visits, and patient refusal. Patients were randomly assigned, using concealed block of four randomization, to either the experimental group receiving lower eyelid massage or the control group receiving standard care. While the authors, acting as massage trainers, were unblinded, an independent plastic surgeon, serving as the assessor, remained blinded to the study interventions.

A preliminary review of medical records from Chiang Mai University Hospital was conducted. Subsequently, sample size determination was performed based on two independent proportions, which were 0.95 for good outcome in the massage group versus 0.60 in the non-massage group, with an alpha of 0.05, beta of 0.10, and a 1 to 1 ratio. The calculated minimum sample size was 28 cases per group. Accounting for a 10 percent dropout rate, a sample size of 30 patients per group was adopted. The intended study population comprised 30 patients in each group. Patients in the experimental group received training and guidance from trained investigators regarding post-operative lower eyelid massage.

The massage technique was executed with the patient in a fully open-eyed state, maintaining an upward gaze. The lateral aspect of the distal phalanx of the index finger was employed, exerting pressure on the lower eyelid to bring its margin into contact with the upper eyelid margin for a 10 second duration per repetition. This procedure comprised 10 repetitions per set, administered once hourly, spanning 10 hours daily (Figure 1). The massage instruction was provided either by the authors or plastic surgical residents.

Facial fracture surgery was conducted by

Grading of lower eyelid scar contracture (GLESCO)

Patient in normal neutral gaze, examiner use a finger to push the patient's lower eyelid up to reach upper eyelid, evaluate the lower lid margin compare with cornea

Grade	Description
0	Can push lower eyelid up to 100% of cornea
1	Can push lower eyelid up to 75% of cornea
2	Can push lower eyelid up to 50% of cornea
3	Can push lower eyelid up to 25% of cornea
4	Can push lower eyelid less than 25% of cornea

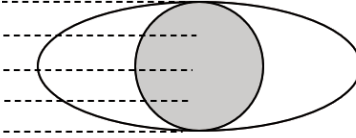


Figure 2. Grading of lower eyelid scar contracture (GLESCO).

experienced plastic surgeons and/or proficient fourth- or fifth-year plastic surgical residents at Chiang Mai University Hospital, utilizing the skin-muscle flap subciliary approach. Cauterization was applied two millimeters from the eyelid margin to control bleeding, followed by closure of the incision using Vicryl 4-0 for periosteum, Vicryl 5-0 for muscle, and Prolene 6-0 for the skin. All patients underwent surgery one week after the injury to mitigate soft tissue swelling, which had subsided by that time.

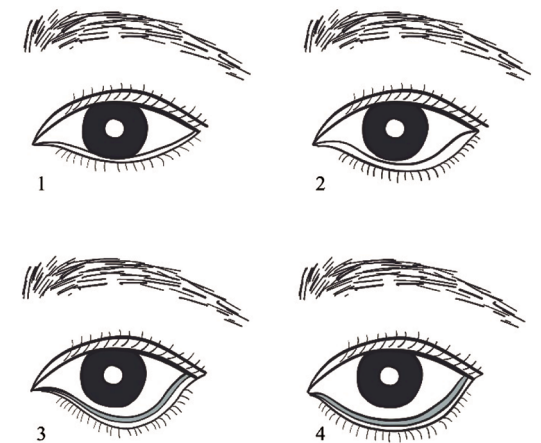
Consistent pre-operative, peri-operative, and post-operative care protocols were administered to both patient groups. Stitches at the subciliary incision site were extracted on post-operative day 5. Patients in the massage group were instructed to commence lower eyelid massage on the day when stitches were removed.

The follow-up assessments occurred at 1-week, 3-week, 6-week, 3-month, and 6-month intervals post-operatively. Evaluation criteria included the grading of lower eyelid scar contracture (GLESCO). This was an anatomical score adapted by the authors (Figure 2), which was not independently validated as it relies on consistent anatomy across patients. Additionally, grading of lower eyelid malpositioning⁽⁸⁾ (Figure 3), comfort scores that represent subjective clinical evaluations by patients, assessing the overall comfort of the eye, including factors like dryness and tightness of the eyelid, rated on a scale of 0 to 10, adapted from POSAS⁽⁹⁾ and Verbal Rating Scale⁽¹⁰⁾, wound infection, dehiscence, eyelid comfort, and management related to the subciliary incision were assessed and documented by the plastic surgeon, which is the author, and plastic surgery resident (Figure 4).

Patients presenting with GLESCO and concurrent clinical symptoms such as dry eye or conjunctivitis were categorized as failed-prevention cases. The treatment protocol for these patients involved intra-

Grading of eyelid malpositioning

Patient in normal neutral gaze, examiner observe position and characteristic of lower eyelid



Grade	Description
0	Normal eye position
1	Lateral rounding of the eye
2	Central sclera show involving limbus
3	Mild eversion of lower lid with tear pooling in inferior cul-de-sac
4	Frank outward eversion of lower lid with exposure of palpebral conjunctiva

Figure 3. Grading of eyelid malpositioning.

Adapted from McGraw BL, et al. Postblepharoplasty ectropion. Prevention and management. Arch Otolaryngol Head Neck Surg 1991;117:852-6

scar steroid injection and release of scar contracture utilizing a needle with hanging suture (Figure 5). In cases where notable improvement was not achieved following these interventions, surgical release of scar contracture was contemplated.

Categorical data were analyzed utilizing Fisher's exact test and subsequently presented in frequency and percentage formats. Continuous data underwent analysis employing Student's t-test and were expressed in terms of mean and standard deviation. Statistical significance was established at a p-value

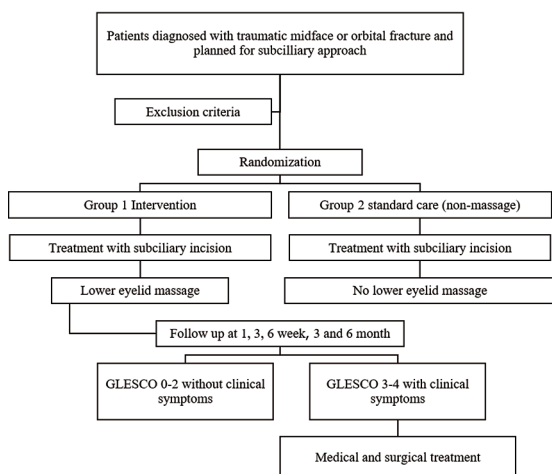


Figure 4. Study follow-up protocol.

less than 0.05. In instances where patients underwent bilateral subciliary incision, the side exhibiting the poorer clinical outcome was selected for analysis. Statistical analyses were conducted using the standard statistical software, Stata Statistical Software, version 16 (StataCorp LLC, College Station, TX, USA). Post-operative assessment encompassing evaluation of GLESCO, grading of lower eyelid malpositioning, and assessment of comfort score at 1-week, 3-week, 6-week, 3-month, and 6-month intervals was conducted utilizing repeated measurement analysis with a mixed model.

Table 1. Patients' characteristic data

Characteristics	Group		p-value
	Massage (n=30)	Non-massage (n=29)	
Age (year); mean [SD]	28.33 [12.37]	26.14 [11.13]	0.477
Sex; n (%)			0.252
Male	19 (63.33)	23 (79.31)	
Female	11 (36.67)	6 (20.69)	
Education degree; n (%)			0.605
Lower than junior high school	4 (13.33)	5 (17.24)	
Junior high school	11 (36.67)	6 (20.69)	
High school	10 (33.33)	13 (44.83)	
Bachelor's degree or higher	5 (16.67)	5 (17.24)	
Duration from injury to operation (day); mean [SD]	12.33 [6.80]	11.27 [7.40]	0.897
Operative time (minutes); mean [SD]	189.67 [95.03]	223.03 [119.57]	0.134
Operation; n (%)			0.601
ORIF with PAS	19 (63.3)	16 (55.2)	
ORIF with PAS with MMF	11 (36.7)	13 (44.8)	
Operative duration (minute); mean [SD]	189.67 [95.03]	223.03 [119.57]	0.223
Duration from injury to operation (day), mean [SD]	12.33 [6.80]	11.27 [7.40]	0.897

ORIF=open reduction with internal fixation; PAS=plate and screw; MMF=mandibulomaxillary fixation; SD=standard deviation

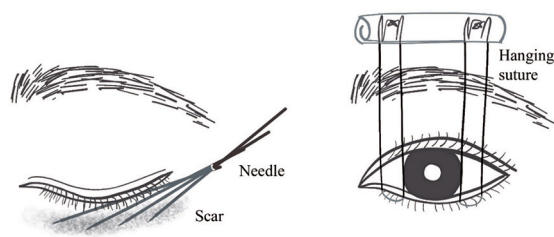


Figure 5. Release scar technique: using needle with hanging suture.

Results

Between November 2016 and November 2019, sixty-four patients were enrolled in the present study, with 32 patients assigned to the intervention or massage group and 32 patients to the control or non-massage group. Among them, five patients were excluded from the analysis due to aggravated comorbid conditions, voluntary withdrawal from the study, remote residency, and inability to adhere to the study protocol-specifically, two cases from the massage group and three cases from the non-massage group. Nonetheless, the overall participant count remained sufficient for the predetermined sample size calculation. The demographic characteristics of the patients, including fracture site, operation, and operative time in each group, are presented in Table 1. Notably, no statistically significant differences were observed between the two groups in terms of severity of facial injury, age, or other health conditions.

Table 2. Post-operative grading of lower eyelid scar contracture and grading of eyelid malpositioning

Outcome	1-week post-operative		3-week post-operative		6-week post-operative		3-month post-operative		6-month post-operative		
	Message (n=27)	Non-message (n=22)	Message (n=23)	Non-message (n=23)	Message (n=11)	Non-message (n=11)	Message (n=10)	Non-message (n=5)	Message (n=10)	Non-message (n=6)	
Grading of lower eyelid scar contracture; n (%)											
Grade 0	11 (40.74)	8 (36.36)	5 (22.73)	1 (4.35)	5 (45.45)	1 (9.09)	9 (90.00)	1 (20.00)	10 (100)	0 (0.00)	0.003
Grade 1	4 (14.81)	2 (9.09)	4 (18.18)	1 (4.35)	1 (9.09)	0 (0.00)	1 (10.00)	0 (0.00)	0 (0.00)	2 (66.67)	
Grade 2	6 (22.22)	5 (22.72)	0 (0.00)	3 (13.04)	0 (0.00)	2 (18.18)	0 (0.00)	1 (20.00)	0 (0.00)	0 (0.00)	
Grade 3	1 (3.70)	1 (4.55)	1 (4.55)	1 (4.35)	4 (36.36)	0 (0.00)	0 (0.00)	1 (20.00)	0 (0.00)	0 (0.00)	
Grade 4	5 (18.52)	6 (27.27)	11 (50.00)	17 (73.91)	1 (9.09)	8 (72.73)	0 (0.00)	2 (40.00)	0 (0.00)	1 (33.33)	
Grading of eyelid malpositioning; n (%)											
Grade 0	16 (59.26)	13 (59.09)	10 (45.45)	3 (13.04)	5 (45.45)	2 (18.18)	7 (70.00)	2 (40.00)	7 (70.00)	1 (33.33)	0.315
Grade 1	6 (22.22)	6 (27.27)	5 (22.73)	7 (30.43)	3 (27.27)	2 (18.18)	1 (10.00)	0 (0.00)	1 (10.00)	1 (33.33)	
Grade 2	5 (18.52)	2 (9.09)	3 (13.64)	6 (26.09)	1 (9.09)	4 (36.36)	2 (20.00)	1 (20.00)	2 (20.00)	1 (33.33)	
Grade 3	0 (0.00)	1 (4.55)	1 (4.55)	1 (4.35)	1 (9.09)	1 (9.09)	0 (0.00)	2 (40.00)	0 (0.00)	0 (0.00)	
Grade 4	0 (0.00)	0 (0.00)	3 (13.64)	6 (26.09)	0 (0.00)	2 (18.18)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	

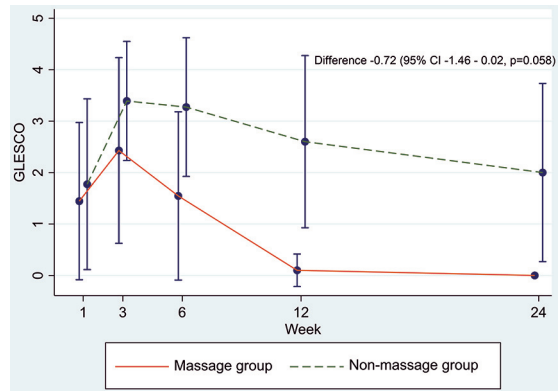


Figure 6. Grading of lower eyelid scar contracture (GLESCO) in message and non-message group.

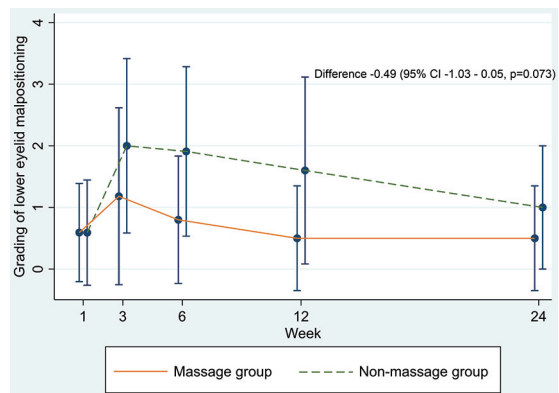


Figure 7. Grading of lower eyelid malpositioning in message and non-message group.

No occurrences of surgical site infection or wound dehiscence were observed in either study cohort. The GLESCO and lower eyelid malpositioning for each group across post-operative follow-up intervals were delineated in Table 2, Figure 6, and Figure 7. Notably, the GLESCO scores in the message group were consistently lower than those in the non-message group at the 6-week, 3-month, and 6-month post-operative assessments, with corresponding p-values of 0.010, 0.003, and 0.003, respectively. Additionally, the comfort scores for each group throughout the post-operative follow-up periods are presented in Table 3 and Figure 8.

Eleven cases were identified as failed-prevention patients, with five cases in the message group and six cases in the non-message group. The proportions of failed-treatment patients in the message and non-message groups were 19.35% and 28.57%, respectively, with a p-value of 0.542. These patients underwent TA injection and scar release using

Table 3. Comfort score per follow-up timing

Post-operative comfort score	Total	Massage group mean (SD)	Non-massage group mean (SD)	p-value
1-week	15	7.00 (2.60)	6.50 (1.64)	0.684
3-week	15	7.86 (0.38)	7.75 (1.58)	0.864
6-week	10	8.60 (0.89)	7.60 (1.14)	0.161
3-month	8	8.60 (1.14)	9.33 (1.16)	0.414
6-month	10	8.38 (1.60)	8.50 (0.71)	0.919

SD=standard deviation

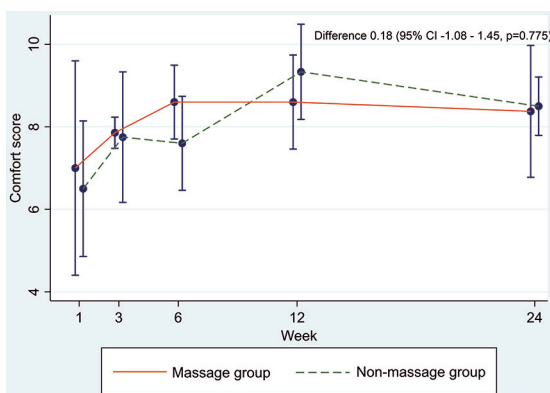


Figure 8. Mean and SD of comfort score in massage and non-massage group.

needle and hanging suture techniques. Following the interventions, GLESCO improved from grade 4 to grade 0 in eight cases (72%), from grade 4 to grade 1 in one case (9%), and from grade 4 to grade 3 in one case where partial contracture occurred and the patient declined further treatment. Additionally, one case was lost to follow-up after treatment.

The GLESCO in the massage group exhibited a significant average decrease of 0.07 grade per week (95% CI -0.11 to -0.03 , $p<0.001$), while in the non-massage group, it decreased by 0.01 grade per week, which was not statistically significant (95% CI -0.06 to 0.06 , $p=0.955$). Furthermore, the massage group demonstrated an average decrease of 0.72 grade per week compared to the non-massage group (95% CI -1.46 to 0.02 , $p=0.058$) (Figure 6).

Regarding the grading of eyelid malpositioning, there was no significant change observed. In the massage group, the grading decreased by an average of 0.02 grade per week but did not reach statistical significance (95% CI -0.05 to 0.02 , $p=0.374$), while in the non-massage group, it increased by 0.02 grade per week, also without statistical significance (95% CI -0.04 to 0.07 , $p=0.535$). Additionally, the massage group displayed an average decrease of 0.49 grade per week compared to the non-massage group (95%

CI -1.03 to 0.05 , $p=0.073$) (Figure 7).

Regarding the comfort score, both the massage and non-massage groups exhibited significant increases, with the massage group showing a rise of 0.06 score per week (95% CI 0.01 to 0.10 , $p=0.024$), and the non-massage group showing a rise of 0.11 score per week (95% CI 0.02 to 0.19 , $p=0.016$). However, the difference between the massage and non-massage groups, with the massage group having an average increase of 0.18 score per week higher than the non-massage group, did not reach statistical significance (95% CI -1.08 to 1.45 , $p=0.775$) (Figure 8).

Discussion

In patients undergoing traumatic facial repair, the subciliary incision has gained popularity since the 1990s due to its advantages, including concealed scarring, excellent exposure of fracture sites, and the ability to extend the wound without necessitating lateral canthotomy, as seen with the transconjunctival approach. However, despite its widespread use, this approach is not without complications. Reported complications associated with the subciliary incision include lower eyelid scar contracture for 2.5%, hypertrophic or visible scarring for 0.9% to 3.6%, and lower eyelid malposition ranging from 0.5% to 42%, which may manifest as scleral show for 2.5% to ectropion for 0.5% to 37%⁽¹⁻⁶⁾.

The development of transconjunctival and extended transconjunctival incisions has provided alternatives with lower incidence rates of certain complications compared to the traditional subciliary approach. These include lower lid malposition/ectropion in 0% to 10% and hypertrophic or visible scarring in 0%, while introducing new complications such as entropion in 0% to 30%, which may necessitate surgical correction in 0% to 4.4% of cases, and lacrimal canaliculus transaction in 1.1%, which may require surgical correction in 1.1% of cases. It is noteworthy that these complications, although less frequent, often necessitate surgical intervention more frequently than complications associated with the subciliary approach. Such considerations should inform the selection of the surgical approach^(1,2,4).

In the present study, the majority of lower eyelid complications were identified at 3-week and 6-week post-operative intervals.

The lower eyelid massage group demonstrated significantly improved GLESCO scores at 6-week, 3-month, and 6-month post-operative intervals. These findings suggest the potential efficacy of

massage techniques in preventing lower eyelid scar contracture. However, no significant differences were observed in the prevention of lower eyelid malpositioning.

The present study encountered limitations with a lower than anticipated number of cases completing the follow-up protocol at 16 (27%). Several factors may have contributed to this, including logistical challenges for patients residing in remote rural areas, the extended duration of the follow-up protocol, and the presence of low to non-troublesome clinical symptoms in some patients. Furthermore, the present study did not assess the negative and positive vectors of lower eyelid support, which could significantly influence the occurrence of ectropion. Patient compliance also served as an uncontrolled and significant confounding factor throughout the study.

Conclusion

Lower eyelid massage demonstrates benefits in preventing lower eyelid scar contracture. Nevertheless, the impact of massage on eyelid malpositioning and comfort scores remain statistically insignificant. Further investigations with larger sample sizes are warranted. However, the authors advocate the incorporation of lower eyelid massage into post-surgical care protocols for all patients.

What is already known on this topic?

The subciliary incision technique is associated with potential complications, including lower eyelid scar contracture and eyelid malpositioning. Studies have proposed various management strategies for addressing these complications, including observation, lower eyelid massage, steroid injection, or surgical intervention⁽¹⁻⁶⁾.

What does this study add?

Patients who were educated and advised to perform post-operative lower eyelid massage exhibited significant improvements in the grading of lower eyelid scar contracture.

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Conflict of interest

The authors declare no conflict of interest pertaining to this study.

References

1. Ridgway EB, Chen C, Colakoglu S, Gautam S, Lee BT. The incidence of lower eyelid malposition after facial fracture repair: a retrospective study and meta-analysis comparing subtarsal, subciliary, and transconjunctival incisions. *Plast Reconstr Surg* 2009;124:1578-86.
2. Ishida K. Evolution of the surgical approach to the orbitozygomatic fracture: From a subciliary to a transconjunctival and to a novel extended transconjunctival approach without skin incisions. *J Plast Reconstr Aesthet Surg* 2016;69:497-505.
3. Patrocinio TG, Loredó BA, Arevalo CE, Patrocinio LG, Patrocinio JA. Complications in blepharoplasty: how to avoid and manage them. *Braz J Otorhinolaryngol* 2011;77:322-7.
4. Girardi GB, Syed MK. Preseptal transconjunctival vs. subciliary approach in treatment of infraorbital rim and floor fractures. *Ann Maxillofac Surg* 2012;2:136-40.
5. Czerwinski M, Martin M, Lee C. Quantitative comparison of open reduction and internal fixation versus the Gillies method in the treatment of orbitozygomatic complex fractures. *Plast Reconstr Surg* 2005;115:1848-54; discussion 55-7.
6. Ellis E 3rd, Perez D. An algorithm for the treatment of isolated zygomatico-orbital fractures. *J Oral Maxillofac Surg* 2014;72:1975-83.
7. Rubin P, Mykula R, Griffiths RW. Ectropion following excision of lower eyelid tumours and full thickness skin graft repair. *Br J Plast Surg* 2005;58:353-60.
8. McGraw BL, Adamson PA. Postblepharoplasty ectropion. Prevention and management. *Arch Otolaryngol Head Neck Surg* 1991;117:852-6.
9. Draaijers LJ, Tempelman FR, Botman YA, Tuinebreijer WE, Middelkoop E, Kreis RW, et al. The patient and observer scar assessment scale: a reliable and feasible tool for scar evaluation. *Plast Reconstr Surg* 2004;113:1960-5; discussion 6-7.
10. Glossary. *Spine* 2000;25:3200-2.