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The Efficacy of Magnesium Sulfate (MgSO4) Wet Dressing in Reducing Eyelid Swelling and Bruising after Blepharoplasty: A Randomized, Controlled, and Observer-Blinded Assessment Study

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Abstract

The purpose of this study was to evaluate the effects of wet dressing with 50% magnesium sulfate ($MgSO_4$) solution on decreasing eyelid swelling and bruising after blepharoplasty. Fifty-eight patients (23 male and 35 female) who underwent bilateral blepharoplasty were enrolled in our randomized clinical trial. One side of the periorbital area (upper and lower eyelids) per patient received a wet dressing with 50% $MgSO_4$ solution randomly, and the other side was cooled with an ice pack from the first postoperative day for two consecutive days (30 minutes per time and twice a day). The eyelid edema and ecchymosis were evaluated and classified using respective graded scales. Degrees of eyelid edema were similar after surgery in both groups ($p > 0.05$) and were significantly decreased with time. Compared with the cooled ones, less swelling was observed in the eyelids treated by $MgSO_4$ wet compress on postoperative day 5 ($p < 0.01$). Both the incidence and area of ecchymosis were lower in the $MgSO_4$ group than those in the cooling group ($p < 0.01$ and $p < 0.05$, respectively). Moreover, the majority of patients (39/58, 67.2%) indicated a preference for $MgSO_4$ wet dressing over ice cooling. $MgSO_4$ wet dressing can be conveniently applied to alleviate eyelid swelling and reduce recovery time after blepharoplasty.

Keywords
- blepharoplasty
- magnesium sulfate
- wet dressing
- eyelid swelling
- ecchymosis

Blepharoplasty is one of the most common aesthetic procedures performed by plastic surgeons, but subsequent postoperative complications such as edema and ecchymosis of the eyelids will result in a battered appearance and are major concerns of patients. Therefore, it is of great importance to restore patients' confidence and self-image to faster the process of postoperative recovery. Many efforts, including cryotherapy (cooling) and intense pulsed light (IPL), have been attempted to minimize hematoma and swelling after eyelid plastic surgery.[1,2] However, the actual results of these

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methods still remain uncertain, and they may cause side effects to patients when used inappropriately.[3]

Magnesium sulfate ($MgSO_4$) is a common medication with a variety of uses in clinical settings, including eclampsia, constipation, and hypomagnesium.[4–6] In ophthalmic surgery, $MgSO_4$, as one of the main components of the compound electrolyte intraocular irrigation solution, is commonly used for intraocular irrigation.[7] It also has the effect of alleviating wound bruise, an off-label but FDA-approved indication.[8] For example, in the nursing practice, wet dressing with 50% $MgSO_4$ solution can be used to treat extravasation and hemorrhage caused by ruptured blood vessels during intravenous infusion.[9,10] The osmolarity of 50% $MgSO_4$ solution is almost seven times higher than that of plasma (2,086 vs. 290 mOsm/L). Differences in osmotic pressures between them can decrease the extent of edema by accelerating the absorption of the interstitial fluid. Moreover, Mg^{2+} ions have an antagonistic effect on voltage-gated Ca^{2+} channels, which can lower capillary blood pressure, vasodilate blood vessels, and reduce exudation further.[8,11,12]

In our present study, we designed a randomized, controlled, and double-blinded trial to investigate the effects of $MgSO_4$ wet compress on reducing edema and ecchymosis after blepharoplasty, aiming to provide more options for patients to minimize postsurgical discomforts and shorten their recovery time.

Participants and Methods

This prospective clinical study was approved by the Ethical Review Board of Shanghai Tenth People's Hospital (No. 2020-0081). From July 2021 to December 2021, 58 adult healthy patients who underwent bilateral blepharoplasty in the Department of Plastic and Reconstructive Surgery of Shanghai Tenth People's Hospital were enrolled in this study and written informed consent was obtained from them before the surgery. All patients had provided written informed consents to participate in this study and publish their case details including images. Exclusion criteria from this study included (1) use of glucocorticoid; (2) with abnormal coagulation function; (3) allergic to $MgSO_4$; and (4) history of previous eyelid surgery.

All the eyelid surgeries were performed under local anesthesia (2% lidocaine with 1:100,000 epinephrine) with the assistance of bipolar coagulation. Pressure dressings were applied around the surgical wound immediately after the operation to prevent bleeding and were changed in the first postoperative morning. Afterward, one side of the periorbital area (including upper and lower eyelids) in all patients was treated with $MgSO_4$ wet dressing and the other side was cooled with an ice pack. The side choice was randomly determined using computer software and kept blinded to the senior authors (Jin Y and Liu G). For the $MgSO_4$ wet dressing group, two layers of sterile cotton gauze were immersed in 50% $MgSO_4$ solution (completely soaked with no drips) and applied to cover the eyelid skin (avoiding the surgical incision) for 30 minutes. The wet compress was performed twice a day for 2 days, and the gauze was kept moist during treatment. For the cooling group, the contralateral side was cooled using an ice pack (10 cm × 8 cm in size) wrapped with sterile gauze for 30 minutes, also two times a day for consecutive 2 days.

Photographs were taken to observe the skin reaction on postsurgical day 1 after $MgSO_4$ treatment and on day 5 after removing the wound stitches. Based on the pictures, the degrees of eyelid swelling and ecchymosis were evaluated separately by two senior authors who were blind to the intervention. As previously described, the extents of edema included 0 = no; 1 = minimal; 2 = extending to the iris; 3 = covering the iris; and 4 = upper and lower eyelids swollen shut (►**Fig. 1**).[13,14] The scales of bruising comprised 0 (no ecchymosis); 1 (ecchymosis area $\leq 2\,cm^2$); 2 ($2\,cm^2 <$ ecchymosis area $\leq 4\,cm^2$); 3 ($4\,cm^2 <$ ecchymosis area $\leq 6\,cm^2$); and 4 (ecchymosis area $> 6\,cm^2$).[15] Furthermore, the patients were asked to make a personal comparison between the feeling and acceptance of $MgSO_4$ wet dressing and cold compress at postoperative day 1 and day 5.

Data were analyzed using SPSS17.0 statistical software package (SPSS Inc., Chicago, IL, USA). Difference in eyelid edema and ecchymosis was compared using Wilcoxon signed rank test and chi-squared test with the significance level defined as $p < 0.05$.

Results

Patients' Demographics

A total of 58 adult healthy patients (23 males and 35 females; average age, 37.8 years; range, 19–79 years) were recruited in this trial. Among them, 34 received upper blepharoplasty, 12 underwent lower blepharoplasty, and 12 had both upper and lower operations. Patient demographics and intervention details are summarized in ►**Table 1**.

Postoperative Edema and Ecchymosis

Before $MgSO_4$ and cooling treatment, the scores of bilateral eyelid edema showed no significant difference (2.33 vs. 2.09, $P > 0.05$). Five days after blepharoplasty, the swelling was more significantly reduced in $MgSO_4$-treated eyelids compared with cooling-treated eyelids (0.33 vs. 1.21, $p < 0.01$; ►**Fig. 2A**). The incidence of periorbital ecchymosis in $MgSO_4$ group (12/58, 20.7%) was less than that in the cooling group (27/58, 46.6%; $p < 0.01$). Although the bruising scores in both groups were 1.0, the ecchymosis area in $MgSO_4$-treated eyelids was dramatically lower than that in cooled eyelids (0.35 vs. $1.21\,cm^2$, $p < 0.05$; ►**Fig. 2B**). Typical cases were shown in ►**Figs. 3**, **4**, and **5**.

Patients' Preference

We recorded patients' perceptions of effectiveness and convenience when using $MgSO_4$ and cooling treatment, respectively. The results showed that no skin irritation occurred and most patients (46/58, 79.4%) indicated the skin reaction of $MgSO_4$ wet dressing was superior or comparable to that of cooling at postoperative day 1. Other patients (12/58, 20.6%) considered cooling superior to $MgSO_4$. On day 5, 39 patients (67.2%) indicated that they preferred $MgSO_4$ wet dressing after blepharoplasty, whereas 12 patients (20.6%) preferred to cool the eyelids. Seven patients showed no specific preference (12.2%).

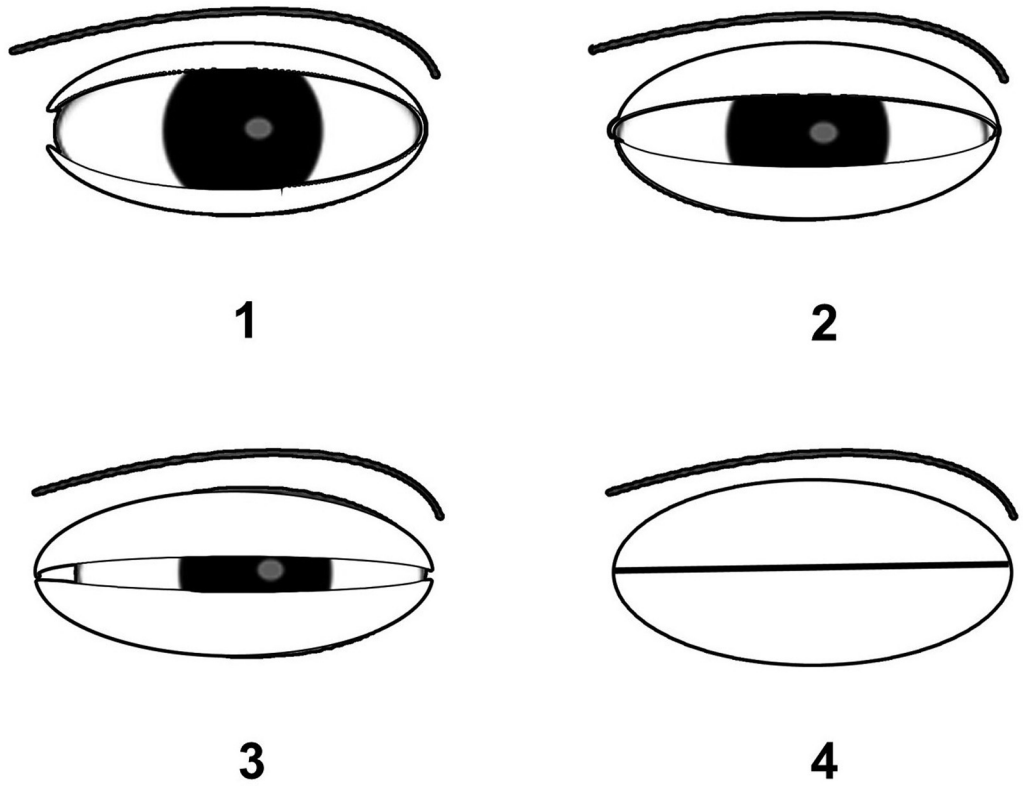

Fig. 1 The 5-point scale for grading postoperative eyelid edema. 0 for no edema; 1, mild swelling; 2, extending to the iris; 3, covering the iris; and 4, the eyelids are totally swollen shut.

Table 1 Baseline characteristics of patients

Characteristics	Patients
	n (%)
Gender	
Male	20 (34.5)
Female	38 (65.5)
Age(years)	
Median(range)	37.8 (19–58)
Type of operation	
Upper blepharoplasty	12 (20.7)
Brow lifting	24 (41.4)
Lower blepharoplasty	12 (20.7)
Multiple surgical procedures	12 (20.7)

Discussion

Postoperative swelling and bruising are major discomforts to patients after blepharoplasty and sometimes even frightening for them. Up to now, cryotherapy (ice compress) has been the most common method used to reduce postoperative swelling, but its effects are sometimes controversial. For example, Pool et al found that except for relieving pain, cooling did not decrease edema, erythema, or hematoma of the eyelids after upper blepharoplasty.[1]

Inspired by the phenomenon that hypertonic $MgSO_4$ solution can treat local swelling caused by intravenous infusion leakage in clinical practice,[9] we applied a wet compress of 50% $MgSO_4$ to manage complications after eyelid plastic surgery in our present study. To our knowledge, this is the first observer-blinded, randomized and side-by-side controlled trial exploring the effects of $MgSO_4$ wet dressing on reducing postoperative swelling and bruising after blepharoplasty. Our results confirmed that using a wet compress of 50% $MgSO_4$ solution can significantly minimize these postoperative complications and contribute to superior outcomes and faster recovery compared with traditional cryotherapy.

Pain and edema almost occur at the same time after surgery, but the effect of alleviating postoperative pain by $MgSO_4$ wet dressing was not included in our present study owing to the following reasons. First, postoperative pain often appears 1 or 2 hours after blepharoplasty and will gradually decrease within 12 to 24 hours thereafter. During this period, the periorbital area is usually bandaged, and it is inconvenient to apply a wet dressing. Second, acute pain after surgery is more frequently managed by analgesics than by nonpharmacological methods in the daily practice of our hospital as well as in the literature.[16]

One major concern in this study design is whether the differences in tissue injury and bleeding between the two eyelids during surgery may influence the development of postoperative edema and ecchymosis. Hatton et al reported the recovery time and bruising area were similar between

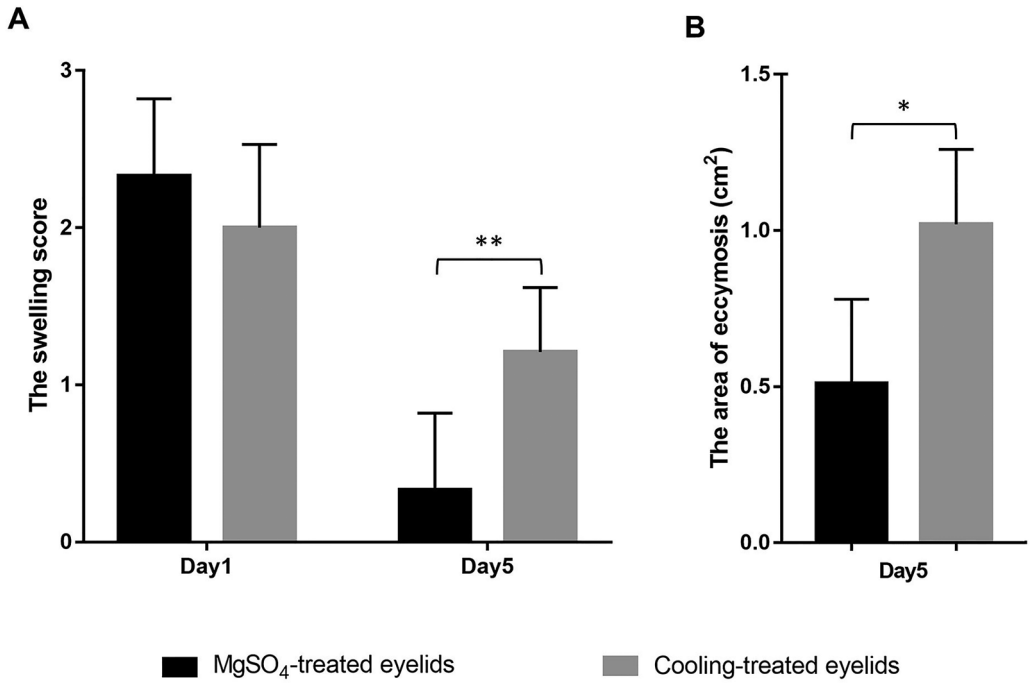

Fig. 2 Evaluation of eyelid edema (**A**) and ecchymosis (**B**) before and after MgSO4 and cooling treatment. Data were expressed as mean ± SD. $^{*}p < 0.05$; $^{**}p < 0.01$.

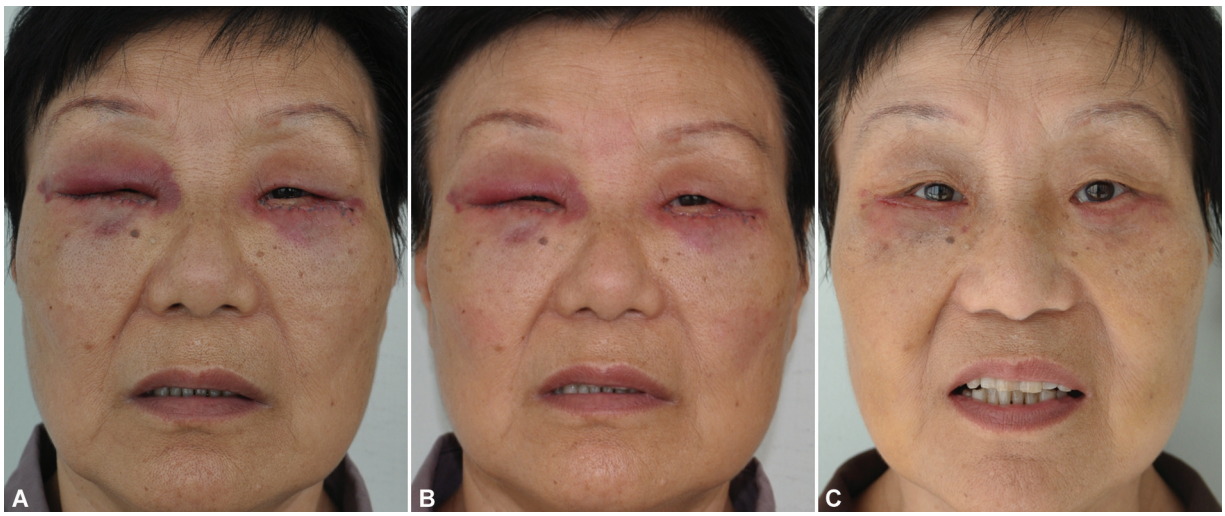

Fig. 3 (**A**) A 49-year-old woman showed the highest edema score (4 points) of the right eyelid at day 1 after lower blepharoplasty. (**B**) The right eyelid received $MgSO_4$ wet dressing treatment for 30 minutes and the edema degree was apparently decreased. The swelling scale of left side was 3 points and showed no obvious change after cooling for 30 minutes. (**C**) On postoperative day 5, edema scores were 1 on both eyelids and no bruising occurred.

both sides after eyelid procedures and advised bilateral blepharoplasty as a good model of observing postsurgical healing.[17] In our present study, we also found no significant difference in the edema degree between both eyelids before starting $MgSO_4$ and cooling treatment. Another drawback of our trial is that photographic assessment was performed only on postoperative day 1 and day 5. As we could not correctly evaluate patients' compliance at home, some patients might have used $MgSO_4$ wet compress and ice cooling strictly while some might have neglected the instructions they were informed of. Therefore, the continuous changes in eyelid edema and ecchymosis were missed during the period between day 2 and day 4. Still, the convenience and efficacy of using $MgSO_4$ treatment made it the preference of most patients (39/58, 67.2%).

A final precaution note is regarding the risks of $MgSO_4$ wet compressing. According to FDA-approved indications, $MgSO_4$ can be safely used to alleviate edema by soaking cuts.[8] Our experience indicates that it will evoke mild-to-moderate irritation when touching the wound directly. We recommend

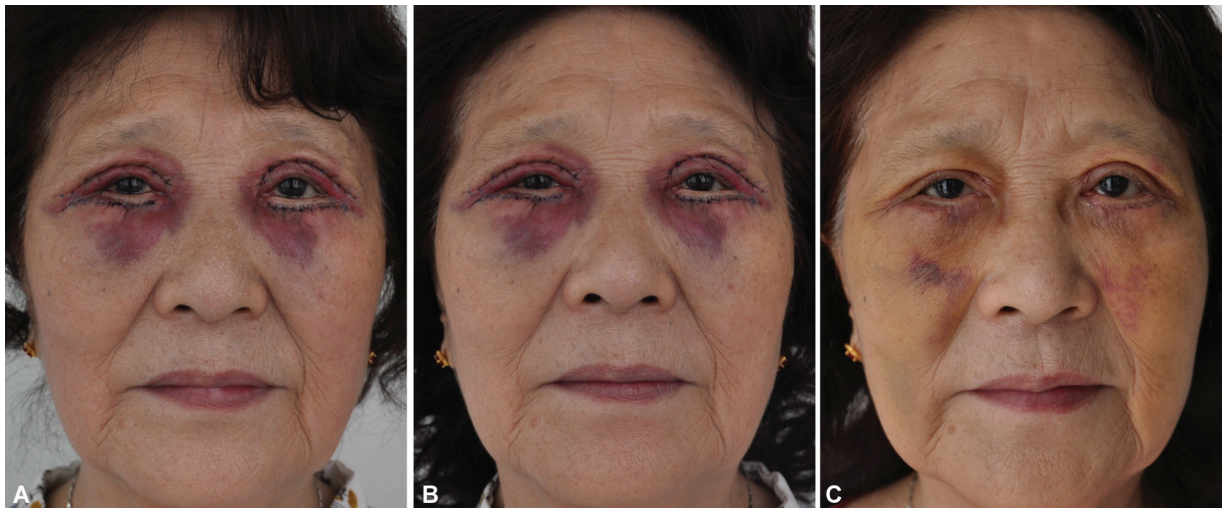

Fig. 4 (**A**) A 79-year-old woman on day 1 after upper and lower blepharoplasty. Both eyelids showed similar edema scores (3 points). (**B**) After $MgSO_4$ wet dressing treatment for 30 minutes, the left eyelid skin was loosened. (**C**) On postoperative day 5, the edema degree was 1 point on the left side and 2 points on the right side (cooling treatment). Ecchymosis of 1.05 cm^2 in area was also found on the right eyelid.

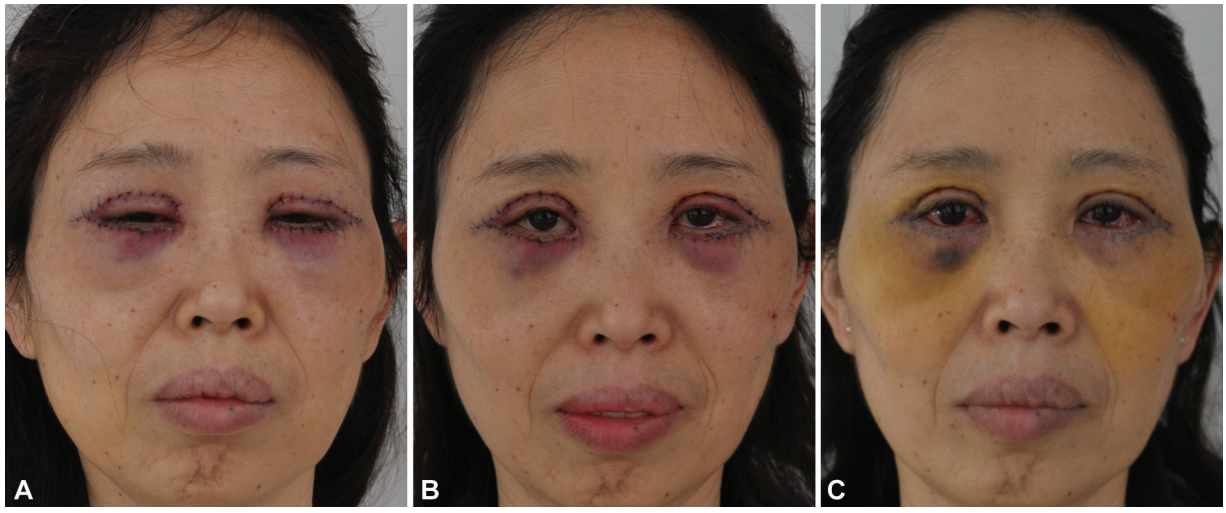

Fig. 5 (A) A 53-year-old woman on day 1 after upper and lower blepharoplasty. Both eyelids showed similar edema scores (3 points). (B) After wet dressing treatment for 30 minutes, the edema degree was decreased on both eyelid. (C) On postoperative day 5, both eyelids showed similar edema scores (2 points). Visible ecchymosis can be observed on the right side.

to apply the wet compressing at least 5 mm from the surgical incision. To prevent the solution from spreading onto the eyes, the gauze is completely $MgSO_4$-soaked but not dripping.

Conclusion

Similar to ice pack cooling, $MgSO_4$ wet dressing is safe and convenient to perform and can serve as an alternative nursing intervention for decreasing postsurgical swelling and shortening recovery time after blepharoplasty. Application of $MgSO_4$ treatment in other surgical or trauma sites is under further investigation in our clinical practice and similar results on reducing postoperative edema are observed (data not shown).

Conflict of Interest
None declared.

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