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RESEARCH ARTICLES

Evaluation of the efficacy and safety of bipolar cauterization of the orbicularis oculi muscle for the purpose of reshaping: A retrospective, controlled, clinical study

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ABSTRACT

Aim: We aimed to compare the aesthetic results and safety profile of bipolar coagulation of muscle during blepharoplasty with those of blepharoplasty with muscle resection.

Materials and Methods: This retrospective study included patients who underwent isolated upper eyelid blepharoplasty. The patients were divided into two groups according to the blepharoplasty technique: patients who had muscle resection (Group A) and patients who had muscle contraction with bipolar cautery (Group B). The data were obtained from patient files and photograph archives. The photographs of the patients were evaluated by two independent plastic surgeons. The Visual Analysis Scale/Score (VAS) was used to evaluate the safety profile, And the Global Aesthetic Improvement Scale (GAI) was used to evaluate the aesthetic results. The scores were compared between the two groups.

Results: The mean VAS scores of Group A were 5.21 for edema, 4.95 for bruising, 0.91 for scar, 0.67 for fold loss, and 0.86 for asymmetry. Same scores for Group B were 5.43 for edema, 4.83 for bruising, 0.87 for scar, 0.63 for fold loss, and 0.79 for asymmetry. The mean GAI scores were 3.82 at 3 months and 3.76 at 12 months for Group A, and 4.19 at 3 months and 4.12 at 12 months for Group B. There was no statistically significant difference between the groups for VAS ($p>0.05$), but there was a statistically significant difference for GAI ($p<0.05$).

Conclusion: We state that in the upper lid blepharoplasty, bipolar cautery coagulation technique could be applied as an alternative to muscle and soft tissue resection.

Keywords: blepharoplasty, bipolar cautery, eye aesthetics, orbicularis oculi muscle, periorbital rejuvenation

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INTRODUCTION

Upper blepharoplasty is the gold standard procedure for the management of dermatochalasis and for restoring youthful contours to the periorbita (1). It is among plastic surgery's most common procedures in the US and ranks third in surveys (2). It might be predicted that the number of blepharoplasty operations performed in today's society, which is trying to prevent the undesirable effects of normal aging, will probably increase in the coming years.

In aged individuals the supratarsal fold tends to degenerate, which can cause elevation of the crease, lid ptosis, and skin laxity of the upper lid (3). During upper lid blepharoplasty, excess skin resection for the purpose of skin laxity treatment is applied to almost every patient today as a gold-standard technique. However, no consensus has yet been reached on the management of herniated muscle and periorbital soft tissue or on the actions that should be taken to replace the palpebral crease (4).

It is obvious that laxity in the upper eyelid soft tissue, which appears as a result of periorbital aging, affects the aesthetic appearance of patients. However, no gold-standard technique for the management of the deformity in question has yet been established.

In this study, we aimed to compare the aesthetic results and safety profile of bipolar coagulation blepharoplasty (BCB) technique, which is based on the principle of coagulating periorbital muscle and soft tissue with bipolar cautery, with those of blepharoplasty with muscle resection (MRB). Additionally, we aimed to share our department's 10 years of experience with the BCB technique.

MATERIALS AND METHODS

Patients who underwent isolated upper eyelid blepharoplasty in our clinic between the years 2013 and 2022 were analyzed retrospectively. Patients who had simultaneous lower eyelid surgery, patients who had additional interventions other than blepharoplasty on the upper eyelid such as brow lift or ptosis correction surgery, patients who previously underwent upper eyelid surgery, patients who were not followed up regularly for at least 1 year, and patients whose photos of the operative period could not be accessed appropriately were excluded from this study.

The patients included in the study were divided into two groups according to the blepharoplasty technique applied: those who had orbicularis oculi muscle resection (MRB) and those who had muscle contraction with bipolar cautery coagulation (BCB). Patients who could not be included in either of these two groups were excluded from the study.

All surgical procedures were performed by the senior author.

Surgical technique

Surgical markings were performed while the patients were sitting. In patients with frontal hyperactivity, drawings were done after blocking the frontal muscle manually. The lower border of the skin excision was marked at least 7 mm above the orbital fissure, with care taken to preserve the upper tarsus. While the patients' eyes were in open and closed positions, the excess skin amount was determined using the pinch technique, and the upper excision border was marked. The surgical marking was designed so that the skin excision did not extend beyond the medial canthus in all the patients. The lateral border was adjusted according to the excess skin amount of the patient. The final scar was designed to remain within the eyelid crease (Figure 1).

The operations were performed under local anesthesia (20mg/ml lidocaine hydrochloride + 0.0125mg/ml epinephrine). The local anesthetic solution was infiltrated under the skin to be excised to provide hydrodissection.

After local infiltration, the starting incision was made with a surgical blade in accordance with the drawings. The skin to be excised within the incision was resected with a scalpel using a technique similar to full-thickness skin graft harvesting. Even if the muscle tissue was unveiled, it was left intact in all patients during the skin resection (Figure 2).

Figure 1. 47 years old, female patient. Surgical markings have been just performed. Excess skin was determined by pinch test. A-) eyes are open. B-) eyes are closed. Patient consent about using the photographs in scientific publications has been obtained

Figure 2. 43 years old, female patient. Intra-operative view of orbicularis oculi muscle. The muscle is completely exposed. Patient consent about using the photographs in scientific publications has been obtained.

In the BCB technique, after exposure of the muscular layer, linear bipolar coagulation was applied on the muscle to create the newly designed eyelid crease line, for the management of excess soft tissue under the skin (Video 1). As a result of coagulation, shrinkage of the orbicularis oculi muscle, the orbital septum, and the fatty tissue below the septum was observed. Due to this shrinkage, the distance between the upper and lower incision edges decreased.

In the MRB group, the excess amount of muscle was resected using scissors (Figure 3). Bipolar cautery was used only for hemostasis in this group, if necessary. After muscular resection, muscle incision lines were sutured with 5-0 vicryl sutures.

In patients deemed necessary, after a 5 mm length incision, only the medial fat pad was excised with the pull-through technique, limited to those patients in both groups for whom fat excision was considered necessary. Fat pads were left intact in all other patients. After bleeding control, the skin was closed using primary 6-0 polypropylene suture.

Sterile strips were applied to upper eyelids at the end of the operation. The patients were discharged with prescriptions for antibiotics and anti-inflammatory treatment. On the 7th day post-op, the sterile strips were opened and the sutures were removed.

All patients were followed up regularly at the first week, second week, first month, third month, sixth month and first year after the operation. During follow-ups, standard photographs were taken (Figure 4, Figure 5).

Figure 3. 41 years old, female patient. Intra-operative view during the resection of orbicularis oculi muscle. Patient consent about using the photographs in scientific publications has been obtained

All patient data were obtained from patient files and photographic archives. Patient photos were evaluated by two independent plastic surgeons who had no knowledge of the groups and patients.

The Visual Analysis Scale/Score (VAS), which is a line marked from 0 to 10 points, was used to evaluate the safety and side effect profile of the surgery (5). Bruising and edema were evaluated in photographs taken on the 7th day post-op to assess early side effects. For the late period side effects, scarring, palpebral asymmetry and fold loss were evaluated in the photographs taken at the 12th month post-op. The scores were compared between the two groups. In addition, other major and minor complications not included in this scale were also noted.

The Global Aesthetic Improvement Scale (GAI) was used to evaluate the aesthetic results (5). According to this scale, the photographs of the patients taken at the third and 12th months were rated by two independent, blinded plastic surgeons. The score range was between

Figure 4. 49 years old, female patient who underwent blepharoplasty with bipolar coagulation of orbicularis oculi muscle A-) pre-operative view of upper eyelids. B-) 12th month post-op view. In post-operative view, upper eyelid fullness and newly designed palpebral creases are seen clearly. Patient consent about using the photographs in scientific publications has been obtained

Figure 5. 52 years old, female patient who underwent blepharoplasty with only skin resection A-) pre-operative view of upper eyelids. B-) 12th month post-op view. Patient consent about using the photographs in scientific publications has been obtained

1 and 5. Details of the scale can be seen in Table 1. The scores were compared between the two groups.

Consent for the use of patient data in scientific studies was taken from all participants of the study. Signed confirmation for the publication of their photographs was taken from the patients whose photographs were used in this paper.

Statistical analysis

The statistical significance of the differences between the mean values was analyzed using SPSS 27.0 (USA) statistical software. An independent sample t test was used to compare the VAS and GAI scores between the groups, and paired t test was used to compare the VAS and GAI score changes for each group between sessions. P values < 0.05 were considered statistically significant.

RESULTS

A total of 322 patients, 237 women and 85 men, were included in this study. The mean age of the patients was 53.68 (min 38-max 74). The mean follow-up duration was 14.5 months (min 12 – max 38). Group A consisted

Table 1. Global Aesthetic Improvement Scale scoring system of groups

Score	Situation	Comment
1	Very much improved	Optimal cosmetic result in this patient
2	Much improved	Marked improvement in appearance from the initial condition, but not completely optimal for this patient
3	Improved	Obvious improvement in appearance from the initial condition, but a small corrective surgery is suggested
4	No change	The appearance is essentially the same as the original condition
5	Worst	The appearance is worse than the original condition

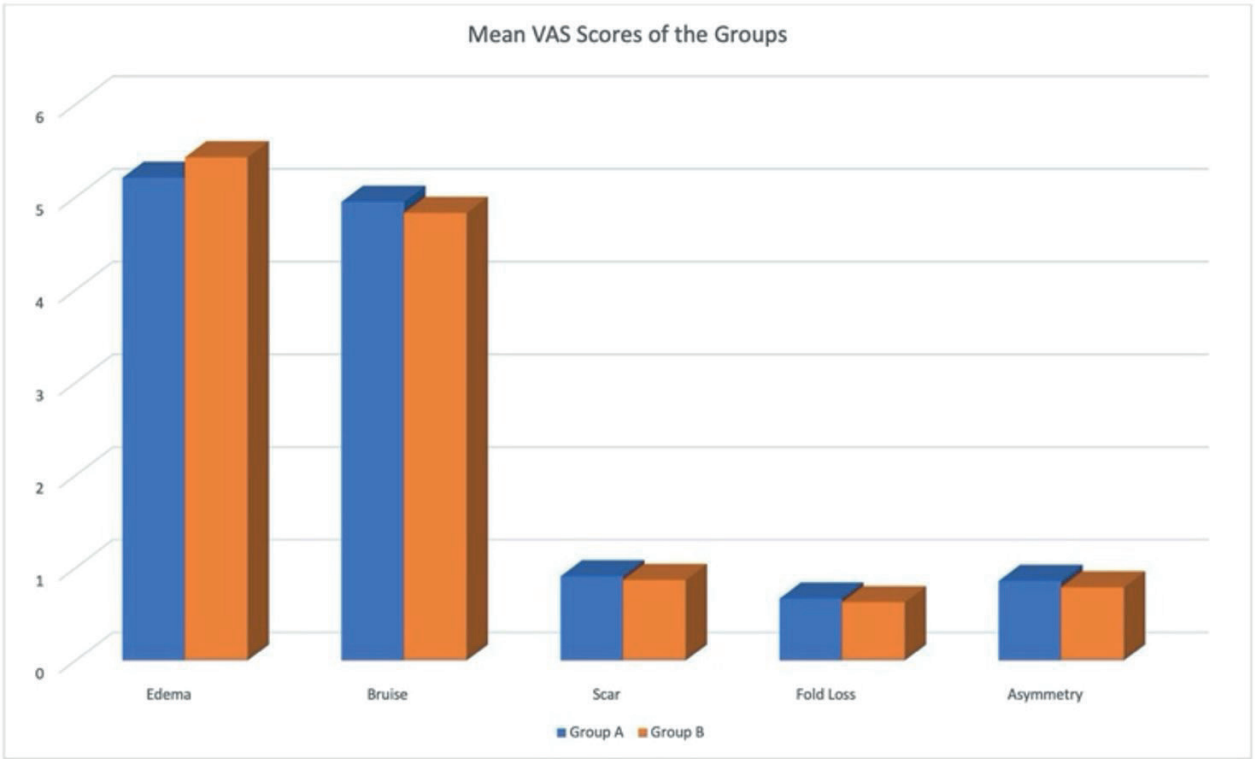

Figure 6. The graphic shows Mean Visual Assessment Scores (VAS) of the groups

of 143 patients who underwent MRB, while Group B consisted of 179 patients who underwent BCB.

The mean VAS scores of Group A were 5.21 (min 1 - max 8) for edema, 4.95 (min 2. - max 7) for bruising, 0.91 (min 0 - max 2) for scar, 0.67 (min 0 – max 3) for fold loss, and 0.86 (min 0 -max 5) for asymmetry. The corresponding scores for Group B were 5.43 (min 2 - max 8) for edema, 4.83 (min 2 - max 8) for bruising, 0.87 (min 0 - max 2) for scar, 0.63 (min 0 - max 2) for fold loss, and 0.79 (min 0 - max 4) for asymmetry (Figure 6). There was no statistically significant difference between the groups for VAS scores ($p>0.05$).

When we analyzed other complications that occurred in the groups, no major complication was observed in any patient in either group. Postoperative prolonged edema (more than 6 weeks) was observed in two patients in Group B and in one patient in Group A. In addition, one patient in Group A had unilateral incomplete closure of the eyelid, which was thought to have developed due to muscle skin removal. However, complete recovery without additional surgical intervention was observed at post-operative 6th week control. There wasn't any complaints about orbicularis oculi functions or dry eye in any patient.

The mean GAI scores were 3.82 (min 3 – max 5) at three months and 3.76 (min 2 - max 5) at 12 months for Group A, and 4.19 (min 3 – max 5) at three months and 4.12 (min 3 – max 5) at 12 months for Group B. When the data obtained were analyzed statistically, it was seen that Group B had superior aesthetic results compared with Group A, at both the third and 12th months ($p<0.05$).

DISCUSSION

The treatment of excess soft tissue in the upper blepharoplasty has not yet been clearly standardized. In recent studies, new techniques are being tried and recommended in this regard. For upper blepharoplasty, it is known that the complication rate and aesthetic results are at an acceptable level, even when one of

the techniques that has been used for many years is applied (6). The search for new techniques is not aimed at reducing complications, but rather at achieving better aesthetic results while preserving the existing physio-anatomy and functions.

Skin excess and laxity are seen in almost every blepharoplasty patient. For this reason, skin resection is a method preferred by nearly all surgeons who perform upper lid blepharoplasty. However, it is impossible to talk about a similar consensus for subcutaneous tissues. The fact that this consensus has not been formed suggests that the ideal method has not yet been defined.

While various authors have suggested the excision of excess muscle and periorbital adipose tissue, some authors have argued that this procedure should not be performed (1,4,7,8). Proponents of resection and excision state that, as a result of these procedures, the crease is regenerated gracefully and the supratarsal definition increases (4), whereas the opposing authors argue that such resection reduces eyelid fullness, which provides a youthful appearance (7). The rationale for performing both muscle and skin resection, or skin resection alone preserving the muscle, remains uncertain (1).

It is known that the amount of periorbital adipose tissue decreases with aging (9). In fact, fat excision during blepharoplasty accelerates this component of aging. However, laxity of the orbicularis oculi muscle and the orbital septum can be considered the cause of prolapsus of the adipose tissue, rather than excess fat (10). For this reason, the desired result can be obtained by preventing laxity in the covering tissues instead of performing fat resection (11).

Muscle resection is a safe and reliable technique in blepharoplasty patients. However, the side effects of coagulation and contraction of muscle with bipolar cautery are not well known. In our study, there was no statistical difference between the two groups, either in the VAS scores for side effects and safety or in the number of other major complications. Consequently, it can be thought that the BCB technique is as reliable as blepharoplasty with muscle resection, which has been used for years.

We have been using BCB technique for about 10 years as a method to treat laxity of the periorbital soft tissue. We have also performed muscle resection on many patients. Our observation over time was that patients who underwent bipolar cautery tightening showed higher aesthetic satisfaction. Therefore, we investigated this retrospectively. The results of our study also showed a statistically significant difference in this regard. Accordingly, we can say that while bipolar coagulation is no different from muscle resection in terms of safety, it is more successful in terms of aesthetic results.

Our purpose in evaluating the third month and 12th month scores of the patients in the study was to compare the short-term and long-term results of blepharoplasty. There was no difference in aesthetic results between the third and 12th months. According to our findings, the effects of contraction achieved with the BCB method continued for at least one year.

In a previous study, only one strip of orbital muscle was resected, and then the orbital septum and soft tissue behind the muscle were coagulated with bipolar cautery (8). In that study, it was reported that the aesthetic results were at a satisfactory level. Nevertheless, the absence of a control group was a limitation of that study. In our study, it was shown that it is possible to treat excess and laxity in the orbicularis muscle with a similar method, without muscle resection. Longitudinal cauterization of the orbicularis muscle in the palpebral crease region results in fibrosis over time, and it strengthens the orbital septum by providing support to it.

The VAS and GAI scales used in our study provide subjective data. However, the reason these scales were preferred in this study is that evaluations made with standardized measurements in eyelid evaluation do not fully reflect the aesthetic result. Therefore using other methods such as questionnaires or photographic evaluations has been recommended to researchers (12).

Muscle resection performed during blepharoplasty does not result in functional problems with blinking, closing eyes, tear production and distribution (13,14). Similarly, none of these complications related to

orbicular muscle function were observed in our direct coagulation method. This may be explained by the fact that the orbicularis muscle is innervated by the facial nerve branches that enter the muscle laterally and are oriented in a horizontal direction. Thus, horizontally directed coagulation does not damage the structural and functional integrity of other muscle fibers and motor units, while only affecting the coagulated muscle fibers.

One of the disadvantages of our study is that, as it was a retrospective study, we didn't have standardized criteria regarding the management of the muscles. However, the senior surgeon applied bipolar cauterization if she needed to reduce the soft tissue amount intraoperatively. If clear standardized criteria for the approach to the muscular layer had existed, our study would have been more scientifically valuable.

Considering the data obtained from our study, it can be thought that the contraction occurring after bipolar coagulation has an effective function in the restructuring of the orbicularis muscle. In addition, bipolar coagulation causes shrinkage of the orbital septum and muscle, resulting in the immediate desired disappearance of bulging. In this context, coagulation with bipolar cautery could be considered as a method that might be applied to patients with muscle laxity and bulging in soft tissue.

In conclusion, we state that in the upper lid blepharoplasty, muscle and soft tissue management with the bipolar cautery coagulation technique could be applied as an alternative to muscle and soft tissue resection in patients with orbital muscle and orbital septum laxity and related soft tissue herniation.

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Ethical approval

This study has been approved by Necmettin Erbakan University Clinic Research Ethical Commitee (approval date 20/09/2024, number 2024/5193). Written informed consent was obtained from the participants.

Author contribution

Surgical and medical practices: MSK, ZKA; Concept: MSK, ZKA; Design: MSK; Datacollection or Processing: MSK; Analysis or Interpretation: MSK, ZKA; Literature Search: MSK; Writing: MSK, ZKA. Aşş authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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