Radiofrequency vs scalpel incision for upper blepharoplasty: A clinicopathologic and photo comparison

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Abstract

Objective: The aim of this study is to compare scar appearance and the histopathological aspects of inflammatory response induced by the use of radiofrequency [RF] incision and a cold-blade scalpel incision in upper blepharoplasty surgery.

Methods: This is a comparative, prospective, double-blind study that recruited 10 Caucasian patients from Oculoplastic Sector of Ophthalmological Center of Minas Gerais (Belo Horizonte, MG, Brazil) aged 60–70 years, Fitzpatrick skin types 3 and 4, with upper eyelid dermatochalasis and indication for upper blepharoplasty. These patients underwent upper blepharoplasty using RF incision in one eyelid (10 eyelids in total) and cold-blade incision in the contralateral eyelid (10 eyelids in total). The two techniques were compared for clinical scar appearance and histopathology of the excised tissue materials (i.e., upper eyelid skin). To evaluate clinical scar appearance, we employed two distinct methods: photo-documentation and statistical analysis of the assessment performed by two masked observers (oculoplastic specialists) that examined all patients during all the follow-up based on Vancouver scar scale criteria, which includes attributes related to scar’s vascularization, thickness, pigmentation, and elasticity. Follow-up was performed on days 7 (upon removal of the sutures), 30, 60, and 180 after surgery. After the follow-up period, the collected data were statistically analyzed by using the Wilcoxon signed-rank test.

Results: The eyelids incised with a scalpel displayed thicker scars (hypertrophic scars), which differed significantly only in the first month after surgery (p = 0.022). The two surgical techniques did not show statistically significant difference in vascularity, elasticity, or pigmentation of the scar during the follow up period (sixth postoperative month). Regarding the histopathological evaluation, the excised skin fragments exhibited the same patterns, except the cautery effect that was observed at the edges of the skin excised with RF, which showed 0.20–0.30-mm thick thermal damage.

Conclusion: The two techniques did not show statistically significant difference in terms of scar appearance after the sixth postoperative month.

Introduction

Cosmetic blepharoplasty of the upper eyelids has long been a mainstay of aesthetic surgeons and remains one of the most requested functional and aesthetic procedures. Multiple incisional modalities have been used over the years, including scalpel, scissors, electro surgery, radio wave surgery, and CO2 laser [1-12]. Although conventional surgery with scalpel and scissors (i.e., cold incision) produces aesthetic results, it applies skin stretching during incision and leads to enhanced bleeding and increased postoperative edema, ecchymosis, and discomfort [3]. By contrast, radio wave surgery (also designated radiofrequency [RF] surgery or radiosurgery), provides a pressure less incision with no dragging or bunching of tissue (concomitant with an enhanced precision of incision), and a simultaneous cutting and coagulation mode maintains a bloodless surgical field, with minor risks of postoperative hematoma. However, it does lead to lateral tissue damage caused by heat production in the tissue1. Surprisingly, only a few studies were found comparing these two incision modalities in the same patient [1,2].
Methods

This was a comparative, prospective, double-blind study that enrolled 10 patients aged 50–70 years with dermatochalasis and indication for upper blepharoplasty. These patients underwent radiosurgery in one upper eyelid and the conventional procedure in the contralateral eyelid. All of the selected patients were women. None of the patients reported any ophthalmologic pathology. Patients with skin diseases, diabetes or coagulation disorders and those taking anticoagulants were not selected. All patients were requested to sign the free informed consent form. All the patients underwent the same surgical steps: local anesthesia with a vasoconstrictor (2.0 mL of neocaine with 2.0 mL of xilocaine), skin incision, resection of the medial portion of the orbicularis muscle, removal of fat pads (the latter only when indicated), and continuous skin stitches by using nylon 8.0 sutures. The only variable introduced was the incision technique, with the use of RF in one eyelid and scalpel and scissors (cold incision) in the contralateral eyelid. This choice was random and known only to the surgeon. The device used for RF was Wavetronic 5000 (Loktal). The parameter used for the skin incisions was the cut mode (80% cut and 20% coagulation). Excision of the orbicular muscle and fat pads was performed by using the blend mode (50% cut and 50% coagulation), with a very fine tungsten tip. The two techniques were compared with respect to clinical scar appearance and histopathology of the excised tissue (i.e. upper eyelid skin). The clinical scar appearance was evaluated by using two methods: photo-documentation, and statistical analysis of the evaluation by two oculoplastic specialists acting as masked observers.

The photo documentation was standardized, and performed by the same person, with the same camera (Canon Rebel T3i), by using an accessory 100-mm macro lens, a folded external Canon Speedlite 430EX flash, and a tripod. The same shooting parameters (Manual MODE, F 9.0, 1/200 ISO 100) were used. The masked observers evaluated the scar by following the Vancouver Scar Scale criteria, which includes attributes related to its vascularization, thickness, pigmentation, and elasticity. Follow-up was performed on days 7 (upon removal of the sutures), 30, 60, and 180 after surgery. The data thus accumulated were statistically analyzed by using the Wilcoxon signed-rank test in the software R. Photographs of the all patients in 30 and 180 postoperative day were printed side by side as shown above (Figures 1,2). The ones marked with a sign correspond to the eyelid that wavetronic was used in the blepharoplasty incision.

Results

The mean and median of the scores registered 30 and 60 Days after Surgery (DAS). Table 1 shows that the eyelids that underwent upper blepharoplasty surgery using scalpel incision displayed propensity to form thicker scars (hypertrophic scars). However, according to the Wilcoxon

| Oculoplastic Observer | Thickness DAS | Wavetronic | Scalpel | p value |
|-----------------------|---------------|------------|---------|---------|
|                       | Mean          | SD         | Median  | Mean    | SD      | Median |         |
| 1                     | 30            | 0.483      | 1.0     | 1.4     | 0.699   | 1.5    | 0.022*  |
| 1                     | 60            | 0.516      | 0.0     | 0.8     | 0.632   | 1.0    | 0.225   |
| 1                     | 180           | 0.3        | 0.483   | 0.0     | 0.4     | 0.516  | 0.0     | 0.789   |
| 2                     | 30            | 0.789      | 1.0     | 1.1     | 0.876   | 1.0    | 0.361   |
| 2                     | 60            | 0.2        | 0.422   | 0.0     | 0.7     | 0.675  | 1.0     | 0.059   |
| 2                     | 180           | 0.0        | 0.0     | 0.2     | 0.422   | 0.0    | 0.371   |

*Significant difference at 5% significance level; DAS: Days After Surgery.
signed-rank test analysis of the observations made by Observer 1, this difference was only significant during the first 30 DAS ($p = 0.022$).

In both surgical techniques, no statistically significant difference was noted in scar vascularization ($p > 0.180$) or pigmentation ($p > 0.100$). Results are presented in tables 2, 3.

Eyelids treated with wavetronic incision demonstrated slightly lower elasticity score; however, this difference was statistically insignificant ($p > 0.100$) Results are shown in table 4.

During histopathological evaluation, the excised skin fragments revealed lymphohistiocytic perivascular and interstitial infiltrate along with mild fibrovascular proliferation, edema, pigmentary incontinence, and bleeding, with no specific elements in the samples. The only histological difference detected between the excised skin fragments from cold-blade and RF incision was the cautery effect at the edges of the skin excised by using RF, which was in the 0.20–0.30 mm thickness range.

### Table 2: Results of the Wilcoxon signed-rank test used to evaluate the significance of the difference in scar vascularization, following upper blepharoplasty surgery using Wavetronic and scalpel.

| Oculoplastic Observer | Vascularization DAS | Wavetronic Mean | SD | Median | Scalpel Mean | SD | Median | p value |
|-----------------------|---------------------|-----------------|----|--------|-------------|----|--------|---------|
| 1                     | 30                  | 1.1 0.738 1.0   | 0.9 0.316 1.0 | 1.0 1.000   |
| 1                     | 60                  | 0.6 0.966 0.0   | 0.5 0.527 0.5 | 0.1 1.000   |
| 1                     | 180                 | 0.1 0.316 0.0   | 0.2 0.422 0.0 | 1.0 1.000   |
| 2                     | 30                  | 0.5 0.527 0.5   | 0.8 0.789 1.0 | 0.1 0.181   |
| 2                     | 60                  | 0.3 0.483 0.0   | 0.5 0.527 0.5 | 0.3 0.371   |
| 2                     | 180                 | 0.1 0.316 0.0   | 0.1 0.316 0.0 | 0.1 0.100   |

**DAS:** Days After Surgery

### Table 3: Results of the Wilcoxon signed-rank test used to evaluate the significance of the difference in scar pigmentation following upper blepharoplasty surgery using Wavetronic and scalpel.

| Oculoplastic Observer | Pigmentation DAS | Wavetronic Mean | SD | Median | Scalpel Mean | SD | Median | p value |
|-----------------------|------------------|-----------------|----|--------|-------------|----|--------|---------|
| 1                     | 30                | 1.6 1.350 1.50  | 0.9 1.197 0.50 | 0.100     |
| 1                     | 60                | 1.0 1.414 0.00  | 0.2 0.422 0.00 | 0.138     |
| 1                     | 180               | 0.6 0.699 0.50  | 0.5 0.707 0.00 | 0.789     |
| 2                     | 30                | 0.9 1.197 0.00  | 0.7 1.160 0.00 | 0.789     |
| 2                     | 60                | 1.1 1.287 0.50  | 0.8 1.135 0.00 | 0.361     |
| 2                     | 180               | 0.3 0.483 0.00  | 0.2 0.422 0.00 | 0.789     |

**DAS:** Days After Surgery

### Table 4: Results of the Wilcoxon signed-rank test used to evaluate the significance of the difference in scar elasticity after upper blepharoplasty surgery using Wavetronic and scalpel.

| Oculoplastic Observer | Elasticity DAS | Wavetronic Mean | SD | Median | Scalpel Mean | SD | Median | p value |
|-----------------------|---------------|-----------------|----|--------|-------------|----|--------|---------|
| 1                     | 30            | 2.4 1.776 3.0   | 3.2 1.317 3.0 | 0.173     |
| 1                     | 60            | 1.4 1.506 1.0   | 2.1 1.524 3.0 | 0.345     |
| 1                     | 180           | 0.7 1.252 0.0   | 1.8 1.814 2.0 | 0.100     |
| 2                     | 30            | 2.2 1.814 2.0   | 2.7 2.003 3.0 | 0.142     |
| 2                     | 60            | 1.1 1.197 1.0   | 1.3 1.703 0.5 | 0.456     |
| 2                     | 180           | 0.1 0.316 0.0   | 0.4 0.843 0.0 | 0.371     |

**DAS:** Days After Surgery

During the follow-up period, a patient who had undergone a RF incision presented with suture dehiscence on the seventh postoperative day.

### Discussion

Although these two incision techniques are widely used in upper blepharoplasty, only a few articles have been found in the literature comparing RF versus scalpel/scissors (cold incision) performance for upper blepharoplasty [1,2]. In Brazil, there are no studies on this subject, although both techniques are widely used by Brazilian oculoplastic surgeons.

The results gathered from this study corroborate with those of previously published articles on the subject [1,2]. One of those articles showed no difference between the two methods, while another article revealed asymmetries during the first 30 postoperative days but similar aesthetic results in the long term. Kashkouli, et al. [1], examined 23 patients who undergone upper eyelid surgery with an RF incision on one side and a cold blade incision on the other. Statistical analysis of the Manchester Scar Scale scoring by two blinded observers revealed no aesthetic difference between the scars produced by both incision techniques [1]. Likewise, Ritland, et al. [2], conducted a similar study with a smaller sample of 13 patients and observed similar long-term aesthetic results for both techniques. However, they also noticed that according to Hollander Scar Sale assessment, RF incision leads to faster healing and a more satisfying aesthetic outcome in the first month after surgery.

The well-documented disadvantages of RF incision brought about by the underlying heat-induced tissue damage are enhanced scar thickness, slower recovery of the eyelid sensation, and impaired diagnostic ability of the pathologist (the latter is a consequence of the tissue damage at the edges of the lesions that are to be examined) [1,7,8]. The current study revealed that eyelids treated with scalpel incision displayed an enhanced propensity to form thicker scars (hypertrophic scars) in the early postoperative stages. However, scar appearance tended to equalize in the case of both techniques after the sixth post-operative month, thus contradicting the generally accepted notion that RF generates more scars that are hypertrophic.

In terms of vascularity, elasticity, and pigmentation, no statistically significant difference between the eyelids was noted.

The histopathological results revealed the occurrence of heat-induced, 0.20–0.30 mm thick tissue damage in RF-excised eyelids. In a study by Ritland, et al. [2], tissue damage was estimated to reach a thickness of only 0.10–0.15 mm. We ascribe this difference to the use of a lower coagulation power as indicated in that study. Therefore, the use of RF incision to remove suspiciously malignant or malignant skin lesions is not recommended because malignant tissue must
be excised with safety margins, and surgical margins are compromised by thermal damage when using RF. The case of suture dehiscence that occurred in a patient’s eyelid incised with RF is also attributed to this thermal damage. Studies comparing mucosal tissues incisions made with scalpel and electrocautery or CO2 laser [12-14] describe significantly more granulation on histopathological samples in later weeks of the study on incisions made with heat production than the ones made with scalpel. Given that thermocoagulation also affects the remaining un-excised skin, care must be taken to revive the edges while bringing them together, to avoid constraints.

The use of photography in this study did not serve merely a documentary purpose. It also aimed to provide the means for a qualitative analysis by the readers of this article, especially since no objective tests (e.g., elastographic and/or colorimetric studies) were used. Although the assessment performed by the oculoplastic surgeons was controlled and based on a criterion already established in the literature (i.e., the Vancouver scar scale) [6], it was subjective and open to individual interpretations.

In summary, both radiofrequency and scalpel incision modalities produce similar, indistinguishable aesthetic results for upper blepharoplasty. As such, the surgeon should opt for the one that best fits their profile and surgical expertise.

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