DOI 10.5935/0034-7280.20200026

Radiofrequency versus scalpel incision for upper blepharoplasty: a clinicopathologic and photo documentation comparison

Radiofrequencia versus lâmina fria em blefaroplastia superior: comparação clinicopatológica e foto documentação

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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 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.*

Keywords: *Blepharoplasty; Eyelids; Cicatrix; Radiofrequency*

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Project number and institution responsible for the approval of the Research Ethics Committee:
Comitê de Ética e Pesquisa (CEP) do Hospital Universitário São José/FELUMA - CAAE: 23223213.3.0000.5134 - Número do Parecer: 571.460

Os autores declaram não haver conflito de interesses.

Recebido para publicação em 5/1/2020 - Aceito para publicação em 25/2/2020.

Resumo

Objetivo: Este estudo comparou o aspecto da cicatriz e histopatologia da resposta inflamatória induzidas pelo uso de radiofrequência [RF] e incisão fria em blefaroplastia superior. **Métodos:** Trata-se de um estudo comparativo, prospectivo, duplo-cego, no qual foram selecionados dez pacientes da raça branca do Departamento de Plástica Ocular do Centro Oftalmológico de Minas Gerais, na faixa etária entre 60-70 anos, fototipos 3 e 4 pela classificação Fitzpatrick, que apresentavam dermatocalase com indicação de blefaroplastia superior. Estes pacientes foram submetidos à blefaroplastia superior com a utilização da RF em uma pálpebra (total de 10 pálpebras) e de incisão fria na pálpebra contralateral (total de 10 pálpebras). As duas técnicas foram comparadas quanto ao aspecto clínico da cicatriz e avaliação histopatológica do material excisado (pele de pálpebra superior). Para avaliação do aspecto clínico da cicatriz optamos por dois métodos: a fotodocumentação e análise estatística da avaliação de dois observadores oculoplásticos mascarados que examinaram os pacientes durante todo o período de follow-up baseado na escala de cicatrização de Vancouver que inclui atributos relacionados à vascularização, espessura, pigmentação e elasticidade. O seguimento foi feito com 30, 60 e 180 dias de pós operatório. Após o follow-up, foi realizada análise estatística dos dados através do Teste de Pontos com Sinais de Wilcoxon. **Resultados:** As pálpebras operadas com bisturi apresentaram tendência a cicatrizes mais grossas (hipertróficas) com diferença estatisticamente significativa apenas para o primeiro mês de cirurgia (p=0.022). Não houve diferença estatisticamente significativa entre vascularização, elasticidade e pigmentação entre as duas técnicas de cirurgia avaliadas. Em relação à avaliação histopatológica, os fragmentos de pele excisados apresentaram o mesmo padrão inflamatório com a exceção do efeito de cautério nas bordas das peles excisadas com RF, que variaram de 0,20-0,30mm de espessura de dano térmico. **Conclusão:** As duas técnicas não mostraram diferença estatisticamente significativa no aspecto clínico da cicatriz após o sexto mês pós-operatório.

Descritores: Blefaroplastia; Pálpebras; Cicatrizes; Radiofrequência

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, electrosurgery, radiowave 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, radiowave surgery (also designated radiofrequency [RF] surgery or radiosurgery), provides a pressureless 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 tissue.[1] 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 from Oculoplastic Sector of Ophthalmological Center of Minas Gerais (Belo Horizonte, MG, Brazil) aged 60–70 years, Fitzpatrick skin types 3 and 4, with dermatochalasis and indication for upper blepharoplasty. All of the selected patients were women. The exclusion criteria were: ophthalmologic pathology, skin diseases, collagenosis, diabetes, hypertension and coagulation disorders. All patients were requested to sign the free informed consent form and this study was approved by FELUMA's Ethics comitee chosen at random by "Plataforma Brasil". These patients underwent radiosurgery in one upper eyelid and the conventional procedure in the contralateral eyelid. All the patients underwent the same surgical steps with the same surgeon: local anesthesia with a vasoconstrictor (2.0 mL of neocaine with 2.0 mL of xylocaine), skin incision, resection of the medial portion of the orbicularis muscle, removal of fat pads (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 parameters: statistical analysis of the evaluation by two oculoplastic specialists acting as masked observers and photo-documentation.

	Scar Characteristic	Score
Vascularity	Normal	0
	Pink	1
	Red	2
	Purple	3
Pigmentation	Normal	0
	Hypopigmentation	1
	Hyperpigmentation	2
Pliability	Normal	0
	Supple	1
	Yielding	2
	Firm	3
	Ropes	4
	Contracture	5
Height	Flat	0
	< 2 mm	1
	2-5 mm	2
	> 5 mm	3
	Total score	**13**

Figure 1: Vancouver scar scale

The masked observers evaluated patient's scars in person (not by photographs) by following the Vancouver Scar Scale criteria (VSS) (Figure 1), which includes attributes related to its vascularization, thickness, pigmentation, and elasticity. Elastogra-

Figure 2 : These photographs show all the 10 patients who underwent upper blepharoplasty in 30 postoperative day (column 1) and 180 postoperative day (column 2). The side marked with (*) correspond to the wavetronic incision's blepharoplasty.

phic and/or colorimetric methods were not used, but clinical exam (based on what they see and touch). Follow-up was performed on 30, 60, and 180 days after surgery. The data thus accumulated were registered (scores given from oculoplastic observers using VSS form for each patient at each follow up period) and statistically analyzed by using the Wilcoxon signed-rank test in the software R. Four tables were presented (one for each parameter analysed – thickness, vascularization, pigmentation and elasticity) showing the mean and median of the scores registered 30, 60 and 180 Days After Surgery (DAS) based on observers 1 and 2 evaluation.

The photo documentation was standardized, and performed by the same person, with the same camera (Canon Rebel T), by using an accessory 100-mm macro lens, a folded external Canon Speedlite 430EXII flash, and a tripod. The same shooting parameters (Manual MODE, F 9.0, 1/200 ISO 100) were used during all the follow up, but just 30 and 180 postoperative day were printed side by side (Figure 2) as they can be representative of an early and late postoperative, respectively. The ones marked with a sign (*) correspond to the eyelid that wavetronic was used in the blepharoplasty incision. As the photos were taken with the same parameters and white balance calibrated equally with a 18% gray card, scar's colors at printed photographs can be trustworthy to the readers.

The histological study was done just once, soon after skin removal. Formalina 10% fixation was performed, with paraffin inclusion and hematoxylin/eosin blush. The induced trauma was measure by ocular micrometer.

Results

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 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 and 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.

Table 1
Results of the Wilcoxon signed-rank test used to evaluate the significance of the difference in scar thickness after upper blepharoplasty surgery using Wavetronic and Scapel

Oculoplastic Observer	Thickness DAS	Wavetronic			Scalpel			p-value
		Mean	SD	Median	Mean	SD	Median	
1	30	0.7	0.483	1.0	1.4	0.699	1.5	0.022*
1	60	0.4	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	0.8	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	0.000	0,0	0.2	0.422	0.0	0.371

* Significant difference at 5% significance level
DAS: Days After Surgery

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			Scalpel			p-value
		Mean	SD	Median	Mean	SD	Median	
1	30	1.1	0.738	1.0	0.9	0.316	1.0	1,000
1	60	0.6	0.966	0.0	0.5	0.527	0.5	1,000
1	180	0.1	0.316	0.0	0.2	0.422	0.0	1,000
2	30	0.5	0.527	0.5	0.8	0.789	1.0	0,181
2	60	0.3	0.483	0.0	0.5	0.527	0.5	0,371
2	180	0.1	0.316	0.0	0.1	0.316	0.0	1,000

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			Scalpel			p-value
		Mean	SD	Median	Mean	SD	Median	
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			Scalpel			p-value
		Mean	SD	Median	Mean	SD	Median	
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 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.

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

Discussion

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 hypertrophic scars.

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

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,[1] while another article revealed asymmetries during the first 30 postoperative days but similar aesthetic results in the long term.[2] Kashkouli et al.[1] examined 23 patients who underwent 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.

There are currently at least 5 scar scales that were originally designed to assess subjective parameters in an objective way: The Vancouver Scar Scale (VSS), Manchester Scar Scale (MSS), Patient and Observer Scar Assessment Scale (POSAS), Visual Analog Scale (VAS), and Stony Brook Scar Evaluation Scale (SBSES). These scales are frequently used in research settings and are beneficial to study small, linear scars. The authors decided to use the VSS as it remains widely applicable to evaluate therapy and as a measure of outcome in burn studies[13].

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 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 scapel 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 scapel. 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. Although RF histopathological samples exhibit thermal damage, this study didn't find any clinical outcome as a result of this pattern.

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 by masked observers on their clinical exam. 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)[6,13]it was subjective and open to individual interpretations.

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.

Even though the results of this study are similar to the literature[1-3, 7-12, 14-16] none of them show visual results for comparing two or more skin incision's modalities. The authors chose to work with a smaller sample, so we could be able to publish a complete photo-documentation showing all patient's scars appearance on early and late postoperative in blepharoplasty .

Conclusions

In summary, both radiowave and scalpel incision modalities produce similar, indistinguishable aesthetic results for upper blepharoplasty. Even though histologic tissue damage is evident with the use of RF, this did not translate into any clinically outcome. Although photographs in this study corroborates with the results, they allow the reader to see early and late postoperative results side by side and take their own conclusions, as the results presented on this study was based on clinical exam of two oculoplastics and it's open to subjective evaluation.

As such, the surgeon should opt for the one that best fits their profile and surgical expertise.

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