

ELECTROSURGICAL MICRONEEDLE VERSUS SCALPEL SKIN INCISIONS IN THE FACIAL REGION

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Abstract: Objective: Electrosurgery is widely used in surgical procedures, but mainly for subcutaneous and deep layer dissections. The aim of this study was to clinically evaluate the results of routine use of electro-surgical microneedle in performing skin incisions in the facial regions. **Material and methods:** Eighty patients with both benign and malignant skin lesions in the facial regions undergoing surgery were enrolled in this study. In group A comprising 40 patients, cold steel surgical scalpel N° 15 was used for the surgical procedure. Electro-surgical microneedle with 0.06 mm tip radius and generator unit *KLS Martin Electrosurgical Unit ME MB 2* set on cutting mode, power 12 W was used for performing the surgery in group B including the same number of patients. Differences between incision time, excision time, blood loss and the wound related complications were evaluated. **Results:** The two groups did not significantly differ in the speed of incision and speed of excision although both the speed of incision and the speed of excision were found to be slightly faster in the electro-surgery group. There was significantly less blood loss in the electro-surgery group compared with the scalpel group. Statistical analysis did not confirm as significant the difference in complications between the two groups although most of the complications were associated with the patients operated with scalpel. **Conclusion:** Electro-surgery presents safe and effective way of work. In that manner, it is very important to choose the right generator unit's settings and the right type of electrode.

Key words: surgical scalpel, electro-surgery, facial regions.

INTRODUCTION

Surgical scalpel is the most widely used cutting instrument in surgery. The incisions made with the

scalpel are sharp and very precise causing only mechanical injury to the tissue together with profound bleeding. Different types of scalpel are used for different procedures in surgery (1, 2).

However, over the years different alternative ways for cutting the skin have been developed with electro-surgery being the most popular one (3). Electro-surgery involves the passage of high frequency alternating electrical current in the tissues to produce the effect of cutting or coagulation (3, 4).

In recent years there has been a huge improvement in the design of electro-surgical devices thus making electro-surgery safe and effective method for work. But although it is widely used in surgical procedures, mainly for subcutaneous and deep layer dissections its use on skin has been precluded by the fear of complications like delayed wound healing and surgical site infections (4). In that manner it is very important to choose the right generator unit's settings and the right type of electrode.

In order to achieve the effect of the scalpel, pure cut mode with the generator unit output power set on the lowest power that can produce the effect of cutting combined with an electrode in form of needle or micro-needle should be used for cutting the skin (5, 6). The microneedle electrode with the tip radius of 0.06 mm is used for performing fine surgical procedures (1, 7, 8).

The aim of this study was to clinically evaluate the results of routine use of electro-surgical microneedle in performing skin incisions in the facial regions.

MATERIALS AND METHODS

Eighty patients with both benign and malignant skin lesions in the facial regions undergoing surgery were enrolled in this study. The patients were recruited

from the University Clinic for Plastic and Reconstructive Surgery, Medical Faculty, Ss. Cyril and Methodius University in Skopje, Macedonia, in the time interval between September 2017 to September 2018.

Patients were randomized in two groups using the envelope randomization method. Each group included 40 patients. In group A cold steel surgical scalpel N° 15 was used for the surgical procedure whereas electro-surgical microneedle with 0.06 mm tip radius and generator unit *KLS Martin Electrosurgical Unit ME MB 2* set on cutting mode, power 12 W was used for performing the surgery in group B. Electrosurgery was used for hemostasis during the dissection process in both groups using the same generator unit set on coagulation mode power 20 W.

Surgical procedures were performed under local infiltrative anesthesia (lidocaine 1% with adrenalin) as to standard practice.

In each surgical procedure the proposed skin excision was marked. When the excision was a circle its perimeter was calculated using the standard formula and when the excision was an ellipse its perimeter was calculated using the Ramanujan formula. The time required to complete the incision was calculated. The incision included cutting of the epidermis and dermis. Incision was considered completed when hypodermis was reached. The perimeter in millimeters divided by the time in seconds gave the speed of incision movement (mm/s).

Only the tip of the microneedle was allowed to come in contact with the proposed incision line while the sides of the microneedle were not allowed to touch the skin edges at any time. To avert the skin edges away as cutting precedes, the surgeon and assistant applied mild traction pressure on either side of the skin incision.

The time needed to complete the excision was calculated. In all the cases only skin and superficial part of the subdermal tissue were excised. The excision was considered completed with the completion of the haemostasis.

Blood loss was also calculated. First dry gauze swabs were measured and then the gauze swabs soaked with blood. The difference between the two measurements was considered the total blood loss. One gram of blood was regarded as equivalent of 1ml of blood. No suction evacuation of blood was done while making the skin incision.

On completing total skin excision, the vitality of the skin was evaluated by checking its color and blood supply. Wound edges were inspected for any thermal trauma in form of fulguration and dermal peeling.

At the termination of the operation the postoperative defect was closed in manner of direct closure where there was no tension or with the use of local skin flaps in order to release the tension. Wound closure was achieved in two layers with interrupted sutures.

The subcutis was sutured with 3/0 Polyglactin 910 while the skin was sutured with silk fibroin 4/0.

Wound complications occurring at any stage after the operation and at one month follow up were recorded. Each wound was inspected for wound healing complications comprising wound infection, dehiscence, necrosis, and haematoma.

All the patients were informed about the nature of the skin incision and written informed consent was signed.

RESULTS

Statistical analysis of the data was performed using the statistical program Statistics for Windows 7,0. A value of $p < 0,05$ was considered statistically significant.

Both groups of patients were homogenous according to the sex structure ($p = 0.64$). The mean age of the patients in group A was 61.45 ± 19.8 and the mean age of the patients in group B was 69.03 ± 11.9 .

The indication for surgery in terms of underlying diagnosis did not differ significantly between the groups and malignancy was diagnosed in majority of patients in each group.

The velocity of incision was analyzed in mm/s from the start of cutting till completing the incision. The speed of incision when steel scalpel was used ranged 2.6 ± 1.1 mm/s while the speed of incision when microneedle electrosurgery was used ranged 2.95 ± 1.2 mm/s. The speed of incision although not significantly was found to be slightly faster in the group B (2.6 ± 1.1 vs 2.95 ± 1.2 ; $p = 0.17$) (Table 1).

The speed of excision was also analyzed. Excision included excision of skin and superficial part of the subcutaneous tissue. Excision was considered completed with the completion of the hemostasis. The speed of the excision was registered as non-significantly faster in group B in our study (1.74 ± 1.1 vs. 1.97 ± 1.0 ; $p = 0.33$) (Table 2).

Table 1. Speed of Incision

Groups	Speed of incision (mm/s)			p value
	n	mean ± SD	min - max	
Scalpel	40	2.6 ± 1.1	0.7 – 5.1	0.17ns
Microneedle	40	2.95 ± 1.2	0.7 – 6.3	

p (Student t-test)

Table 2. Speed of Excision

Groups	Speed of excision (mm ² /s)			p value
	n	mean ± SD	min - max	
Scalpel	40	1.74 ± 1.1	0.4 – 6.7	0.33ns
Microneedle	40	1.97 ± 1.0	0.5 – 5.1	

p (Student t-test)

Table 3. Blood Loss

Groups	Blood loss (ml/mm ²)			p value
	n	mean ± SD	min - max	
Scalpel	40	0.017 ± 0.013	0.003 – 0.062	0.00089sig
Microneedle	40	0.009 ± 0.006	0.002 – 0.03	

p (Student t-test)

Table 4. Complications in general

Complications in general	Treatment			p value
	n	Scalpel	Microneedle	
No	62	30 (75%)	32 (80%)	0.59 ns
Yes	18	10 (25%)	8 (20%)	

p (Chi-square test)

Table 5. Complications

Complications	Treatment			p value
	n	Scalpel	Microneedle	
Infection				
No	77	40 (100)	37 (92.5)	^b 0.24 ns
Yes	3	0	3 (7.5)	
Hematoma				
No	75	36 (90)	39 (97.5)	^b 0.36 ns
Yes	5	4 (10)	1 (2.5)	
Delayed wound healing				
No	67	31 (77.5)	36 (90)	^a 0.13ns
Yes	13	9 (22.5)	4 (10)	
Dehiscence - partial				
No	69	32 (80)	37 (92.5)	^a 0.1 ns
Yes	11	8 (20)	3 (7.5)	
Necrosis				
No	71	33 (82.5)	38 (95)	^b 0.15 ns
Yes	9	7 (17.5)	2 (5)	

^ap (Chi-square test) ^bp (Fisher exact, two tailed)

When the blood loss was measured as ml/mm² there was significant difference between the two groups for the value $p = 0.00089$. The mean blood loss was significantly lower in the group of patients operated with electro-surgery (0.009 ± 0.006 vs 0.017 ± 0.013) (Table 3).

Results of this study showed that complications had 25% of the patients in the scalpel group and 20% of the patients in the microneedle group. Statistical analysis did not confirm as significant the difference in complications between the two groups ($p = 0.59$) (Table 4).

The patients in both groups did not significantly differ in the postoperative complications ($p > 0.05$), al-

though of the complications were associated with the patients operated with scalpel (Table 5).

Macroscopic signs for thermal trauma as charcoal effect together with dermal peeling was noticed in two patients and only dermal peeling in only one patient. Prolonged wound healing and partial wound dehiscence was noticed in only one patient, one of the patients with signs of fulguration and dermal peeling.

In our study the postoperative complications were not significantly associated with smoking ($p = 0.54$).

DISCUSSION

Wound healing of the skin after surgical incision is a primary factor affecting patient morbidity and recovery time. Although electro-surgical instruments are used increasingly for making deep layer incisions and tissue dissection, concerns about excessive scarring, high wound infection rate and poor wound healing have restricted the widespread use of electro-surgery for skin incisions.

Improvements in the design of electro-surgical devices have created generators that produce pure sinusoidal cut waveforms that cause minimal thermal damage to the tissue. This coupled with specialized cutting tips like microneedle can make a skin incision that does not differ from scalpel incision.

Several previous studies have investigated the use of electro-surgery in skin opening. Most were connected with general surgery and mainly for abdominal and thoracic skin incisions. They have shown that there is no difference in the wound healing between the wounds created with steel scalpel and the wounds created with electro-surgery (10-19).

The study of Sheikh B. et al. recommend the use of microneedle electro-surgery surgery in all neuro-surgical procedures especially when blood loss has significant importance, such as in paediatric cases (20).

Similar results were shown in the study of Kumar and al. which analyses the outcome of patients following use of scalpel and electro-surgery in elective skin incisions of head and neck cancer. Due to the reduced blood loss and shorter operative time they strongly recommend the use of electro-surgery in these group of patients.

In our study the two groups did not differ significantly in the both incisional and excisional speed although both the incisional and excisional time were faster in the electro-surgery group. There was significantly less blood loss in the electro-surgery group compared with the scalpel group. There is no change in wound complications rate in the electro-surgery group. More over in our study most of the complications were associated with the patients operated with scalpel.

On the base of this study it is suggested that the skin may be safely incised with electrosurgery. Furthermore, the recent increase in blood borne disease makes exclusion of the scalpel from the operative field an attractive option and the role of scalpel in making incisions may be completely taken over by the electrosurgery.

CONCLUSION

Electrosurgery is safe and effective way of performing elective surgical procedures in the facial region.

The findings of this study support the use of microneedle in surgical procedures concerning the facial region.

DECLARATION OF INTEREST

The authors declare that there are no conflicts of interests.

This study was done as a part of a more extended PhD thesis.

Licensing

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Sažetak

POREĐENJE ELEKTROHIRURŠKIH KOŽNIH INCIZIJA MIKROIGLOM I KOŽNIH INCIZIJA SKALPELOM U PREDELU LICA

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Uvod: Elektrohirurgija se široko koristi u hirurškim procedurama, ali uglavnom za potkožne i duboke disekcije. Cilj ove studije bio je da se klinički proceni rezultat rutinskog korišćenja elektrohirurške mikrogile za kožne incizije u predelu lica. **Materijal i imetode:** U studiju je uključeno osamdeset pacijenata sa benignim i malignim lezijama kože u predelu lica koji su operisani. U grupi A, koja se sastojala od 40 pacijenata, korišćen je hirurški skalpel broj 15. Grupa B je imala isti broj pacijenata i tu je korišćen elektrohirurška mikroigla sa radiusom 0.06 mm i generatorskom jedinicom KLS Martin Electrosurgical Unit ME MB2 postavljen na režim sečenja, snage 12 W. Vrednovane su razlike između vremena incizije, vremena ekscizije, gubitka krvi i komplikacija

vezanih za ranu. **Rezultati:** Dve grupe se nisu značajno razlikovale u brzini incizije i ekscizije, iako su se ove dve vrednosti pokazale nešto brže u grupi gde je korišćena elektrohirurška mikroigla. Bilo je značajno manje gubitka krvi u grupi B u poređenju sa grupom gde je korišćen skalpel. Statistička analiza nije potvrdila značajnu razliku u komplikacijama između dve grupe, iako je većina komplikacija bila povezana sa pacijentima kod kojih je korišćen skalpel. **Zaključak:** Elektrohirurgija predstavlja bezbedan i efikasan način rada. Važno je odabrati odgovarajuće postavke generatorske jedinice i odgovarajući tip elektrode.

Ključne reči: hirurški skalpel, elektrohirurgija, region lica.

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