Original Article - Comparative Study

Evaluation of Electrocautery and Stainless Steel Scalpel in Oral Mucoperiosteal Incision for Mandibular Anterior Fracture

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Abstract

Background: Traditionally, mucosal incisions are made by stainless steel scalpel due to its ease of use, accuracy, and minimal tissue damage effect, but these incisions are more bloody and painful. To obviate the inherent disadvantages of scalpel, surgical diathermy was introduced at the beginning of the 20th century. **Aim and Objectives:** The study aimed to compare the efficacy of electrocautery and stainless steel scalpel in oral mucoperiosteal incisions in terms of time taken for incision, blood loss, pain, edema, and healing for mandibular symphysis or parasymphysis fracture. **Materials and Methods:** Forty patients who reported to the Department of Oral and Maxillofacial Surgery between December 2015 and November 2017 with symphysis or parasymphysis fracture were divided into two groups by randomized envelope method. **Results:** The mean time taken and mean blood loss for electrocautery were less than that of stainless steel scalpel. The postoperative pain was significantly reduced at 24 h, 48 h, and 1 week in the diathermy group as compared to the scalpel group. At 24 h and 48 h, the extraoral edema measured was not significant. Wound healing at 24 h and 48 h was better in the scalpel group as compared to the electrocautery group. **Conclusion:** From present study, we can conclude that electrocautery is better than stainless steel scalpel in relation to time taken for incision, intraoperative blood loss and postoperative pain.

Keywords: Electrocautery, incision, stainless steel scalpel

Introduction

Incision for oral and maxillofacial surgery is always a surgeon's choice. Traditionally, mucosal incisions are made by stainless steel scalpels due to its ease of use, accuracy, and minimal tissue damage effect, but these incisions are more bloody and painful.[1] To obviate the inherent disadvantages of steel scalpel, surgical diathermy was introduced at the beginning of the 20th century.[2] With the advent of modern electrosurgical units, this technique is now becoming extremely popular because of rapid hemostasis, faster incision, and reduced overall operative blood loss.[3]

Electrosurgery has been defined as the intentional passage of high-frequency waveforms or currents through the tissues of the body to achieve a controllable surgical effect.[4] Electrocautery involves current frequencies in the range of 400 KHz–10 MHz. Currents up to 500 MA can be safely passed through the patient. Electrocautery may be either monopolar or bipolar.

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Monopolar electrocautery is more commonly used than bipolar electrocautery. In monopolar electrocautery, high frequency current from an electrocautery machine is delivered to an active electrode held by the surgeon. Density of the current is high, where the electrode touches the body tissues and a pronounced local heating effect occurs. The current subsequently spreads out in the body and then returns to the diathermy machine through the patient plate electrode (a pad which is kept under the patient).[5] Different types of electrode tips are used for

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different purposes such as ball tip for coagulation and blade tip/needle type for incision or excision of tissues.[6]

Very few studies have been taken up for mucosal incisions in major surgical procedure in the maxillofacial region. The purpose of this study is to compare the traditional scalpel blade incision with that of electrocautery blade in a prospective, controlled, randomized fashion.

Materials and Methods

This clinical study was conducted between December 2015 and November 2017 at the Department of Oral and Maxillofacial Surgery on 40 healthy patients diagnosed with mandibular symphysis or parasymphysis fracture. Patients were selected irrespective of sex, religion, and socioeconomic status with age group ranging between 18 and 50 years. Informed consent was obtained from all included patients.

These 40 patients were divided into two groups by randomized envelope method. Group A consists of 20 patients receiving incision by stainless steel scalpel with no. 15 blade and Group B consists of 20 patients receiving incision by electrocautery blade.

After endotracheal intubation, under general anesthesia, the surgical field was prepared and isolated. The area to be operated was infiltrated using 2% lignocaine with epinephrine (1:80,000). Incisions were made with a Bard-Parker blade no. 15 in Group A patients and electrocautery blade in Group B patients, the mucoperiosteal flap was reflected to expose the fracture site, and then, the surgical procedure was performed. The flaps were approximated and sutured with 3-0 Vicryl suture. Postoperative intravenous antibiotics, anti-inflammatory drugs, and analgesics were given after surgery for 5 days.

Time taken to complete the mucoperiosteal flap reflection was measured in minutes from the time of incision till the elevation of mucoperiosteal flap. Bleeding was measured by weighing blood-soaked gauzes and collection in suction apparatus from the time of incision till the elevation of the mucoperiosteal flap. Pain assessment was done on 100-mm visual analog scale (VAS), with score 0–10, where 0 indicates no pain and 10 indicates worst pain. Extraoral edema was studied by measuring the horizontal distance from right to left angle of the mandible and the vertical distance from vermilion border of lip to laryngeal prominence with the help of thread. Wound healing was assessed for inflammation, even healing, and surface epithelization by comparing with the adjacent mucosal tissues. Wound healing was assessed using healing scoring system [Table 1].

Any other complications occurred were observed.

The participants were clinically examined at 24 h, 48 h, 7 day, and 1 month, postoperatively.

Results

Time taken

The mean time taken to complete the mucoperiosteal flap reflection for electrocautery (2.9960 min) was less than that of stainless steel scalpel (4.7910 min), and this difference was statistically highly significant ($P < 0.001$). These data were presented using joint bar diagram [Table 2].

Blood loss evaluation

The mean blood loss for electrocautery (7.9100 ml) was less than that of stainless steel scalpel (13.3225 ml), and this difference was statistically highly significant ($P < 0.001$). These data were presented using joint bar diagram [Table 3].

Pain assessment

Pain was recorded postoperatively at 24 h, 48 h, 1 week, and 1 month by VAS ranging from 0 to 10, where 0 indicates no pain and 10 indicates worst pain.

At 24 h, the minimum VAS for stainless steel scalpel group was 1 and maximum VAS was 4, and for electrocautery, minimum VAS was 0 and maximum VAS was 3; the difference in both the groups was statistically significant ($P < 0.01$).

At 48 h, the minimum VAS for stainless steel scalpel group was 1 and maximum VAS was 3, and for electrocautery, minimum VAS was 0 and maximum VAS was 3; the difference in both the groups was statistically significant ($P < 0.01$).

At 1 week, the minimum VAS for stainless steel scalpel group was 0 and maximum VAS was 2, and for electrocautery, minimum VAS was 0 and maximum VAS was 1; the difference in both the groups was statistically significant ($P < 0.01$).

At 1 month, the minimum VAS for stainless steel scalpel group was 0 and maximum VAS was 1, and for electrocautery, VAS was 0; the difference in both the groups was not statistically significant ($P > 0.05$).

The data were presented by joint bar diagram [Table 4].

Extraoral edema

At 24 h, the mean extraoral edema measured mediolaterally in Group A was 2.900 mm, and in Group B, it was 2.200 mm (not significant $P = 0.059$). Superoinferiorly, in Group A, it was 1.800 mm, in Group B, it was 1.700 mm (not significant $P = 0.746$).

At 48 h, the mean extraoral edema measured mediolaterally in Group A was 2.350 mm, and in Group B, it was 0.7864 (not significant $P = 0.094$). Superoinferiorly, in Group A, it was 1.450 mm, and in Group-B, it was 1.300 mm (not significant $P = 0.666$).

At 1 week and 1 month, the extraoral edema was also not significant in both the groups mediolaterally and superoinferiorly. The data were presented by joint bar diagram [Table 5].

Wound healing assessment

The participants were clinically examined at 24 h, 48 h, 7 day, and 1 month, postoperatively for assessment of wound healing, and the scores were given from 3 to 1, where score 3 was good healing, score 2 was satisfactory healing, and score 1 was bad healing.

At 24 h, in Group A, 10% (2) of the patients had healing assessment score 2 and 90% (18) had healing assessment

Table 1: Healing scoring system

Interpretation	Score	Sign
Good	3	No inflammation present, no wound gaping Color of scar matches the surrounding mucosa
Satisfactory	2	Mild-to-moderate inflammation No signs of infection and no wound gaping
Bad	1	Severe inflammation and wound gaping present

Table 2: Time taken for incision

Time taken for incision	Scalpel	Electrocautery	Total
2-3			
Count	0	8	8
Percentage	0.0	40.0	20.0
3-4			
Count	0	12	12
Percentage	0.0	60.0	30.0
4-5			
Count	11	0	11
Percentage	55.0	0.0	27.5
5-6			
Count	9	0	9
Percentage	45.0	0.0	22.5
Total			
Count	20	20	40
Percentage	100.0	100.0	100.0

Independent sample *t*-test=11.69; *P*<0.001; highly significant

Table 3: Bleeding evaluation

Blood loss (ml)	Scalpel	Electro	Total
<7			
Count	0	8	8
Percentage	0.0	40.0	20.0
7-9			
Count	0	10	10
Percentage	0.0	50.0	25.0
9-11			
Count	0	1	1
Percentage	0.0	5.0	2.5
11-13			
Count	11	1	12
Percentage	55.0	5.0	30.0
>13			
Count	9	0	9
Percentage	45.0	0.0	22.5
Total			
Count	20	20	40
Percentage	100.0	100.0	100.0

Independent sample *t*-test=13.12; *P*<0.001; highly significant

score 3. In Group B, 70% (14) of the patients had healing assessment score 2 and 30% (6) had healing assessment score 3 (significant $P < 0.01$).

At 48 h, in Group A, 10% (2) of the patients had healing assessment score 2 and 90% (18) had healing assessment score 3. In Group B, 60% (12) of the patients had healing assessment score 2 and 40% (8) had healing assessment score 3 (significant $P < 0.01$).

At 1 week, in Group A, 10% (2) of the patients had healing assessment score 2 and 90% (18) had healing assessment score 3. In Group B, 10% (2) of the patients had healing assessment score 2 and 90% (18) had healing assessment score 3 (not significant $P > 0.05$).

At 1 month, in Group A, 5% (1) of the patients had healing assessment score 2 and 95% (19) had healing assessment score 3. In Group B, 10% (2) of the patients had healing assessment score 2 and 90% (18) had healing assessment score 3 (not significant $P > 0.05$).

The data were presented by joint bar diagram [Table 6].

Discussion

Time taken

Sharma and Sachdeva[7] suggested that the mean time taken for incision and elevation of mucoperiosteal flap was less for electrosurgery (5.1373 min) than that of scalpel surgery (6.5578 min). Bhatsange *et al*.[8] reported that the time taken for excision by electrocautery was more which is statistically significant than scalpel. Kearns *et al*.[9] found that the time taken to complete the laparotomy incision was significantly faster with the diathermy than with the scalpel.

However, in this study, the mean time taken to complete the mucoperiosteal flap reflection for electrocautery (2.9960 min) was less than that of stainless steel scalpel (4.7910 min) (highly significant $P < 0.001$).

Blood loss

Sharma and Sachdeva[7] reported that the mean blood loss for electrosurgery was very less (1.5858 ml) as compared with scalpel surgery (4.1619 ml). Priya *et al*.[10] reported that the mean blood loss was significantly very less in the diathermy (1.000 ml) group as compared to the scalpel group (6.960 ml). Liboon *et al*.[1] reported that amount of bleeding was least for electrosurgery and laser, followed by constant-voltage electrocautery ($P < 0.001$).

In this study, the mean blood loss for electrocautery (7.9100 ml) was less than that of stainless steel scalpel (13.3225 ml) (highly significant $P < 0.001$).

Pain assessment

Sharma and Sachdeva[7] in their study found that the postoperative pain values in all the three visits were almost same in both electrosurgery and scalpel surgery sites. The difference in pain in both the sites was not statistically significant at all postoperative visits. Kearns *et al*.[9] in their study found that postoperative pain was significantly reduced on the first ($P = 0.04$) and second ($P = 0.02$) postoperative days in the diathermy group as compared to the scalpel group. There was no significant difference in pain scores between the two groups on the third and subsequent postoperative days. Priya *et al*.[10] in their study

Table 4: Pain assessment

	Scalpel group				Electrocautery group			
	24 h	48 h	1 week	1 month	24 h	48 h	1 week	1 month
Pain assessment								
0.0								
Count	0	0	7	19	2	4	18	20
Percentage within group	0.0	0.0	35.0	95.0	10.0	20.0	90.0	100.0
1.0								
Count	1	5	9	1	11	14	2	0
Percentage within group	5.0	25.0	45.0	5.0	55.0	70.0	10.0	0.0
2.0								
Count	6	7	4		6	1	0	
Percentage within group	30.0	35.0	20.0		30.0	5.0	0.0	
3.0								
Count	9	8			1	1		
Percentage within group	45.0	40.0			5.0	5.0		
4.0								
Count	4				0			
Percentage within group	20.0				0.0			
Total								
Count	20	20	20	20	20	20	20	20
Percentage within group	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Statistical analysis - At 24 h Chi-square test=20.73; $P<0.01$; significant, At 48 h Chi-square test=18.20; $P<0.01$; significant, At 1 week Chi-square test=13.29; $P<0.01$; significant, At 1 month Chi-square test=1.02; $P>0.05$; not significant

Table 5: Postoperative edema

	24 h		48 h		1 week		1 month	
	ML	SI	ML	SI	ML	SI	ML	SI
Mean (S)	2.900	1.800	2.350	1.450	1.050	0.800	0.200	0.200
SD (S)	1.3338	1.1050	1.3485	1.2344	0.9987	1.0563	0.4104	0.4104
Mean (E)	2.200	1.700	1.750	1.300	0.450	0.500	0.100	0.00
SD (E)	0.8944	0.9787	0.7864	0.9234	0.6048	0.6070	0.3078	0.00

ML - At 24 h, independent sample *t*-test=1.949; $P=0.059$; not significant, at 48 h, independent sample *t*-test=1.719; $P=0.094$; not significant, at 1 week, independent sample *t*-test=2.298; $P=0.027$; not significant, at 1 month, independent sample *t*-test=0.872; $P=0.389$; not significant; SI - At 24 h, independent sample *t*-test=0.303; $P=0.764$; not significant, at 48 h, independent sample *t*-test=0.453; $P=0.666$; not significant, at 1 week, independent sample *t*-test=1.101; $P=0.278$; not significant, at 1 month, independent sample *t*-test=2.179; $P=0.036$; significant. S=Stainless steel scalpel group; E=Electrocautery group; ML=Mediolaterally; SI=Superoinferiorly; SD=Standard deviation

Table 6: Wound healing assessment

Score	Scalpel group				Electrocautery group			
	24 h	48 h	1 week	1 month	24 h	48 h	1 week	1 month
Wound healing								
2.0								
Count	2	2	2	1	14	12	2	2
Percentage within group	10.0	10.0	10.0	5.0	70.0	60.0	10.0	10.0
3.0								
Count	18	18	18	19	6	8	18	18
Percentage within group	90.0	90.0	90.0	95.0	30.0	40.0	90.0	90.0
Total								
Count	20	20	20	20	20	20	20	20
Percentage within group	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

At 24 h Chi-square test=15.00; $P<0.01$; significant, At 48 h Chi-square test=10.98; $P<0.01$; significant, At 1 week Chi-square test=0.00; $P>0.05$; not significant, 1 month Chi-square test=0.360; $P>0.05$; not significant

reported that there was a significant reduced postoperative pain in the diathermy group as compared to the scalpel group.

In this study, the postoperative pain assessed by VAS was significantly reduced on 24 h, 48 h, and 1 week in the

diathermy group as compared to the scalpel group. There was no significant difference in pain scores between the two groups on 1 month postoperative follow-up.

Extraoral edema

Priya *et al*.[10] reported that the electrocautery group has the less wound healing complications than the stainless steel scalpel group. Chhabda and Agrawal[11] reported that both the groups had the same complication rate. Chau *et al*.[12] reported that the scalpel and cautery blades do not differ significantly in terms of collateral injury rate or postoperative complication rate.

In this study, extraoral edema measured mediolaterally and superoinferiorly in Group A and Group B was not significant.

Wound healing assessment

Sharma and Sachdeva[7] reported that the difference in healing in both 1st week and 4th week postoperatively was not statistically significant for both the sites. Although there was slight more inflammation at the electrosurgical site as compared to scalpel site in the 1st postoperative week; by the end of 4 weeks, healing was good at both the sites. Pearlman *et al*.[13] reported that the postoperative wound healing was the same in the scalpel, electrosurgery, and carbon dioxide laser group. Rathofer *et al*.[14] reported that healing occurred at approximately the same rate in both the electrosurgery and blade loop knife groups.

In this study, the wound healing at 24 and 48 h was better in the scalpel group as compared to the electrocautery group, and the difference in both the groups was statistically significant ($P < 0.01$). There was no significant difference in wound healing at 1 week and 1 month postoperatively in both the groups ($P > 0.05$).

Conclusion

From present study, we can conclude that electrocautery is better than the stainless steel scalpel in relation to time taken for incision, intraoperative blood loss and early postoperative pain. But electrocautery is inferior to scalpel in relation to wound healing. So, in all surgical procedures stainless steel scalpel cannot be completely replaced by electrocautery.

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Conflicts of interest

There are no conflicts of interest.

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