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A Comparative Study To Assess The Effects Of Vestibular Incision Made With Electrocautery And Scalpel In Open Reduction And Internal Fixation Of Mandibular Fractures

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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*: To assess the effects of vestibular incision made with electrocautery and scalpel in open reduction and internal fixation of mandibular fractures.*
Materials and Methods*: Sixty patients with mandibular fractures involving from mandibular angle and body were be randomly assigned to two groups of 30 patients each, Group A: Electrocautery incision and Group B: Scalpel incision.*
Results*: There was statistically significant difference in incision time between the two groups (133.9±14.82 sec in group A whereas 116±21.55 sec in group B), p value=0.0081, and blood loss between the two groups (4±1.43 ml in group A whereas 3±0 ml in group B), p value=0.0067. There was no statistically significant difference in post-operative pain in between the two groups (Day one: 0.7±4.66 in group A whereas 52±6.544 in group B), p value=0.6352, Day third: 0.6±0.813 in group A whereas 0.2±0.406 in group B), p value=0.0204, Day seventh: 0±0 in group A whereas 0±0 in group B), p value=NA: all patients had no pain on seventh day. There was no statistically significant difference in wound healing in between the two groups (Day one: 1±0 in group A whereas 0.966±0.413 in group B), p value=0.6624, Day third: 1.1±0.305 in group A whereas 0.9±305 in group B), p value=0.0138, Day seventh: 0.9±0.305 in group A whereas 0.8±0.406 in group B), p value=0.2863.*
Conclusion*: We can conclude that electrocautery is better than scalpel for time taken for incision, intraoperative blood loss and early post-operative pain. But there is no significance difference in terms of post-operative pain after 7 days and wound healing between scalpel and electrocautery.*
Keywords: *Mucosal incision, Scalpel, Electrocautery, Mandibular fractures.*

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I. Introduction

Intraoral surgery, as other surgeries, require an incision of sufficient length to allow the surgeon a good view of the operating field and to permit the visibility of important structures. Traditionally mucosal incision have routinely been made with scalpels. Now a days there is a shift from this method to electrosurgical mucosal incisions.

In 1881, Morton found that an oscillating current at a frequency of 100 kHz could pass through the human body without inducing pain, spasm, or burn. In 1891, d'Arsonval published similar findings with a frequency lowered to 10 kHz. But d'Arsonval did note that the current directly influenced body temperature, oxygen absorption, and carbon dioxide elimination, increasing each as the current passed through the body. Of note, the temperature was determined to increase proportionally to the square of the current density. In 1897, Franz Nagelschmidt discovered that patients with articular and circulatory ailments benefited from the application of electrical currents. He coined the term *diathermy* to describe the heating effect discovered by d'Arsonval 6 years earlier[1]. In electrosurgery or diathermy high frequency electrical current is passed through tissue to create a desired clinical effect. As the current is delivered, it passes through the tissue to produce heat.[2] The scalpel has been used for many years because of its ease of use, accuracy, and minimal damage to adjacent tissue. Surgical

incision using a scalpel was the gold standard method for creating surgical wounds.[3] However need for hemostasis in highly vascular areas such as the head and neck region led to the widespread use of electrosurgery. Electrosurgery provides enhanced hemostasis by sealing blood vessels before cutting.[4] Parente et al in 2011 conducted a pilot study on effects of incisions made with electrocautery and scalpel on upper lip length and found that was a greater potential for lip shortening using electrosurgery but was statistically not significant.[5] Many studies have highlighted the benefits of diathermy in giving skin incisions[6] but very few studies could be found demonstrating its use in intraoral mucosal incisions[7]. Hence the rationale of this study.

The current study aims to assess the effects on incisional time, blood loss, post-operative pain and wound healing of vestibular incision made with electrocautery and scalpel in open reduction and internal fixation of mandibular fractures.

II. Materials And Methods

This hospital-based prospective observational study aimed to evaluate the impact of vestibular incisions made by electrocautery versus scalpel for open reduction and internal fixation of mandibular fractures. Conducted in the Department of Oral and Maxillofacial Surgery at Government Dental College, Kozhikode, the study spanned from January 2020 to September 2022 and clearance from the Institutional Ethical Committee was obtained before the study.

The study aimed to detect a clinically significant difference of 20% with a 5% level of significance and 80% power, requiring a minimum of 30 subjects in each group. Inclusion criteria encompassed ASA I patients aged 18-60 requiring vestibular incision for open reduction and internal fixation of mandibular fractures spanning in between one angle to the other. Exclusion criteria comprised medically compromised patients and those with a smoking habit. Proper case history and Informed consent were obtained. The patients were randomly assigned to two groups of 30 patients each - Group A: Scalpel incision, Group B: Electrocautery incision. The procedure was explained to the patient in the patient's own language. They were allowed to withdraw from the study at any given time. After informing the patients, informed procedural consent were was taken with a detailed case history, routine blood investigations and radiographs investigations. All the surgeries were done by one experienced surgeon.

Following parameters were compared:
1. Duration of incisional time in second.
2. Incisional blood loss using Gauze Visual Analogue[20],
4. Pain on 1st, 3rd and 7th post-operative day based on Visual Analogue Pain scale.
5. Wound healing on 1st, 3rd and 7th postoperative day based on Southampton scoring system.

Method of data collection
1. Length of incision: A sterile flexible ruler was used to measure the length of incision in mm for every case.
2. Duration of incisional time: A digital stop clock was used to estimate the duration of the procedure. The duration was calculated in seconds. The stop watch was started from the beginning of incision and stopped after the completion of incision in the both group.
3. Incisional blood loss: Incisional blood loss was estimated using Gauge Visual Analogue. A Sterile gauze pad of 10 x 10 cm^2 was used to stop the bleeding and achieve hemostasis for every case. No suctions were used during the procedure.
4. Post-operative pain: Post-operative pain was evaluated using Visual Analogue Pain scale on day one, three and seven day post-operatively using a score of 0 – 10; 0 being no pain and 10 being the worst pain.
5. Wound healing: Wound healing was evaluated on day one, three and seven postoperatively using Southampton Grading system where Grade 0 is normal healing, Grade I is normal healing with mild bruising or erythema, Grade II erythema plus other signs of inflammation, Grade III Clear or haemoserous discharge, Grade IV is pus at one point or along the wound, Grade V is deep or severe wound infection.
Data were analysed using Student t test

III. Result

A total of 60 patients were included in the study, 30 were in group A and 30 were in group B. Age distribution in both the groups was similar. All of the patients were male in both the groups. (Table 1)

Table 1: Demographic profile and case distribution.

	Group A	*Group B*	*P value*
Age	27.2±7.6	24±5.06	0.06115

Table 2: Comparison of incisional length in mm

	Group A	*Group B*		
	(mean±SD)	(mean±SD)	P value	CI
Incisional Length (In mm)	51.3±4.66	52±6.544	0.6352	-3.6431 to 2.2431

There was no statistically significant difference in incision length between the two groups (51.3±4.66 mm in group A whereas 52±6.544 mm in group B), p value=0.6352.(Table 2)

Table 3: Comparison of incisional time in seconds

	Group A	*Group B*		
	(mean±SD)	(mean±SD)	P value	CI
Incisional time(in sec)	133.9±14.82	116.9±21.55	0.008106	7.4130 to 26.5899

There was statistically significant difference in incision time between the two groups (133.9±14.82 sec in group A whereas 116±21.55 sec in group B), p value=0.0081 (Table 3)

Table 4: Comparison of Blood loss in ml

	Group A	*Group B*		
	(mean±SD)	(mean±SD)	P value	CI
Blood loss(in ml)	4±1.43	3±0	0.006723	0.46289 to 1.53710

There was statistically significant difference in blood loss between the two groups (4±1.43 ml in group A whereas 3±0 ml in group B), p value=0.0067. (Table 4)

Table 5: Comparison between post-operative pains

	Group A	*Group B*		
Post-op pain	(mean±SD)	(mean±SD)	P value	CI
Day 1	3.7±1.02	2.9±0.711	0.0009	-1.256 to 0.343
Day 3	1.7±0.46	1.5±0.50	0.117	-0.452 to 0.052
Day 7	0±0	0±0	NA	NA

There was statistically significant difference in post-operative pain on day one between the two groups (Day one: 3.7±1.02 in group A whereas 2.9±1.0.711 in group B), p value=0.0009. Also no statistically difference in post-operative pain on day third and day seven, (Day third: 1.7±0.46 in group A whereas 1.5±0.50 in group B), p value=0.117, Day seventh: 0±0 in group A whereas 0±0 in group B), p value=NA: all patients had no pain on seventh day. (Table 5)

Table 6: Comparison of Wound Healing

	Group A	Group B		
Wound Healing	(mean±SD)	(mean±SD)	P value	CI
Day 1	1±0	0.966±0.413	0.6624	-0.1211 to 0.1878
Day 3	1.1±0.305	0.9±0.305	0.0138	0.0422 to 0.3577
Day 7	0.9±0.305	0.8±0.406	0.2863	-0.0861 to 0.2861

There was no statistically significant difference in wound healing in between the two groups (Day one: 1±0 in group A whereas 0.966±0.413 in group B), p value=0.6624, Day third: 1.1±0.305 in group A whereas 0.9±0.305 in group B), p value=0.0138, Day seventh: 0.9±0.305 in group A whereas 0.8±0.406 in group B), p value=0.2863.(Table 6)

IV. Discussion

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[10]. To obviate the inherent disadvantages of steel scalpel, surgical diathermy was introduced at the beginning of the 20th century. 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[13].

Human studies comparing scalpel and electrocautery incisions have predominantly been reported in the general surgery literature. Kearns and colleagues[26] employed a randomized clinical study design to compare

diathermy and scalpel incisions in patients undergoing elective midline laparotomy. Outcomes of incision time, wound size, blood loss, postoperative pain, and complication rate were compared. They reported electrocautery to have superior results in terms of incision time, blood loss, and postoperative pain when compared with the steel scalpel.

The aim of this study was to assess the effects of vestibular incision made with electrocautery and scalpel in open reduction and internal fixation of mandibular fractures in terms of incisional time, blood loss, post-operative pain and wound healing.

Operating time

In this study, the mean operating time from incision to reflection of the mucoperiosteal flap in electrocautry group patients was substantially shorter (p=0.0081) than in stainless steel scalpel group patients. Similarly Liboon et al[10] in mucosal tissue of swine in 1997 and Sharma et al[15] (2012) in human for pre-prosthetic and impacted lower molar surgeries found that operating time for electrocautery was significantly less compared to scalpel. And Bhatsange et al[18] in 2016 compared scalpel, electrocautery, and diode laser in making mucosal incision and found that mean time taken by electrocautery and laser was less compared to scalpel ($P < 0.001$). Other researchers such as Kumar et al[13], Ayandipo et al[16], Talpur et al[6] and Yadav et al[27]have observed similar finding in making skin incisions.

Blood Loss

Rathofer et al[8] in 1985 used blade loop knives and electrosurgery for excision of palatal inflammatory papillary hyperplasia and observed that although electrosurgery did not produce total hemostasis but found substantially less hemorrhage with it than with blade surgery. Sharma et al[15]reported that the mean blood loss for electrosurgery was very less (1.5858 ml) as compared with scalpel surgery (4.1619 ml), ($p < 0.001$). Nagargoje et al[24] in 2019 reported that the mean blood loss for electrocautery (7.9100 ml) was less than that of stainless steel scalpel (13.3225 ml) (highly significant $P < 0.001$) while making mucoperiosteal incision for mandibular anterior fractures. Haser et al[17] also reported that hemostasis was better in electrocautery group. Similar finding were reported in making skin incisions by Chau et al[11] in bilateral neck dissections, Nandurkar VS et al[23]inelective abdominal surgery, Kumar et al[13] in head and neck carcinomas, Ayandipo et al[16]and Talpur AA et al[6] in elective general surgical procedures.

In this study, the mean blood loss for electrocautery was less than that of stainless steel scalpel (highly significant $P < 0.0008$).

Post-operative pain

Farkhunda Mazher et al[25] reported that in their study post-operative pain was significantly low (p=<0.001, <0.001 and 0.001) at day 1, 3 and 7 respectively in diathermy group patients as compared to stainless steel scalpel group patients. Nagargoje et al[24] also reported that 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. In one study by Kearns and colleagues[26] it was found that diathermy produces significantly less postoperative pain on the first and second postoperative day when compared to scalpel incisions in elective midline laparotomy. There was no significant difference in pain of both groups on subsequent days. Talpur et al[8] also reported that in their study that post–operative pain was significantly higher in scalpel incision on day one, day two and day five than electrocautery. Nandurkar VS et al[23] in their study found, postoperative pain was significantly higher in scalpel group (p value <0.05) on postoperative day 1.

However in the study conducted by Aremband et al[28] found that pain following the gingivectomy by electrocautery and knives was insignificant and experienced equally after both surgical modalities. Sharma et al[15] reported that pain following pre-prosthetic and impacted lower third molar surgeries were comparable in both scalpel and electrocautery group. In a study conducted by Pearlman et al[9], observed that there was no difference between the laser-treated group and the scalpel-treated or electrosurgery treated groups in objective pain in elective cholecystectomy.

In our study the post-operative pain was significantly more on day one in scalpel group compared to electrocautery group(p value = 0.00091) and slightly more in scalpel than electrocautery group on day third (mean 1.7 and 1.5 respectively) but it was not statistically significant in both the groups on day third (p value =0.117). There was no complaint of pain on day seventh in both the scalpel and electrocautery groups.

Wound Healing

Morosolli et al[12] in 2009 conducted a study on histomorphologic and histomorphometric analysis of healing process after surgical treatment with scalpel, electrocautery and laser radiation in eighty hamsters of both sexes and examined at postoperative days 7, 14, 21. In the histological analysis it was observed that the dynamics of the healing process was faster in the group treated by scalpel than in the other groups. The histomorphometric

analysis showed progress in the density of the skeletal muscle fibers during the healing process in all the groups; however, it increased significantly in the scalpel group in comparison with the other groups during the 14-day period.

Farkhanda et al[25]in their study found that healing of tissue was significantly better (p=0.040) at day 1 and non-significant (p=0.648 and 0.557) at day 3 and 7 respectively in diathermy group patients as compared to stainless steel scalpel group patients. Similar result was reported by Nagargoje GL et al[24]that significant difference between first 48 hours and the non-significant difference at first week and first month in diathermy group and stainless steel scalpel group. P U Abdul Wahab et al7 showed that there is a statistically significant difference between scalpel and diathermy incisions in reducing postoperative wound healing complications in mucosal incisions (P<0.001).Sharma et al15 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

Kumar V et al[13] in their study compared scalpel and surgical diathermy incision in elective operations of head and neck cancer. They concluded that there was no change in wound complication rate and surgical diathermy was safe and as effective as scalpel during elective skin. Pearlman et al[9] reported that the postoperative wound healing was the same in the scalpel, electrosurgery, and carbon dioxide laser group. Rathofer et al[8] reported that healing occurred at approximately the same rate in both the electrosurgery and blade loop knife groups.
In this study wound healing was not statistically significant in both scalpel and electrocautery groups.

V. Conclusion

From present study, we can conclude that electrocautery is better than the scalpel in relation to time taken for incision, intraoperative blood loss and early postoperative pain. But there is no significance differences in terms of late post-operative pain and wound healing between scalpel and electrocautery. Hence an electrocautery can be used for making mucosal incisions for better hemostasis and comparatively shorter operative time than a scalpel.

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