



Evaluation of the effect of internal and external osteotomy on the amount of mucosal rupture, edema, and ecchymosis in rhinoplasty

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ABSTRACT

Lateral osteotomy is a major part of rhinoplasty for remodeling external facet of the nose and narrowing of nasal base and dorsum after removal of the hump with the edema and ecchymosis being the major sequels of the operation. The present study compared post-operative edema and ecchymosis and mucosa tears between internal and external osteotomy techniques.

Materials and Methods: In a prospective double-blind randomized clinical trial, 20 cases underwent internal and 20 cases underwent external lateral osteotomies from the candidates of rhinoplasty in the Gundi Clinic. Mucosal tears were measured by millimeters and edema and ecchymosis severity were scored by a 4-scaled measure on 7 days after surgery. Mucosal tears of the groups were analyzed by Exact Fisher test while the edema and ecchymosis scores of both groups were subjected to Mann-whitney U test.

Results: In the internal and external techniques; 6 (30.0%) and 4 (20.0%) showed mucosal tears on both sides respectively. In the right sides of the patients underwent internal osteotomy; the edema and ecchymosis grades of +, ++, +++ and ++++ were observed in 1 (5.0%); 9 (45.0%); 8 (40.0%) and 2 (10.0%) while these values were 2 (10.0%); 8 (40.0%); 8 (40.0%) and 2 (10.0%) in the left sides in these patients. In the right sides of the patients in external group; edema and ecchymosis grades of +, ++, and +++ were shown in 3 (15.0%); 12 (60.0%); and 5 (25.0%) while the values were 4 (20.0%); 11 (55.0%); and 5 (25.0%) in the left sides of them. Although with lower grades of associated complications in the external technique; no significant differences were observed between 2 modalities.

Conclusion: Although with no significant differences; external osteotomy seems to be the approach of choice for the plastic surgeries of the nose and correction of bone deformities due to the lower values of edema and ecchymosis and mucosal tears as well as the simple performance of the technique.

Key words: Rhinoplasty, Internal lateral osteotomy, External lateral osteotomy, Mucosal tears, Edema and ecchymosis.

Introduction

Rhinoplasty is one of the most common plastic surgeries. Rhinoplasty is an accurate surgical treatment in which the difference between a good and bad result may be 1 to 2 millimeters [1, 2]. Moreover, lateral osteotomy is a part of surgery in all complete rhinoplasties after modification of nasal hump and tip, whose precise performance is very effective on the fi-

nal results. Its goal is to narrow nasal dorsum after hump correction and reducing the width of nasal base pyramid and softening of nasal bones. Thus, osteotomy is an unavoidable part of rhinoplasty and is used in avoidable part of rhinoplasty and is used in most patients and different modifications in different ways. On the other hand, most complications of rhinoplasty occur in lateral osteotomy

and the least control can be applied in this part of rhinoplasty [3]. Lateral osteotomy can be applied in various way, internal and external lateral osteotomy are more prevalent [3].

Many improvements have been offered to provide methods which can be predictable, accurate, and repeatable [4] among which Chisel Plough, Saw, and Osteotomy can be mentioned [5]. It is better that osteotomy be delayed until the last part of surgery so that splint would be placed rapidly. Osteotomy provides the possibility to narrow nasal pyramid after hump is removed and open roof is established. Achieving symmetry and removing curves in nose and smoothing convex surface of the nose is the base of an osteotomy in proper place and with proper method [3]. To determine best treatment method, it is important to be aware of different osteotomy methods (Internal continuous and external perforated). The nasal bone fracture stability, airway volume reduction, bleeding, edema, and ecchymosis are different in osteotomies and mucosal torsion may delay resolution of tissue, ecchymosis and swelling and also patient's mental status and coming back to the society. Moreover, awareness of effectiveness of different types of osteotomy in mucosal torsion will be helpful [6].

Subsequent edema and ecchymosis to rhinoplasty are two common complications about which patients may be concerned. Presence of ecchymosis in nasal region affect cosmetic results of the surgery and nasal edema may last longer than usual and lead to surgeon and patient dissatisfaction. Using fine tissue surgery techniques in correct surgery plan [7-9], minimal trauma surgery [10, 11], prevention of hypertension in the surgery, using injectable local solution for nasal vasoconstriction [12] before surgery and appropriate position of patients after the surgery have been suggested to reduce these complications. Current study is intended to compare internal and external osteotomy regarding amount of mucosal torsion, edema, and ecchymosis in patients undergoing rhinoplasty.

Methods and Materials

In this prospective randomized double-blinded clinical trial, Iranian patients undergoing rhinoplasty in a private clinic (Gandi Clinic) by an oral and maxillofacial surgeon were continuously selected and evaluated. Patients included in this study did not have any acute uncontrolled systemic disease such as hypertension, diabetes, liver disorders, lung disorders, respiratory system diseases, allergic rhinitis, history of receiving anti-hypertensive, anti-coagulation, anti-depressant

medications and did not take alcohol and cigarette. They have not experience nasal trauma or surgery on the nose. Moreover, they did not have severe problems in their nasal structure (such as very thick skin, severe septum deviation, septum perforation, severe fracture due to trauma). Finally, we tried that match the two groups regarding mean age and gender of patients. 40 rhinoplasty candidate were divided into two group to perform osteotomy, so that 20 patients underwent internal osteotomy bilaterally (collectively 40 internal osteotomy) and 20 patients underwent external osteotomy bilaterally (collectively 40 external osteotomy). The number of patients were chosen based on equipment and duration of the study as well as number of samples in previous studies. Patients referring to Gandi clinic for rhinoplasty, gave written consent after being informed about the procedure. For this purpose, samples were divided into A and B group using randomized table.

In Group A (internal osteotomy), the following actions were performed in order:

1. Patient underwent general anesthesia.
2. After primary preparations for surgery, local anesthesia with lidocaine and epinephrine 1/100000 in nasal septum, tip of nose, supra trochlear artery and osteotomy position.
3. 7 minutes after local anesthesia, open rhinoplasty surgery was performed in the following order:
 - a. Columellar incision
 - b. Skeletization
 - c. Septoplasty
 - d. Removing cartilage from septum
 - e. Hump Resection
 - f. Tip-plasty
 - g. Internal osteotomy
 - h. Dressing including placement of internal and external splint

In Group B (external osteotomy), the following actions were performed in order:

1. Patient underwent general anesthesia.
2. After primary preparations for surgery, local anesthesia with lidocaine and epinephrine 1/100000 in nasal septum, tip of nose, supra trochlear artery and

osteotomy position.

3. 7 minutes after local anesthesia, open rhinoplasty surgery was performed in the following order:

- a. Columellar incision
- b. Skeletinization
- c. Septoplasty
- d. Removing cartilage from septum
- e. Hump Resection
- f. Tip-palsty
- g. External osteotomy
- h. Dressing including placement of internal and external splint

During the operation, blood pressure was maintained between 5-7 cmHg (diastolic pressure) and 8-10 cmHg (systolic pressure). Unless, the patient was excluded from this study. In this study, to perform osteotomy, nasal pyramid was broken by the pressure of finger of surgeon and Denver internal and external splint was placed with 10 cm mesh bilaterally. In internal osteotomy, after making a 3 mm incision in Piriform area inside the nose, the periosteum was detached from bone, using guarded Osteotom and hammer, osteotomy was continued to internal contuse. In external method, a 3 mm incision was made on the skin of nose bilaterally, using a Chisel Ploughs Osteotom, osteotomy was performed in bone prominence on the sides of nose form Piriform area to internal contuse was performed. Incision was sutured with nylon zero.

All patients were suggested to have 35 degrees head angle and use ice pack every 10 minutes for 24 hours. Patients were similarly instructed to use ice packs. Medical therapy of patients were the identical in the first day and included 3 doses of 8 mg Dexamethasone daily and 1 g acetaminophen 4 times a day and 1 g Cefazolin 4 times a day. After 5 days, mesh and internal splint were removed and after 7 days, external splint was removed as well.

Follows

Edema and bruising +: when internal one third of inferior eyelid is involved.

Edema and bruising ++: when internal two third of inferior eyelid is involved.

Edema and bruising +++: when the whole inferior eye-

lid and internal one third of superior eyelid is involved.

Edema and bruising ++++: when the whole inferior and superior eyelids and the preiorbit area involved.

Moreover, amount of mucosal torsion after osteotomy was assessed via direct vision using sturs endoscope and measuring clipper by a resident who was not aware of the type of osteotomy and was reported in mm.+++++

Frequency of edema and ecchymosis degrees post operation and nasal mucosa torsion 7 days after surgery were determined and reported in two internal and external osteotomy groups. Edema and ecchymosis degrees of two groups and amount of mucosa torsion were statistically evaluated by Mann-Whitney U and Exact Fisher tests, respectively.

Results

Average age were and in internal osteotomy and external osteotomy groups respectively. There were 21 female (52.5%) and 19 male (47.5%) patients, collectively. Internal osteotomy group consisted of 11 female (55.0%) and 9 male (45.0%) patients and external osteotomy group consisted of 10 female (50.0%) and 10 male (50.0%) patients.

In internal osteotomy group, 14 patients (70.0%) did not have mucosal torsion on the left side and 6 patients (30.0%) had mucosal torsion in this side. In external osteotomy group, 16 patients (80.0%) did not have mucosal torsion and 4 patients (20.0%) had mucosal torsion (Table 1). According to the results of Exact Fisher test, there was no significant difference between internal and external osteotomy groups in this regard ($p=0.72$), though lack of torsion was more common in external osteotomy method. In other words, mucosal torsion probability is estimated to be lower in external osteotomy, though this difference was not significant.

In internal method, of 6 patients with mucosal torsion, 5 cases (83.3%) had 2 mm mucosal torsions and 1 case (16.7%) had 5 mm mucosal torsion. Moreover, in external method, of 4 patients with mucosal torsion, 3 cases (75.0%) had 2 mm mucosal torsions and 1 case (25.0%) had 3 mm mucosal torsion.

In internal osteotomy group, 14 patients (70.0%) did not have mucosal torsion on the right side and 6 patients (30.0%) had mucosal torsion in this side. In external osteotomy group, 16 patients (80.0%) did not have mucosal torsion and 4 patients (20.0%) had mucosal torsion (Table 2). There was no significant differ-

ence between internal and external osteotomy groups in this regard ($p=0.72$), though lack of torsion was more common in external osteotomy method. In other words, mucosal torsion probability is estimated to be lower in external osteotomy, though this difference was not significant.

In internal method, of 6 patients with mucosal torsion, 4 cases (66.7%) had 2 mm mucosal torsions, 1 case (16.7%) had 3 mm mucosal torsion, and 1 case had 5 mm mucosal torsion. Moreover, in external method, of 4 patients with mucosal torsion, 1 case (25.0%) had 1 mm mucosal torsion, 2 cases (50.0%) had 2 mm mucosal torsion, and 1 case (25.0%) had 3 mm mucosal

torsion.

Edema and ecchymosis frequency for both methods are presented in Table 3 and 4 for right side and left side, respectively. Although edema and ecchymosis degrees were somehow lower in external osteotomy group compared with internal osteotomy, according to Mann-whitney U test, no significant differences was observed both on right side ($p=0.09$) and left side ($p=0.11$).

Table 1. Frequency of mucosal torsion on the left side after internal and external osteotomy surgery.

Osteotomy method mucosal torsion	Positive	Negative	Total
Internal	14 (70.0%)	6 (30.0%)	20 (100.0%)
External	16 (80.0%)	4 (20.0%)	20 (100.0%)
Total	30 (75.0%)	10 (25.0%)	40 (100.0%)

Table 2. Frequency of mucosal torsion on the right side after internal and external osteotomy surgery.

Osteotomy method mucosal torsion	Positive	Negative	Total
Internal	14 (70.0%)	6 (30.0%)	20 (100.0%)
External	16 (80.0%)	4 (20.0%)	20 (100.0%)
Total	30 (75.0%)	10 (25.0%)	40 (100.0%)

Table 3. Frequency of edema and ecchymosis on the right side in patients after internal and external osteotomy.

Osteotomy method grade of edema and ecchymosis	+	++	+++	+++++	Total
Internal	1 (5.0%)	9 (45.0%)	8 (40.0%)	2 (10.0%)	20 (100.0%)
External	3 (15.0%)	12 (60.0%)	5 (25.0%)	0 (0.0%)	20 (100.0%)
Total	4 (10.0%)	21 (52.5%)	13 (32.5%)	2 (5.0%)	40 (100.0%)

Table 3. Frequency of edema and ecchymosis on the left side in patients after internal and external osteotomy.

Osteotomy method grade of edema and ecchymosis	+	++	+++	+++++	Total
Internal	2 (10.0%)	8 (40.0%)	8 (40.0%)	2 (10.0%)	20 (100.0%)
External	4 (20.0%)	11 (55.0%)	5 (25.0%)	0 (0.0%)	20 (100.0%)
Total	6 (15.0%)	19 (47.5%)	13 (32.5%)	2 (5.0%)	40 (100.0%)

Discussion

According to the results of current study, the amount of mucosal torsion and degrees of edema and ecchymosis was to some extent lower in patients who underwent external osteotomy compared with patients who underwent internal osteotomy; although the difference was not significant. On the right side, edema and ecchymosis ++++ did not exist in external group and the frequency of edema and ecchymosis + and ++ were lower than internal group. Despite this fact, the difference was not significant. Maybe by evaluating higher number of patients, significant difference could be observed. On the left side, degrees of edema and ecchymosis was to some extent lower in external group compared with internal group, although the difference was not statistically significant.

Severe ecchymosis and edema are one of the complications of rhinoplasty which may cause blindness in more severe cases [6]. Thus, it is necessary that a method be chosen with lowest probability of ecchymosis and edema, since lateral nasal osteotomy is a part of rhinoplasty that should be performed. In Kara et al. study (2001), ecchymosis and conjunctiva bleeding was observed in 19.1% of patients [6]. So we should try to reduce this complication of lateral nasal osteotomy. Post operation edema and ecchymosis are the most common complication of patients [14, 15, 16]. Although these complications does not make patients feel pain, due to changes on shape and difficulty for presence in the society, it has been a source of anxiety. Sometimes skillfulness of the surgeon is measured by taking these complications in account by ordinary people [10]. Different factors affect the frequency of edema and ecchymosis, one of the most important of them is type of osteotomy and different methods of osteotomy and medical treatments have been suggested for reducing them [17-19].

In some studies, lower complications in external osteotomy is insisted on compared with internal osteotomy. Khakzad (2004) evaluated internal and external osteotomy methods and reported that severe edema and ecchymosis is 16% and 3.1% percent in internal osteotomy and external osteotomy, respectively (20).

In Shirani et al study (2014) on the evaluation of complications of internal and external osteotomy in primary rhinoplasty surgery with open roof method, swelling and ecchymosis were reported to be significantly lower for external osteotomy compared with internal osteotomy at different times after the surgery

and it has been concluded that external osteotomy is safe technique with proper results [21].

On the other hand, Hashemi et al. (2005) compared the severity of edema and ecchymosis in internal and external osteotomy and reported that in the first day after surgery, edema and ecchymosis was significantly lower in external osteotomy method. Also, ecchymosis severity 7 days after surgery has been lower in external osteotomy and the difference was significant [22].

In Gryskiewicz and Gryskiewicz survey (2004) when comparing clinical results of perforating and continuous methods in nasal osteotomy, researchers showed that perforated osteotomy technique lower the severity of edema and ecchymosis after the surgery [23]. Results of these studies is consistent with the results of current study.

According to the results of current study; in the internal method, 70.0% of cases did not have mucosal torsion on the right or left side and 30.0% had mucosal torsion. Despite identifying significant differences, the frequency was to some extent higher in internal method.

In Kilic et al. study (2015), the frequency of edema and ecchymosis was reported in short and long term after the surgery in 4% of the patients who have undergone internal lateral osteotomy. While no mucosal torsion was observed in patient with external osteotomy [24]. Moreover, Sinha et al (2006), assessed the results of two external and internal osteotomy method and reported that 100% of the patients undergoing internal osteotomy showed mucosal torsion while only 30% of patients who underwent external osteotomy showed mucosal torsion [25].

Also, Giacomarra et al (2001). Assessed the results of rhinoplasty results on 142 patients and 4 cadavers and showed that edema and ecchymosis was more common in those who have undergone internal osteotomy compared with those who have undergone external osteotomy [26].

Lower frequency of edema and ecchymosis in external treatment group compared with internal osteotomy can be result of less tissue trauma. Since in external technique, osteotomy is performed green stick and perforated. No effort is done to separate periosteum from bone. Protecting periosteum in external osteotomy can help control of the osteotomy pieces and subsequent lower complications such as hemorrhage, edema and ecchymosis [16]. Since external osteotomy resulted

in less mucosal torsion, related ecchymosis and edema were less common [16].

On the other hand, in external osteotomy, without separating the periosteum be required, multiple bone microfractures are made and thus, by the pressure of finger, fracture is put in new position. External osteotomy method is associated with less hemorrhage which not only saves periosteum but also angular vein and artery. Ostum special movement to reach the bone puts vessels out of the way and reduces the risk of hemorrhage [25, 29]. In external method, less damage is done to nasal mucosa which is associated with less edema (25). In external osteotomy, it is not always necessary to penetrate all the bone width. This way, the risk of damaging nasal mucosa is reduced which may explain why edema and ecchymosis is less frequent in external osteotomy [26, 29].

Method of external osteotomy was first performed by Gorla in 1955 and was welcomed by surgeons [18]. This was because it was highly precise and provided high control and lesser tissue and mucosa damage [23, 26]. Simultaneously, using internal method by using microosteotomy was used by some surgeons and it was reported to be highly accurate and associated with lower edema and ecchymosis [30]. Denny and Tardy (1984) used 2-3 mm osteotomy for internal osteotomy and reported that this was associated with lower hemorrhage and edema [15].

Yücel (2005), evaluated internal and external osteotomy and reported that edema degrees 2 and 7 days after surgery and ecchymosis 7 days after surgery were similar. Though, ecchymosis degree was significantly lower in internal continuous method (compared with external method) [10]. Results of 4 this study is not consistent with current study about ecchymosis 2 days after surgery; since all complications including edema and ecchymosis were less frequent in external method compared with internal method 7 days after the operation.

Conclusion

Although significant difference was not observed, due to less edema and ecchymosis and mucosal torsion in external osteotomy and being more easily performed compared with internal osteotomy, external osteotomy is suggest for rhinoplasty surgeries and bone deformity correction surgeries.

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