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Visualized Subperiosteal Internal Lateral Osteotomy in Open Rhinoplasty for Improved Recovery and Outcome

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ABSTRACT

Background: Many techniques are described for performing lateral osteotomies with the external perforating and the continuous internal methods being the most common. Osteotomy remains challenging, being done blindly and associated with morbidities. In this study a new simple approach for lateral osteotomy is described. This technique aims at achieving more precise osteotomy outcomes with a short learning curve and with morbidity reduction, in terms of edema and ecchymosis.

Patients and Methods: A prospective, single-arm case series study is conducted on 20 patients seeking primary rhinoplasty. A periosteal incision is done and subperiosteal dissection is performed at the level of the proposed osteotomies. The osteotome is anchored under vision to the edge of the nasal bone and the osteotomy is performed along the proposed site till the radix. Follow-up visits with photography are at day two, day ten then at three weeks, two months, and three months.

Results: Upon assessing the post-operative course of our cases, sixteen patients (80%) developed grade I edema, which resolved completely by the 3rd post-operative day. Eighteen patients (90%) did not complain of any ecchymosis in the post-operative period. An accelerated learning curve was noticed through shorter intraoperative time 42% downtime, easy replication of technique and better results.

Conclusion: This technique of lateral osteotomies enables a higher degree of control for the fracture line with short learning curve and easy reproducibility. Furthermore, the amount and the duration of post-operative complications in terms of edema and ecchymosisare minimal.

Key Words: *Rhinoplasty – Osteotomy – Subperiosteal – Internal.*

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Consent: Patients provided verbal and written consent for their participation in the study.

INTRODUCTION

Rhinoplasty remains one of the technically demanding procedures in plastic surgery. Although the performance of osteotomy seems simple in theory, making an accurate cut in nasal bones is tricky in practice with some unacceptable results. Several instruments have been used for the osteotomy, such as chisels, hammers, and occasionally saws. The use of these instruments has led to an increased incidence of edema and ecchymosis postoperatively **[1]**. Diverse studies were done with the objective of finding the best technique that aids in reducing morbidity when it comes to edema and ecchymosis. Osteotomy can either be performed via external percutaneous or internal way.

Lateral osteotomies can be performed through trans-nasal, percutaneous or intraoral approaches. Some surgeons find the percutaneous approach allows better controlled fractures and decreases deep tissue trauma. Others advocate the intranasal approach as they claim it minimizes morbidity and avoids possible scarring. The complication of incorrectly performed osteotomy can lead to a poor esthetic outcome, rocker deformity as well as poor functional outcomes. Problems that are technically demanding to correct **[4]**.

Lateral osteotomies can result in a significant amount of periorbital swelling and ecchymosis, especially if the angular vessels are injured. Several techniques have been adopted to decrease postoperative edema and swelling. Denecke performed lateral osteotomies with angulated saw through the inter-cartilaginous incision **[5]**.

Many studies suggested that periosteal preservation may decrease eyelid edema and ecchymosis **[13,14]**.

The preservation of as much as possible of periosteum and lateral suspensory ligaments of the lower lateral cartilage can help to lower the incidence of postoperative airway obstruction. From a functional point of view, the surgeon must consider the possible effects of osteotomy on the patient's airway **[2,3]**.

Osteotomy remains challenging, being done blindly and associated with morbidities. In this study a new simple approach for lateral osteotomy is described.

This technique aims at achieving more precise osteotomy with a short learning curve and decreased morbidity, in terms of edema and ecchymosis.

PATIENTS AND METHODS

The study is a prospective, single-arm case series study. The study adopts the globally accepted standards of GCP and in conformity with the latest revision of the Declaration of Helsinki. Besides, it conforms to national laws and regulations and has been approved by the Local Ethics Committee.

The study is conducted on 20 patients coming to Kasr Al-Ainy University Hospital, Plastic Surgery Department, Faculty of Medicine, Cairo University, from August 2018 till March 2019. Only cases of primary rhinoplasty are included in the study. Cases of redo rhinoplasty and post traumatic nasal deformities are excluded from the study. We obtain detailed medical history and examination from all patients. Informed consent is taken from all patients.

The purpose of this study is explained to all subjects before their enrollment, and all of those enrolled sign an informed consent form.

A detailed history is obtained from patients, including personal data, previous surgeries, and drug allergies. Full functional and aesthetic nasal analysis are performed during the examination as part of the preoperative preparation. Frontal, lateral, oblique and basal views are all analyzed. Frontal view analysis includes facial proportions, skin quality, asymmetry and nasal deviation, septal deviations, dorsum of the nose, the broadness of nasal bones. The basal view shows basal width, caudal septal deviation, nasal projection and columella. Nasal hump and its relation to broad nose are viewed laterally and obliquely.

Photography is performed pre-operative, intra-operative, and post-operative. Follow-up visits are at day two, day ten then at three weeks, two months, and three months. Pre and post-operative views include frontal, basal, lateral, and oblique views.

Operative details:

All cases are done under general hypotensive anesthesia with oral intubation. One dose of IV cefazolin is given to all patients 30 minutes before surgical intervention. The patient is placed supine on the operative table with the head tilted up. Injection of 10ml saline solution with epinephrine (1:100,000) is done by insulin syringeover the radix till the tip of the nose and at the proposed incision lines.

Through a trans-cartilaginous approach, columellar V-shaped incision is performed and the nasal elements are addressed according to the proposed pre-operative plan. Nasal osteotomies are performed as the last step to decrease the bleeding that could obscure the surgical field.

Technique: At the level of the cranial end of the upper lateral cartilage, the edge of the nasal bone is identified. A slit incision using a number 11 blade is done in the periosteum. A 2mm periosteal elevator is then introduced to dissect the periosteum from the nasal bone 2-3mm wider than the line of the proposed osteotomy. The two-millimeter osteotome with ball guard is introduced through the incised periosteum and anchored over the edge of the nasal bone. Osteotomy is done along the proposed line till the radix where external compression over the nasal bone creates a green-stick fracture. The bone is manipulated into the desired position and the same procedure is repeated on the opposite side. A nasal metal splint and nasal pack are inserted. (Figs. 1-3).

Post-operative care:

In the post-operative period, the patients are placed in semi-sitting position for the first 24 hours and then advised not to lie flat until edema subsides for one to 2 weeks. A single dose of IV cefazolin is prescribed 12 hours postoperatively. The nasal packs are removed after 24 hours. Post-operative bleeding, edema, or ecchymosis are regularly checked throughout the postoperative course. Patients are brought for adjustment with tightening of the splint after 48-72 hours. The nasal splint is removed after ten days to two weeks. Follow-up visits are scheduled after the first week as follows: 3 weeks, two months, and three months.

The outcome of the technique has been evaluated by multiple parameters: The effectiveness and

reproducibility of the technique, the post-operative complications related to osteotomy as the periorbital edema and ecchymosis. Post-operative eyelid edema is assessed according to the grading system introduced by Kara and Gokalan in 1999 to assess periorbital edema and ecchymosis. (Fig. 4) **[12]**.

The post-operative ecchymosis is assessed according to the following grading system dividing it into three grades. Grade 1, ecchymosis is up to the medial 1/3 of lower and/or upper eyelid. Grade 2, ecchymosis is up to the medial 2/3 of lower and/or upper eyelid. Grade 3, ecchymosis is up to the full length of the lower and/or upper eyelid. (Fig. 5) **[12]**.

Intraoperative time is measured for osteotomy step performed for the first time by the surgeon. This has been compared to intraoperative time of osteotomy step of each surgeon performed by their usual technique. Junior surgeons are asked postoperatively about their comfort of reproducing the technique alone.

{VIDEO}

https://drive.google.com/file/d/1X50y9LFoxoyBn9S03sXVFHkti0Tqy9BW/view?usp=sharing

Fig. (1): Showing internal lateral osteotomies performed through the open rhinoplasty approach.

Fig. (2): Showing internal lateral osteotomies performed through the open rhinoplasty approach.

Fig. (3): Showing internal lateral osteotomies performed through the open rhinoplasty approach.

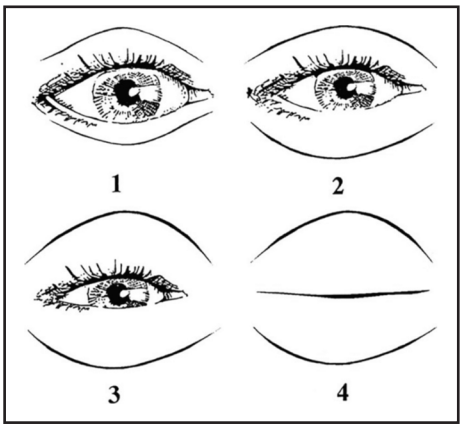

Fig. (4): Scoring diagram for edema. Grade 1, no coverage of iris with eyelids. Grade 2, slight coverage of iris with swollen eyelids. Grade 3, full coverage of iris with swollen eyelids. Grade 4, full closure of eyes.

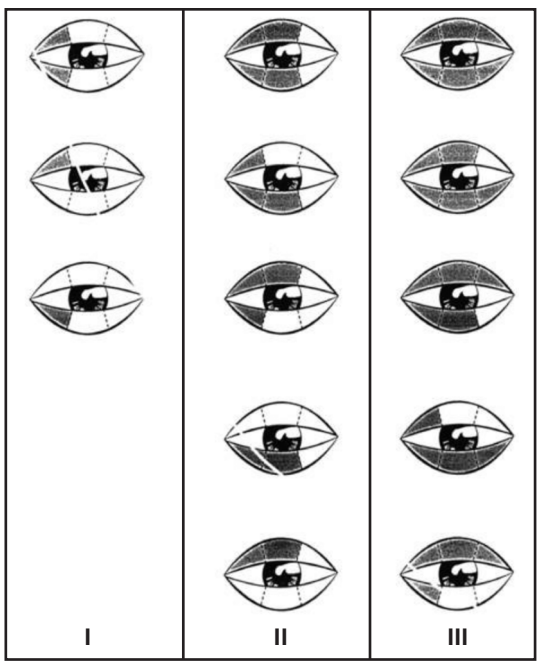

Fig. (5): Scoring diagram for ecchymosis.

RESULTS

The study includes 20 patients (4 males and 16 females) with a mean age of 30 years (18-48). The duration of the procedure ranged between 90 and 120 minutes. The technique is reproducible with accurate identification of the osteotomy lines under direct visualization through the open rhinoplasty approach.

In this study, both the duration and the amount of eyelid edema are assessed. Sixteen patients developed grade I edema, which resolved totally by the 3rd postoperative day. Three patients developed grade II edema, which needed five days to resolve. One patient suffered from grade III edema, which ultimately resolved one week after the procedure.

As for the ecchymosis 90% (18) patients did not suffer from ecchymosis, whereas only 10% (two) patients suffered from grade 1 ecchymosis, that resolved within 48 hours post-operatively.

All patients had minimal intraoperative bleeding, except for three patients (15%) where moderate intraoperative bleeding was reported.

Intraoperative time of osteotomy step with the new technique showed an average of 17.85 minutes. Surgeons reported their intraoperative time of osteotomy step with their usual techniques to be an average of 30.75 minutes. A decrease of about 12.9 minutes was reported, accounting for about 42% downtime for osteotomy. (Figs. 8-31).

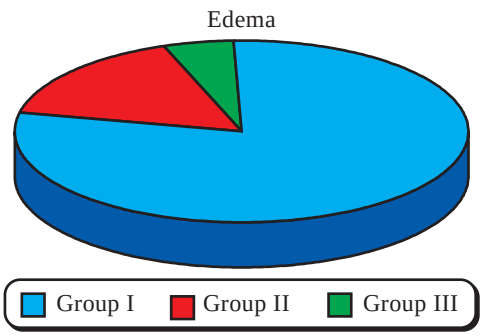

Fig. (6): Pie chart illustrating edema grades among patients.

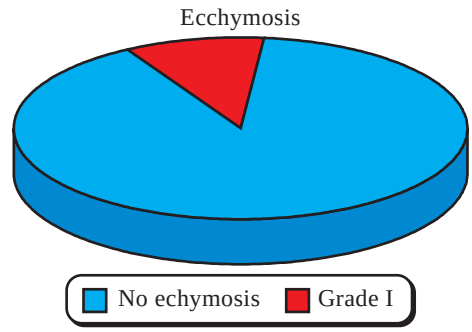

Fig. (7): Pie chart illustrating 18 patients with no ecchymosis and 2 patients with grade 1 ecchymosis.

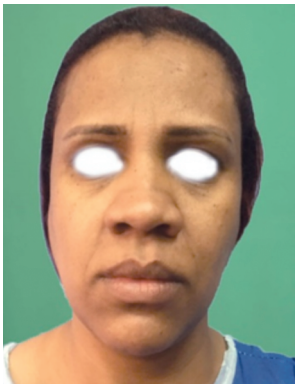

Fig. (8): Case 1 pre-operative.

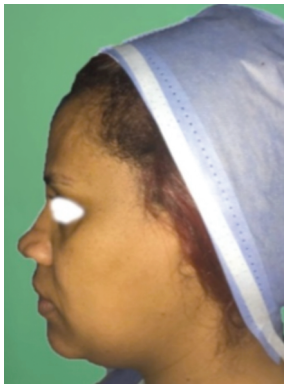

Fig. (9): Case 1 pre-operative.

Fig. (10): Case 1 post-operative 5 days.

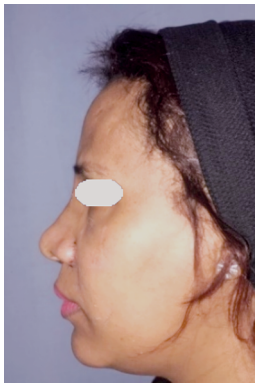

Fig. (11): Case 1 post-operative 5 days.

Fig. (12): Case 1 post-operative 3 months.

Fig. (13): Case 1 post-operative 3 months.

Fig. (14): Case 2 pre-operative.

Fig. (15): Case 2 pre-operative.

Fig. (16): Case 2 post-operative 5 days.

Fig. (17): Case 2 post-operative 5 days.

Fig. (18): Case 2 post-operative 3 months.

Fig. (19): Case 2 post-operative 3 months.

Fig. (20): Case 3 pre-operative.

Fig. (21): Case 3 pre-operative.

Fig. (22): Case 3; 6 months post-operatively.

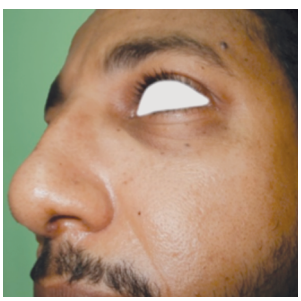

Fig. (23): Case 3; 6 months post-operatively.

Fig. (24): Case 4 pre-operative picture.

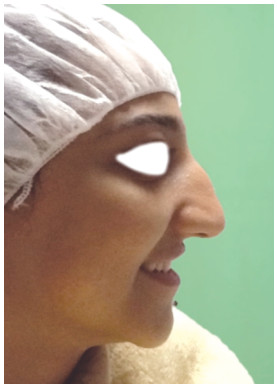

Fig. (25): Case 4 pre-operative picture.

Fig. (26): Case 4; 6 months post-operatively.

Fig. (27): Case 4; 6 months post-operatively.

Fig. (28): Case 5 pre-operative picture.

Fig. (29): Case 5 pre-operative picture.

Fig. (30): Case 5; 1 week post-operatively.

Fig. (31): Case 5; 1 week post-operatively.

DISCUSSION

Rhinoplasty is a common facial aesthetic procedure that passed through multiple evolutionary steps. Osteotomies have always been the bloody blind part of the surgery. In an osteotomy, it is essential to achieve adequate mobilization of the nasal bones and minimizing the damage to the surrounding soft tissues. An ideal osteotomy produces a precise, reproducible, aesthetic and functional results **[6,7]**.

Revision surgeries in rhinoplasty vary between 5 and 15% due to post-operative deformities **[8]**.

Osteotomy complications include; "Rocker" deformity, "Open roof" deformity and "Step" deformity. Rocker deformity may follow medial osteotomy. In this study no major complications are seen **[9]**.

Osteotomy types may be divided according to approach; external or internal or according to location. Location of osteotomy varies and is to be chosen and tailored according to each patient; such as lateral, medial and intermediate osteotomies. Medial osteotomies may be needed in cases with deviated noses and are generally associated with higher rates of complications **[10]**.

The most common disturbing post-operative sequelae of osteotomies are edema and ecchymosis. Patients seek a rapid recovery with a short non-obvious downtime so they can resume work and social activities as early as possible.

This led to the introduction of a grading system by Kara and Gokalan in 1999 for both complications.

This study includes 20 patients seeking full rhinoplasty with lateral osteotomies. Dissection of a subperiosteal tunnel of two to three millimeters wider than proposed line of osteotomy was created.

According to the study, it has been observed that extensive periosteal dissection was of benefit. This helped give better access to the osteotomy site compared to conventional techniques and avoiding the injury of angular vessels, thus reducing the chance of bleeding. Despite the concerns of over bleeding from extensive dissection, the outcomes showa minimal incidence of ecchymosis and edema with less downtime.

Traditionally, it has been taken as dogma that periosteum must be preserved to decrease the dead space and minimize bony instability. Kim et al., concluded through their meta-analysis that periosteal preservation might improve edema and ecchymosis, yet additional research was recommended **[11]**. However, under direct visualization, limited periosteal dissection can be performed with the preservation of the internal mucosa that compensates for the elevated periosteum **[12,13]**.

Different studies were taken into consideration and compared to our results, where we had less edema that resolved entirely by the 5th day. Only one of our patients had grade III edema that subsided by the 7th day. As for ecchymosis, only ten percent of our patients suffered just grade one ecchymosis.

A meta-analysis comparing external and approaches during osteotomies showed no significant advantage in edema and ecchymosis **[14]**. A comparative study by Chan et al., showed no significant effects on postoperative edema and ecchymosis with subperiosteal tunnel formation **[15]**. Our study showed less postoperative sequalae when compared to other studies in literature.

Khalaf et al., conducted a study in 2017 comparing external and internal lateral osteotomies. They included thirty patients. They observed in endonasal group that: 16.6% (2 patients) had grade I edema, 25% (3 patients) had grade II, 50% (6 patients) had grade III, and one patient (8.3%) had grade IV edema **[16]**.

In his study, Khalaf et al., did not consider the time needed for periorbital edema and ecchymosis to subside, which is important in assessment for not only the extent but also the duration of complications is a significant concern for the patients.

Yucel, in his study, included two groups that contained 20 patients each. The extent of edema was the same in both groups in the 2nd and the 7th day post-operative. As for the ecchymosis, the internal method showed less ecchymosis on the 2nd day postoperative and the same degree on the 7th day **[17]**.

Internal sub-periosteal lateral osteotomy technique helps provide the surgeon with improved visualization of the surgical field. It has been found that this method is both accurate and safe. This technique preserves the nasal mucosa without injury, thus reducing intraoperative bleeding.

Adopting this technique reduces both the amount and duration of post-operative edema and ecchymosis. This is both beneficial for the patients to recover rapidly and return to their normal routine,

and for the surgeon to have better early assessment of the outcome of the procedure. Early recovery and overall reduction of post-operative downtime reflects markedly in patients' satisfaction rates.

This technique allows easy reproducibility. Operative time comparison showed a remarkable 42% improvement. Decreased operative time helps in turn reduce complications, including bleeding and consequentially edema and bruising.

Conclusion:

This technique of lateral osteotomies enabled a higher degree of control for the fracture line with short learning curve. The results were more precise and reproducible.

This technique showed simplicity and accuracy with a fast-learning curve and fewer complications that allowed the patients to return to normal life more quickly. Further comparison between the external percutaneous and internal continuous osteotomy technique are needed to determine efficacy on all fronts.

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