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Amr Gouda Shafik

Professor of Otorhinolaryngology Faculty of medicine- Ain Shams University

Mohamed Sherif Abdelmonem

Assistant Professor of Otorhinolaryngology Faculty of medicine- Beni-Sueif University

Ashraf Mahmoud Khaled

Professor of Otorhinolaryngology Faculty of medicine- Beni-Sueif University

Tamer Abdelmonem Azzam

Khaled Abd El Moaty Hafez

Lecturer of Otorhinolaryngology Faculty of medicine- Beni-Sueif University, khaledabdelmoate@med.bsu.edu.eg

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ORIGINAL STUDY

Piezosurgery Versus Conventional Osteotomies and Rasping in Open Rhinoplasty

Amr G. Shafik ^{a,*}, Mohamed S. Abdelmonem ^b, Ashraf M. Khaled ^b, Tamer A. Azzam ^c, Khaled A. El Moaty Hafez ^b

^a Otorhinolaryngology Faculty of Medicine, Ain Shams University, Egypt

^b Otorhinolaryngology Faculty of Medicine, Beni-Suef University, Egypt

^c Police Academy, Egypt

Abstract

Background: Piezosurgery is appropriate for all bony surgeries, but it is predominantly helpful when access is limited and/or the bones are close subtle soft tissue.

Aim and objectives: This work aimed for comparing conventional osteotomies and rasping with the Piezosurgery medical device, as regard operative time, post-operative edema, ecchymosis, and pains in open rhinoplasty patients.

Subjects: and methods: It is a prospective study done at our university hospital from June 2019 to December 2020. This study included 40 patients, 20 done with Piezosurgery technique in osteotomy and rasping, other 20 with conventional technique in osteotomy and rasping. This study involves both males and females their age range from 18 to 50 years, informed consent taken.

Results: Postoperative ecchymosis was statistically significant in 2nd and 4th day's postoperative, Piezosurgery better than conventional osteotomy and rasping ($P < 0.05$), but in 7th day no significant difference between both techniques ($P = 1.00$). Postoperative edema was statistically significant on 2nd and 4th day Piezosurgery better than conventional osteotomy and rasping ($P < 0.05$), but in 7th day no significant difference between both techniques ($P = 1.00$). There is significant less pain in second day postoperative with Piezosurgery compared with conventional osteotomy. Piezosurgery taking more time than conventional osteotomy but the result is insignificant.

Conclusion: Piezosurgery is a safe, feasible, and helpful technique for accomplishment of lateral osteotomy and rasping in rhinoplasty. The Piezo electrical medical device concentrates the action completely on mineralized tissue therefore protecting the nasal mucosa. Piezosurgery is accompanying with reduced severity of edema and ecchymosis, and pain in comparison to conventional osteotomy.

Keywords: Conventional technique, Osteotomy, Piezosurgery, Rhinoplasty, Soft tissues

1. Introduction

In rhinoplasty operation, managing the bony vault and side walls is commonly accomplished with mechanical tools: chisels, saws, osteotomes, and rasps [1]. For decades, these devices were advanced to minimalize damages to the adjacent soft tissue and to increase accuracy [2].

But the sustained absence of accuracy and the accompanying non-controllable fractures lines encouraged the exploration for more accurate operative devices tools. So, electronic devices with responding

heads have been established to surmount the restrictions of manual tools [2]. Power-derived burrs, rasps, and saws were made explicitly for the usage in rhinoplasty operation with respectable outcomes [3].

While restrictions existing like the cost, elevated surgical period, and risk of soft tissues injuries, more exposures, and trouble doing lateral osteotomies [4]. Lately, surgeons have started to use Piezo-electric-derived ultrasonic devices for the managing bony vault and lateral osteotomies [5].

Experimental and clinical research in several topics of oral and maxillofacial operation proposes

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* Corresponding author.

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the usage of Piezotome to decrease post operative morbidities and improve healing. This work aimed to study if rhinoplasty operation with Piezotome may reduce post-operative morbidities and rise general cases satisfactions in comparison to rhinoplasty with old-style devices and protocol.

Piezo-electric operation is built on Piezo-electric vibration made by an electric piezoceramic transducers, which could then be employed for cutting bone via different tips [6]. Fundamentally, electric current goes across the ceramic, causing oscillations of ultrasonic frequencies that is then amplified and transported to a vibrant insert [7]. Bony tissues are blended and detached by suction irrigations with no thermally or mechanically injuries to the adjacent tissues [6].

Piezosurgery is appropriate for all bony operation, but it is predominantly valued when accessing restricted and/or the bones are adjacent to delicate soft tissue (nerves, vessels, skin, dura, mucosa, and pleura). It permits the surgeons to accomplish osteotomy, osteotomy, and osteoplasty. PE is well-known clinically, with review studies describing its development over the past two decades [8].

In 2010, Pribitkin et al. described on their practice utilizing PEI (Piezo-electric instruments) for dorsal hump elimination in 60 cases. As well as managing the bony vaults, deepening of the radix-glabellar zone was accomplished as shown. Significantly, they can smooth the mobilized nasal bone next osteotomies with no danger of disrupting serious soft tissues attachments. They as well described the usage of PEI for turbinectomy, septoplasty, and frontal nasal spine resections [9].

In 2011, Greywoode and Pribitkin extended their retrospective clinical analysis to dorsal reductions in 103 cases with more focus on frontal nasal spine resections (100 cases) and glabellar deepening (3 cases), in addition to routine usage in smoothing mobilized nasal bone and carving convexness of the nasal bone [10].

This work aimed for comparing conventional osteotomies and rasping with the piezo surgery medical instrument, as regards operative time, post-operative edema, ecchymosis, and pains in open rhinoplasty patients.

2. Patients and methods

It is prospective study done at our university hospital from June 2019 to December 2020. This study included 40 patients, 20 done with Piezosurgery technique in osteotomy and rasping, other 20 with conventional technique in osteotomy and

rasping. This study involves both males and females their age range from 18 to 50 years, informed consent taken.

For all patient's operative duration has been documented, and photos were taken and scored for ecchymosis and edema on post-operative days 2, 4, 7 days. Furthermore, pain levels were assessed on the 2nd day postoperatively.

2.1. Study methods

2.1.1. Inclusion criteria

Patients with nasal deformity with age range from 18 to 50 years old either males or females, informed consent were given to all patients.

2.2. Randomization

The included patients were randomized using a computer based program into two groups, guided by a table of random numbers to ensure that every patient fulfilling the inclusion criteria has the same chance of participating.

2.2.1. Exclusion criteria

Pediatric patients, revision cases, recent nasal infection and recent nasal trauma and bone fracture (3months -trauma).

2.3. Surgical technique

The interferences have been accomplished under general anaesthesia by the same surgeon; An 'open' approach has been utilized for all patients. Anesthetic infiltration was attained with 1: 100,000 epinephrine solution at the level of the side nasal pyramid walls and intranasally.

In our study we used Piezo medical device from Mectron Carrasco, Italy.

All surgeries were initiated with a mid-columellar V incision, and the nasal skeleton was exposed in the subperichondrial and subperiosteal operative anatomic plane. The comprehensive subperiosteal degloving of the whole nasal bones had been performed up to the nasal maxillary sulcus, medial canthus, and nasion in all cases, non-dependent of the kind of osteotomy device utilized. Vessels, counting the angular vein and arteries, have been sealed if visible throughout the expositions of nasal bones to minimize soft-tissue injuries. Thereafter the explanation of nasal skeleton, septal mucoperichondrial has been raised bilaterally and cartilage grafts have been gathered from cartilaginous



Fig. 1. Mectron piezo medical device (PMD).



Fig. 3. Medial osteotomy tip.

septum to utilize in re-shaping and re-construction of the nose in all cases.

For patients suffering from dorsal hump, thereafter dorsum exposures, hump elimination was done with a Piezoelectric medical device (Fig. 1) (PMD; Piezo-surgery, Mectron Carrasco, Italy) with an OP-1insert tip (Fig. 2).

A gentle rasping movement has been accomplished to eliminate the additional dorsal bony mass. Through a columellar access, medial nasal osteotomies similarly may be accomplished by means of the Piezo-electric device with an MT-1 insert tip (Fig. 3). Ultrasonic resonance frequency (ranged between 24.7 and 29.5 kHz) in low-frequency amplitudes are selected by the user. A foot pedal permits the surgeons for controlling all the restrictions (power, mode, and irrigation).

For lateral osteotomies, a 2 mm incision of the skin, underlying apparent muscular aponeurotic system, and periosteum has been accomplished 8–10 mm medially and descending from the medial canthus. A bent, narrow, and unguarded tip of the PMD scalpel was introduced via the incision to the bony surface (Fig. 4). The scalpel was manually pushed cranially and caudally into the incision to produce minimal periosteal detachment and was

restricted to the ideal line of the lateral osteotomy. No actual subperiosteal tunnel was created. Then, the PMD was activated. The vibrating scalpel was moved continuously along the ideal line of the osteotomy while gently pressuring the bony surface. The obtained osteotomy was not strictly perforating but almost continuous and was entirely completed from the access position. After the procedure was performed on the contralateral site, a greenstick fracture was obtained with minimal manual pressure at the canthal level. Adequate irrigation was maintained during the osteotomy procedure to avoid heating and consequent skin burn. In conventional osteotomy group, an osteotomy 2-mm width was used.

All cases have been released from hospital care the same day, or at next day afterward rhinoplasty with antibiotic coverage (amoxicillin-clavulanic acid Table 1 gm two times daily), ibuprofen 400 mg when needed to permit following-up of post-operative pains, prednisolone 20 mg once daily for 10 days.

Post-surgical managing was as well uniform. All cases were informed to keep the semi-seated location; cold compresses have been used to the eyes and nonstop changed during the first 24 h, the septal splint together with the dressing cast on the

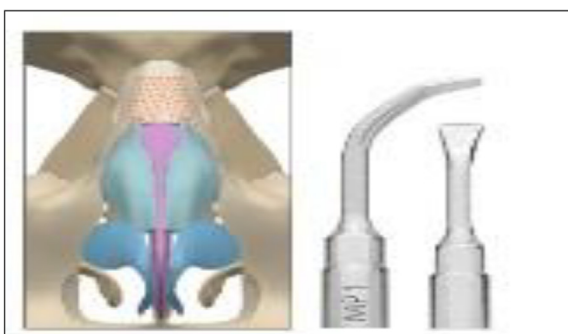


Fig. 2. Hump removal tip.

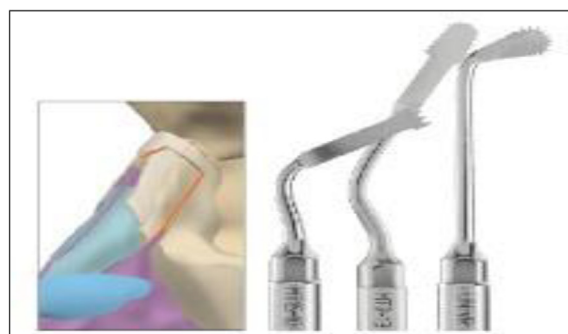


Fig. 4. Lateral osteotomy tip.

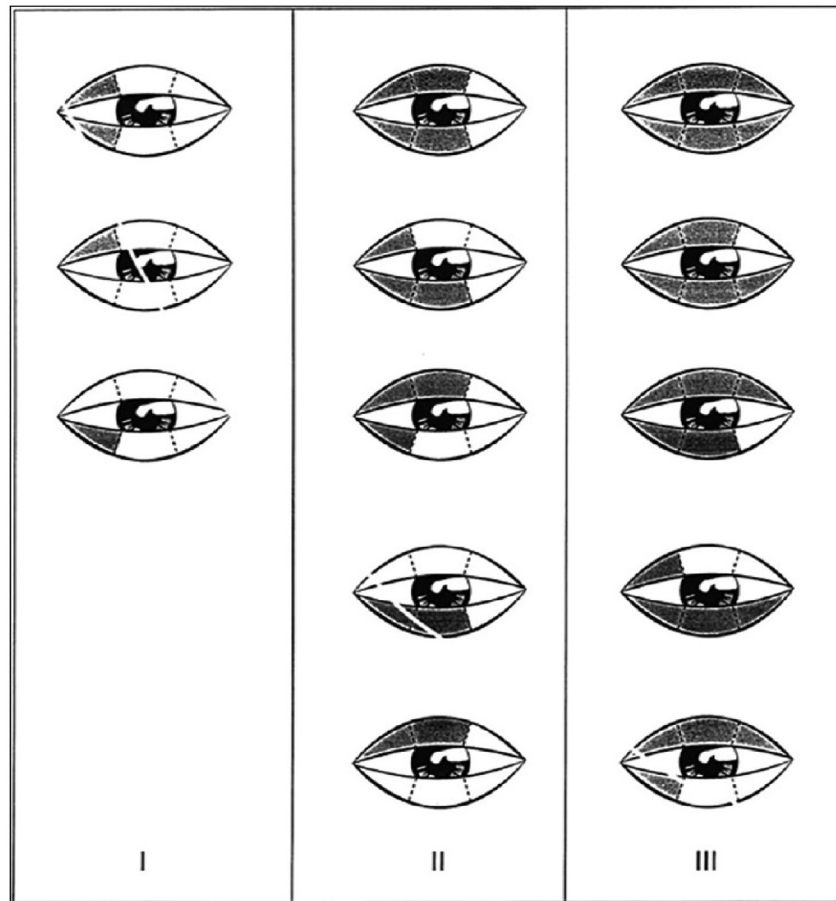


Fig. 6. Method of evaluating periorbital ecchymosis. 1 ecchymosis to the medial one 3rd of the lower or up-per eyelid, 2 ecchymosis to the medial two thirds of the lower or upper eyelid, and grade 3 ecchymosis of the complete extent or up-per eyelid [12].

Table 1. Comparison between 2 techniques in pain score and duration of surgery.

	Conventional osteotomies and rasping		Piezosurgery		P value
	Mean	SD	Mean	SD	
VAS	3.10	0.79	1.85	0.75	<0.001
Duration	13.8	1.7	12.8	1.9	0.088

in 7th day postoperative no statistically difference between both techniques ($P = 0.108$) (Fig. 11) (Table 2).

Postoperative ecchymosis was statistically significant in 2nd and 4th days postoperative, Piezosurgery better than conventional osteotomy and rasping ($P < 0.05$), but in 7th day no significant difference between both techniques ($P = 1.00$) (Fig. 12) (Table 3).

4. Discussion

Successful rhinoplasty is the consequence of controlled variations in the nasal framework and its

soft tissues covering. Changes and formative of the nasal bony structures give a continuing challenging in esthetic and re-constructive operation [14]. Lateral osteotomies accompanying with a rise in haemorrhage, edema, and ecchymosis. This was validated by other reports and may be contributed significantly to rhinoplasty post-operative morbidities [15].

The present work was executed to assess and for comparison of the clinical outcome between Piezosurgery technique against a conventional osteotomy technique for lateral osteotomy and rasping in open-method rhinoplasty. Our study included 40 patients (20 done with piezo, 20 conventional osteotomy). Our results demonstrated that Piezosurgery decreases edema, pains, and ecchymosis post operatively.

There is significant less pain in second day postoperative with Piezosurgery compared with conventional osteotomy in our study which similar to Koc et al. [16] that showed less pain on first and seventh day postoperative with Piezosurgery which was significant.



Fig. 7. Assessment of female patient pre-operative and post rhinoplasty by Piezosurgery at 2, 4, 7 days postoperative.

Fallahi et al. [17] showed also significant less pain postoperatively with Piezosurgery compared with conventional osteotomy days 1, 2, and 3 post-operative. Tirelli et al. [19] also showed less pain which is significant postoperatively in Piezosurgery compared with conventional osteotomy.

In our study Piezosurgery taking more time than conventional osteotomy but result is insignificant which similar to Tirelli et al. [19], but Koc et al. [16] showed that there is significant



Preoperative



Postoperative

Fig. 8. Assessment of female patient pre-operative and post rhinoplasty by conventional instruments at 2, 4, 7 days postoperative.

difference between both techniques (conventional osteotomy short duration of surgery than Piezosurgery). When piezo medical device will be more available for surgeons, and with its easy learning curve the duration of surgery will decrease as shown in our results duration decrease with every patient.

According to our study edema assessed at 2, 4, 7 days postoperatively, and showed significant difference between both techniques in second and

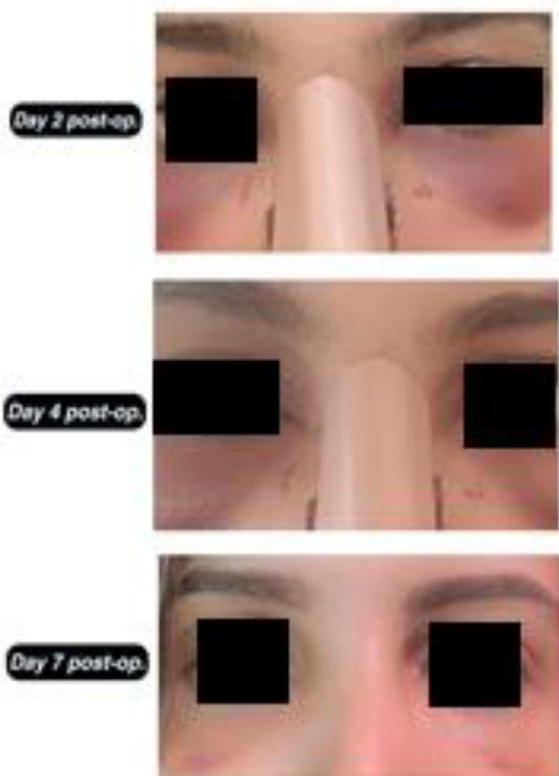


Fig. 9. Assessment of female patient pre-operative and post rhinoplasty by Piezosurgery at 2, 4, 7 days postoperative.

forth days postoperative (less edema in piezo) but in seventh day no significant difference between both techniques.

Koc et al. [16] showed less edema which is significant in first and seventh day postoperatively. Fallahi et al. [17] showed less edema which is significant at second day postoperatively, but insignificant in seventh day postoperatively.

Ilhan et al. [18] showed less edema which is significant in third day postoperatively with



Fig. 10. Assessment of female patient pre-operative and post rhinoplasty by conventional instruments at 2, 4, 7 days postoperative.

Piezosurgery, but in seventh day postoperatively examiner 1 showed less edema which is significant with Piezosurgery, examiner 2 showed no significant difference in seventh day postoperatively. Tirelli et al. [19] showed less edema within first 4 days postoperatively which is significant with Piezosurgery.

In our study we showed less ecchymosis postoperatively with Piezosurgery which is significant in second and fourth, and insignificant in seventh day postoperative when compared with conventional technique.

Koc et al. [16] showed less ecchymosis which is significant in first and seventh day postoperatively with Piezosurgery. Fallahi et al. [17] showed less ecchymosis which is significant at second and seventh days postoperatively with Piezosurgery.

Ilhan et al. [18] showed less ecchymosis which is significant in third and seventh days postoperatively with Piezosurgery. Tirelli et al. [19] showed less ecchymosis in first 4 days postoperatively which is significant with Piezosurgery.

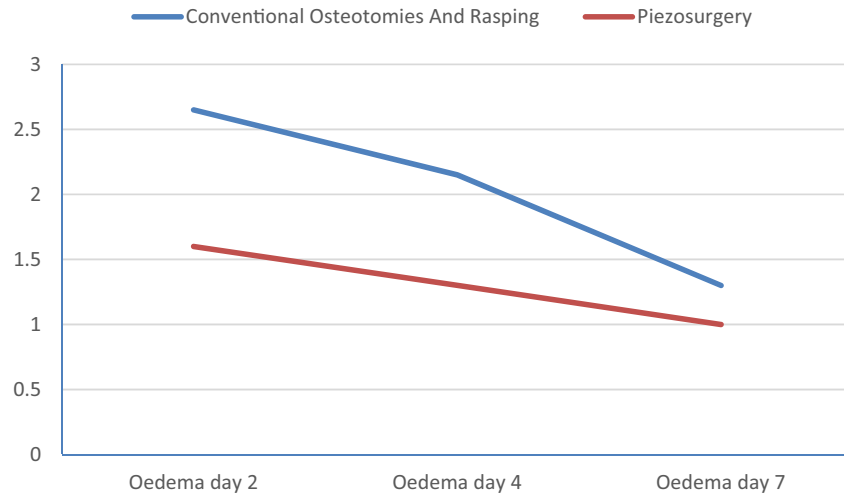


Fig. 11. Comparison of postoperative scores in edema between 2 techniques.

Table 2. Comparison of oedema scores between 2 techniques.

	Conventional Osteotomies and Rasping					Piezosurgery					P value
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
Edema day 2	2.65	0.75	2.50	2.00	4.00	1.60	0.94	1.00	1.00	3.00	0.001
Edema day 4	2.15	0.67	2.00	1.00	3.00	1.30	0.47	1.00	1.00	2.00	<0.001
Edema day 7	1.30	0.47	1.00	1.00	2.00	1.00	0.00	1.00	1.00	1.00	0.108

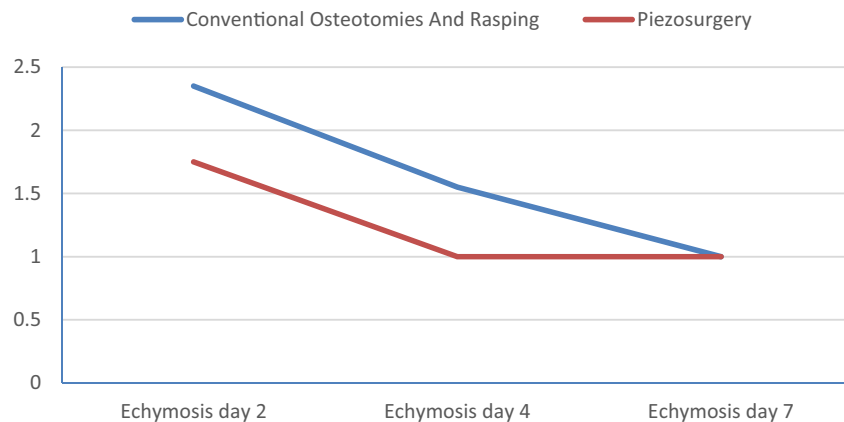


Fig. 12. Comparison of postoperative scores in ecchymosis between 2 techniques.

Conventional approaches of osteotomy might need mechanical power and extended post-operative ecchymosis and edema can happen because of traumas to the nasal mucosa [15].

Robiony et al. [4] showed that when unguarded chisels are dimly utilized, nasal soft tissue and vessels can be injured, and risk of haemorrhage and ecchymosis is elevated.

Table 3. Comparison of Ecchymosis scores between 2 techniques.

	Conventional Osteotomies and Rasping					Piezosurgery					P value
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
Ecchymosis day 2	2.35	0.49	2.00	2.00	3.00	1.75	0.44	2.00	1.00	2.00	0.005
Ecchymosis day 4	1.55	0.51	2.00	1.00	2.00	1.00	0.00	1.00	1.00	1.00	0.002
Ecchymosis day 7	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.000

Koc et al. [16] showed that Piezosurgery may be a perfect device for doing lateral osteotomy, in addition to hump resections, may be performed safely and successfully with this method.

As with any other novel method, a learning curve is essential, but Piezosurgery is a safe and straight forward method.

Labanca et al. [7] showed that Piezosurgery needs minimal exterior pressure post lateral osteotomy. It turns in a gentle way with no need for hammer. Piezosurgery used for avoiding morbidities and progress cases satisfactions.

Koc et al. [16] showed that Piezosurgery helped in lessening post-operative pains, edema, and ecchymosis, thus improving cases comfort, and lessening the period for recovery, and the piezo scalpel is easy to use and doesn't result in any mucosa lacerations.

In our work we found that pain was less and significant with Piezosurgery at 2nd day post-operative, edema was less and significant at 2nd and 4th day postoperative with Piezosurgery and insignificant at 7th day postoperative between both groups, ecchymosis was less and significant at 2nd and 4th day postoperative with Piezosurgery and insignificant at 7th day postoperative between both groups, duration of surgery was shorter in conventional technique than piezo but insignificant. So, we recommend Piezosurgery technique than conventional technique in lateral osteotomy and hump removal in open rhinoplasty.

4.1. Conclusion

Piezosurgery is a secure, reasonable, and efficient technique for execution of lateral osteotomy and rasping in rhinoplasty. The Piezo electrical medical device permits to spare all soft tissue and it emphasizes the action completely on mineralized tissue therefore protecting the nasal mucosa. Piezosurgery is accompanying with reduced severities of edema and ecchymosis, and pain in comparison with conventional osteotomy.

Conflicts of interest

None declared.

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