CASE REPORTS
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UDC: 616.211-089.844
DOI: https://doi.org/10.2298/VSP200709076D

The use of piezoelectric instrumentation and platelet rich fibrin matrix in septorhinoplasty: report of two cases

Primena piezoelektričnih instrumenata i fibrina bogatog trombocitima u septorinoplastici

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Abstract

Introduction. Rhinoplasty is one of the most commonly performed surgeries in the area of aesthetic surgery. Surgical instruments, which are used in traditional rhinoplasty, like saws, chisels and osteotomes are relatively imprecise and their usage can lead to uncontrolled fractures of the bone and consequently to inadequate final results. Piezoelectric-powered ultrasonic instruments (PEI) are currently the most innovative instrumentation available for minimally traumatic reshaping of the bony vault and lateral walls. There are many studies which have shown positive effects of platelet-rich fibrin (PRF) in postoperative course of rhinoplasty patients. **Case report.** We presented two innovative approaches in rhinoplasty combined PEI and PRF matrix through two case reports. In both patients, satisfying results were achieved by use of PEI technique. Also, usage of PRF membrane provided good healing and small postoperative edema. **Conclusion.** Based on our experience, the use of of PEI technique has many benefits. It is safe, practical and effective method and it demonstrates valuable and favourable results in osteotomies. Also, usage of PRF membrane helps patients in better healing and less postoperative edema.

Key words:
osteotomy; platelet-rich fibrin; otorhinolaryngologic surgical procedures; piezosurgery; rhinoplasty.

Apstrakt

Uvod. Rinoplastika je jedna od najčešće izvođenih operacija u polju estetske hirurgije. Hirurški instrumenti koji se koriste u tradicionalnoj rinoplastici, poput dleta, čekića i osteotoma, relativno su neprecizni i njihova upotreba može dovesti do nekontrolisanih fraktura kostiju i, posledično, do neadekvatnog krajnjeg rezultata. Piezoelektrični ultrazvučni instrumenti (PEI) predstavljaju trenutno najnapredniju raspoloživu tehniku za minimalno traumatsko preoblikovanje nosnih kostiju. Postoje mnoge studije koje su dokazale pozitivne efekate fibrina bogatog trombocitima (PRF) u postoperativnom toku kod pacijenta sa prethodno učinjenom rinoplastikom. **Prikaz bolesnika.** Prikazana je kombinacija ova dva inovativna pristupa u rinoplastici (PEI i PRF) kod dva pacijenta. U oba slučaja, primenom PEI tehnike postignuti su zadovoljavajući rezultati. Takođe, upotreba PRF obezbedila je dobro zarastanje i mali postoperativni edem. **Zaključak.** Na osnovu našeg iskustva, PEI tehnika ima mnoge prednosti kao bezbedna, praktična i efikasna metoda sa naročito značajnim i povoljnim rezultatima u osteotomijama. Takođe, upotreba PRF membrane pomaže pacijentima u boljem zarastanju i formiranju značajno manjeg postoperativnog edema

Ključne reči:
osteotomija; fibrin obogaćen trombocitima; hirurgija, otorinolaringološka, procedure; piezohirurgija; rinoplastika.

Introduction

Rhinoplasty is one of the most commonly performed surgeries by otolaryngologists and plastic surgeons in the area of aesthetic surgery. Since nose takes central position and gives every face a definition, any alterations in this region can make huge difference in the appearance of a person. Therefore, it is crucial that surgeons who perform rhinoplasty have thorough knowledge of nose anatomy [1]. Regarding visibility of nose anatomy, it is our opinion that open rhinoplasty could be considered golden standard, since it allows best visibility and much easier reconstruction.

Surgical instruments, which are used in traditional rhinoplasty, like saws, chisels and osteotomes are relatively imprecise and their usage can lead to uncontrolled fractures of the bone and consequently to inadequate final results. Piezoelec

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tric-powered ultrasonic instruments (PEI) are currently the most innovative instrumentation available for minimally traumatic reshaping of the bony vault and lateral walls [2]. The first use of PEI for rhinoplasty was first published by Robiony et al. [3] in 2007. It is based on piezoelectric micrometric ultrasonic vibrations, which can be applied for bone incisions through various tips, depending on what is being done – osteotomy or osteoplasty. Just ten years ago, it was almost unimaginable for surgeons to have such kind of atraumatic device at disposal, with which they can safely reshape the bone, without breaking it, but also simultaneously prevent damaging of surrounding mucosa, soft tissues and ligaments. As a result, patients have faster recovery and more natural looking results, with less bleeding, bruising, scaring, ecchymosis and edema [4, 5].

There are many studies which have shown positive effects of platelet-rich fibrin (PRF) in postoperative rhinoplasty patients [6, 7]. PRF is developed and published by Choukroun et al. [8, 9] and first, it was mostly used in oral and orthopedic surgery for bone regeneration and in plastic surgery for chronic wound healing. PRF is produced from venous blood which is withdrawn in special epruvets without anticoagulants and then centrifuged. After centrifugation, final product is separated in three parts and PRF is created in the middle one as a complex fibrin matrix which can be pulled out and put on bony and cartilaginous vault of the nose [8, 9]. Gode et al. [7] applied PRF membrane on bony dorsum and supratip area and observed positive outcome on skin thickness and postoperative edema, especially in early postoperative period.

We presented two innovative approaches in rhinoplasty combined PEI and PRF matrix through two case reports.

Case report

Case 1

A 21-year-old female came to us complaining about the size of her nose and wide and large nostrils. She also reported some light breathing difficulties. Finding on nasal analysis included presence of dorsal hump, bulbous nasal tip with asymmetric alar cartilages and thick sebaceous skin which requested refinement of her nasal tip. Septal deviation and wide lateral walls of the nose were also present. The operative plan included open rhinoplasty approach through an inverted V shaped transcolumellar incision and dissection with extended soft tissue elevation, allowing a complete visual assessment of the entire osteocartilaginouos vault. After that dorsal hump removal was preformed with a blade tip, additional remodelling of nasal dorsum was made with diamond burr (Figure 1). Whichever instrument is being used, an open roof never occurred, because underlying cartilages and mucosa were unharmed through PEI. After this, a septoplasty with cartilaginous graft harvesting was done. Then a ”low to low“ lateral osteotomy was performed with an angulated saw. Fracture line started from the pyriform aperture and continued along the nasofacial angle. This osteotomy was combined with transverse osteotomy with great caution to preserve Webster triangle. Medial osteotomy was not performed because the narrow of bone pyramid was enough.

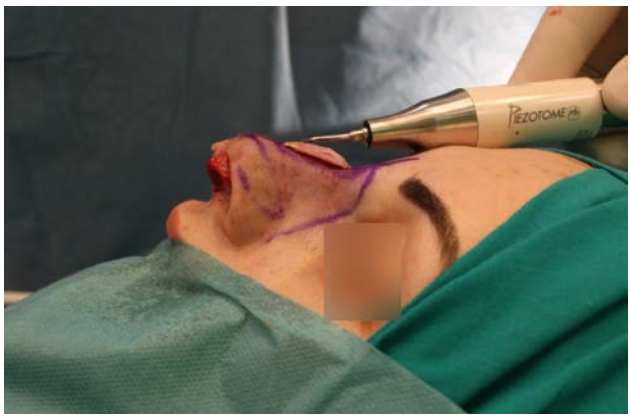


Fig. 1 – The bony cap was removed as preoperatively planned to lower the dorsal profile line.

Cephalic trimming of alar cartilages left them symmetric with a 6-mm rim strip. For tip complex stability and correction of medial crural asymmetry interdomal and transdomal sutures were placed together with collumelar graft from septum harvesting. Finally, PRF membrane was placed on bony and cartilaginous vault of the nose (Figures 2 and 3). One month postoperative results are shown in Figure 4. The patient was satisfied with aesthetic result, although there was still some swelling present.



Fig. 2 – Platelet-rich fibrin (PRF) membrane ready for placing on nasal and cartilaginous dorsum.



Fig. 3 – Platelet-rich fibrin (PRF) membrane being placed on dorsum.



Fig. 4 – Preoperative (up) and postoperative (down) views (one month after) of the patient in Case 1.

Case 2

A 35-year-old female patient presented with complaints about her nasal breathing, dorsal hump and droopy nose. After analysis we agreed that dorsal hump reduction is needed as well as septoplasty and nose tip reinforcement. The operative plan included the following: open rhinoplasty approach through a transcolumellar incision with supraperichondrial, submusculoaponeurotic plane in order to avoid injury to the arterial, venous and lymphatic supply as much as possible. Then a septoplasty with cartilaginous graft harvesting was done. Septum was trimmed and totally realised in caudal part. Dorsal hump reduction was performed with a blade tip, additional remodelling of nasal dorsum was done with diamond burr. After lateral osteotomies with PEI, alar cartilages were trimmed in their horisontal and vertical parts leaving symmetric alar cartilages. Columellar graft was sutured to caudal septum, interdomal and transdomal sutures for nose tip. PRF membrane was placed on bony and cartilaginous vault of the nose for better wound healing and less postoperative swelling and hematoma (Figure 5). The patient was very satisfied with the aesthetic result and all of her complaints were settled. One month postoperative period results are shown on Figure 6.



Fig. 5 – Platelet-rich fibrin (PRF) membrane being placed.



Fig. 6 – Preoperative (up) and postoperative (down) views (1 one month after) of the patient in Case 2.

Discussion

The field of rhinoplasty is well studied and the current literature is full of various techniques. Since the osteotomy is fundamental step in rhinoplasty, multiple different techniques have been employed to overcome postoperative morbidities like ecchymosis, edema, pain, and bleeding. Involvement of PEI in rhinoplasty was definitely a breakthrough moment and represents a significant step forward in rhinoplasty surgery. It provided precise osteotomies without causing unstable and undesirable fractures, comminution, and bony instability and at the same time minimizing soft tissue disruption and postoperative morbidities [10–12].

With traditional chisels, a substantial amount of force is being passed to the incision line and soft tissue surrounding it. Since the chisels are being ”blindly“ used, nasal soft tissue and vessels may be lacerated which increases the risk of bleeding, but also prolongs operation duration and patient recovery time. Comparing to this, PEI requires minimal external pressure and no need for hammer hits [4, 12].

We consider that regardless of the technique of performing an osteotomy, it is very important to point out the necessity of preserve Webster's triangle. This triangle represents a small area on the caudal part of the maxillary frontal process. It is a support for respiratory valvular and is crucial for the primacy of functional nasal airway obstruction and internal valvular collapse.

Meta-analysis from 2019, published by Mirza et al. [13], proved that PEI causes less ecchymosis, edema and pain than conventional osteotomy, without extending the duration of surgery. It included six randomized clinical trials from 2015 to 2019 and additionally proved that PEI has no longer duration in surgery, unlike some previous trials have suggested. The study by Otake et al. [14] was the first to prove the clinical advantage of PEI in the soft tissue. In most studies reporting the superiority of piezosurgery, the evaluations are mostly

based on clinical observations. But, there are also few studies which followed the histopathological effects on bone and periosteum. They showed better osteocyt survival, less damage to the periphral tissue and periosteum [15, 16]. Labanca et al. [17] shared that usage of PEI induces the release of bone morphogenetic proteins with a controlled inflammatory process and triggers the bone remodelling earlier.

After tissue damage platelets and inflammatory cells are first to come to damaged place. The fibrin network captures circulating cells and activates vascularization in the wound area. It is known that fibrin matrix directly activates angiogenesis [18]. Thrombocytes contain growth factors and cytokines that initiate wound healing. PRF matrix contains all growth factors which are wantable in the wound, like endothelial growth factor and vascular endothelial growth factor. It promotes fibroblastic proliferation and induce angiogenesis and at the same time collecting circulating stem cells in blood and promoting osteoblastic activity [8]. Some studies also reported antimicrobial and antifungal activities of PRF matrix against *Escherichia* coli, *Staphylococcus aureus*, *Candida albicans*, and *Cryptococcus neoformans* [19].

Gode et al. [7] investigated effects of PRF on postoperative edema and wound healing with ultrasonography as an objective evaluation method and they found positive effects of PRF on postoperative edema, especially in the early postoperative period. Patients who have thicker skin have bigger tendency of forming „dead space“ which can later be filled with scar tissue, which consequently leads to persistent edema and bad cosmetic outcome. It is our opinion that PRF membrane should be used mandatory in this kind of cases.

Conclusion

Based on our experience adoption of PEI technique has many benefits. It is safe, practical and effective method and it demonstrates valuable and favourable results in osteotomies. Also in our observation usage of PRF membrane helps patients in better healing and less postoperative edema. We hope that our results with piezosurgery combined with PRF matrix will encourage other surgeons who perform rhinoplasty to start its use.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Received on July 9, 2019
Revised on July 10, 2020
Accepted on July 13, 2020
Online First July, 2020