İstanbul Med J 2023; 24(1): 1-5
DOI: 10.4274/imj.galenos.2022.39018

Short-term Postoperative Outcomes of Platelet-rich Plasma after Inferior Turbinate Radiofrequency

Ozan Özdemir, Nihal Seden, Abdurrahman Çağlıyan, Özgür Yiğit

University of Health Sciences Turkey, İstanbul Training and Research Hospital, Clinic of Otorhinolaryngology, Division of Head and Neck Surgery, İstanbul, Turkey

ABSTRACT

Introduction: To evaluate the effect of submucosal platelet-rich plasma (PRP) therapy on intraoperative bleeding and early postoperative pain and crusting in patients undergoing inferior turbinate radiofrequency.

Methods: A total of 70 adult patients with isolated inferior turbinate hypertrophy were included in this prospective study and randomized to the PRP or control groups. PRP was prepared for all patients. After applying submucosal radiofrequency to the inferior turbinates under local anesthesia, submucosal PRP was injected into the study group, and submucosal saline was injected into the control group. Patient controls were performed by another specialist. The patients and the specialist who performed the controls were blinded to which group they were in. All patients were evaluated endoscopically 1, 7, and 21 days after the operation.

Results: The mean age of the patients was 33.37±11.92 years (range: 18 to 54). The two groups had no significant differences in intraoperative bleeding and mucociliary clearance values ($p>0.05$). The amount of crusting and the visual analog scale pain values were significantly lower in the submucosal PRP -injected group ($p<0.05$).

Conclusion: Submucosal injection of PRP after radiofrequency of the inferior turbinate reduces nasal obstruction and pain due to crusting. With these features, it can be concluded that this procedure accelerates recovery and increases patient comfort in the early postoperative period.

Keywords: Platelet-rich plasma, turbinates, radiofrequency ablation, wound healing

Introduction

Wound healing begins with the activation and aggregation of circulating platelets after the endothelial wall is damaged. This process provides the formation of thrombin, a proteolytic enzyme and a potent platelet activator that catalyzes the conversion of fibrinogen to fibrin (1). Many mediators, including growth factors, cytokines, and extracellular matrix modulators, are released from the alpha granules of activated platelets (2-4).

Platelet-derived products have become increasingly popular since the 1990s. Different ways to prepare platelet-rich plasma (PRP) have emerged, and the methodology continues to evolve from a traditional blood centrifuge to commercial systems (5). Nowadays, PRP is being used for surgical operations, chronic wound recovery, ulcers, and burned care.

The inferior turbinates, whose submucosal layer consists of venous sinusoids, have essential functions such as heating, humidifying, filtering the inhaled air, directing the airflow to the olfactory zone, and secreting mucosal immunoglobulin A (IgA) (6). There are many techniques available to reduce the size of enlarged inferior turbinates. Recently, procedures have preserved nasal function by reducing turbinate volume rather than concha resection (7).

Inferior turbinate radiofrequency has recently become popular as it protects the nasal mucosa and improves nasal function with a low postoperative complication rate. This technique provides a sufficient reduction in turbinate volume, and submucosal tissues are replaced by sclerotic ligament-like tissue, while the nasal mucociliary function is apparently preserved (8).

Problems such as pain, crusting, bleeding, and synechia can be seen in the healing of wounds after ITR. To prevent these problems, we investigated the short-term effects of intraoperative submucosal PRP injection in patients undergoing ITR.

Methods

Ethical Approval

The study was reviewed and approved by the University of Health Sciences Turkey, İstanbul Training and Research Hospital Local Ethics

Address for Correspondence: Ozan Özdemir MD, University of Health Sciences Turkey, İstanbul Training and Research Hospital, Clinic of Otorhinolaryngology, Division of Head and Neck Surgery, İstanbul, Turkey
Phone: +90 530 569 43 97 **E-mail:** opdrozanozdemir@gmail.com **ORCID ID:** orcid.org/0000-0001-6534-1672

Cite this article as: Özdemir O, Seden N, Çağlıyan A, Yiğit Ö. Short-term Postoperative Outcomes of Platelet-rich Plasma after Inferior Turbinate Radiofrequency. İstanbul Med J 2023; 24(1): 1-5.

Received: 26.09.2022
Accepted: 11.12.2022

©Copyright 2023 by the University of Health Sciences Turkey, İstanbul Training and Research Hospital/İstanbul Medical Journal published by Galenos Publishing House.

Committee (approval number: 2803, date: 16.04.2021). All procedures were performed in accordance with the ethical standards set forth by the World Medical Association Declaration of Helsinki (Scotland 2000). Informed consent forms were obtained from all the patients.

Patients and Study Design

Seventy patients with isolated inferior turbinate hypertrophy that did not respond to intranasal corticosteroids for 3 months were included in this prospective study and randomized to the PRP or control groups. All the patients were evaluated by endoscopic examination. Those with other causes of nasal obstruction such as septum deviation, nasal polyposis, allergic rhinitis, or comorbidities such as diabetes, hypertension, and coagulation disorder were excluded from the study. The PRP was prepared from all patients, and the procedures were performed by the same specialist. The patients were operated under local anesthesia with the same radiofrequency device. After providing local anesthesia with topical lidocaine spray, all patients received 15 watts and 300 joules of energy for 7-8 seconds from 3 different points on each inferior turbinate. After applying submucosal radiofrequency to the inferior turbinates under local anesthesia, submucosal PRP was injected into 35 patients in the study group, and submucosal saline was injected into 35 patients in the control group. The patients were discharged without prescribing medication.

All controls were performed by another specialist who was unaware of the group in which the patients were in. Pain, bleeding, crusting, and mucociliary clearance were compared between the two groups. Saccharin transit time (STT) was used for mucociliary clearance in the first week and stand-alone visual analog scale (VAS) was used for pain. The patients were evaluated for crusting on the first, 7th, and 21 days after surgery. All evaluations were performed under a 4 mm diameter 0-degree endoscope (Karl Storz, Germany).

Platelet-rich Plasma Preparation

PRP was prepared from patients' autologous blood samples and collected in anticoagulant-coated sterile vacuum tubes. An automated centrifugation machine (Centrifuge, CompactStar CS4, VWR International, England) was used for obtaining PRP with a speed of 1300 rpm for 10 min. After centrifugation, the platelet-poor upper layer and the lower layer consisting of erythrocytes were disposed of. Then "buffy coat" layer rich in platelets and growth factors was applied to the surgical site (9).

Inferior Turbinate Radiofrequency

All surgical procedures were performed by the same senior surgeon after local anesthesia was provided with topical lidocaine spray. By using a radiofrequency generator (CelonLabENT; Celon AG, Teltow, Germany), 15 watts and 300 joules of energy per shot were delivered submucosal to the anterior, middle, and posterior thirds of each inferior turbinate with the conchal probe.

Patient Evaluation

The intraoperative bleeding was calculated by the number of pads contaminated during the inferior turbinate radiofrequency. All patients were evaluated endoscopically 1, 7, and 21 days after the operation. A score between 1 and 4 was given according to the amount of crusting. 0-25% crusting was scored as 1, 25-50% crusting 2, 50-75% crusting 3, and above 75% crusting as 4. Patients were asked to complete a VAS questionnaire regarding pain during the first 7 days. Additionally, nasal mucociliary transport was evaluated with STT postoperatively in the first week.

Statistical Analysis

In the data obtained from the study of Sinem Gökçe Kutuk and Talih Özdaş using the G*Power 3.1.9.7 (Franz Faul, Germany) program, it was determined that there should be a total of at least 70 samples.

Statistical analysis was performed using the IBM SPSS Statistics 25.0 package program (SPSS Inc.; Chicago, IL, USA). The Kolmogorov-Smirnov test was used to determine whether the variables were normally distributed. While presenting descriptive analyses, mean ± standard deviation and median (minimum-maximum) values were used. The Mann-Whitney U test was used for unpaired group comparisons. Changes in measured values were examined by the Wilcoxon test within the group and with Repeated Measurements Analysis between the groups. A p-value less than 0.05 was considered statistically significant.

Results

The mean age of 48 male and 22 female patients was 33.37±11.92 years (range: 18 to 54). There was no significant difference between the two groups in the amount of bleeding according to the number of contaminated pads during the operation (p=0.056). Similarly, no significant difference was observed between the groups in the mucociliary transport times evaluated by a STT in the postoperative 1st week (p=0.077) (Table 1).

The amount of crusting on the 1st, 7th, and 21st days evaluated by endoscopic examination was significantly higher in the submucosal saline-injection group for all 3 days (p<0.05) (Table 2). Additionally, when both groups were evaluated separately, no significant difference was observed in the change in the amount of crusting (Figure 1). As a result, the amount of crusting on the PRP -injected group was lower from the first day.

Table 1. Changes in the amount of bleeding and mucociliary clearance between the two groups

	Saline-injected group		PRP-injected group		p
	Mean ± SD	Median	Mean ± SD	Median	
Amount of bleeding	1.66±0.73	2.00	1.29±0.75	1.00	0.056
Mucociliary clearance	1.31±0.93	1.00	0.91±0.82	1.00	0.077

Mann-Whitney U test (SD: Standard deviation). A value of p<0.05 was considered statistically significant

The daily scored facial pain scale values during the first week were compared between the groups and the values were found to be lower on the 3rd, 4th, 5th and 6th days in the PRP-injected group ($p<0.05$) (Table 3). When the changes in the facial pain scale were evaluated separately between the two groups, the pain decreased more rapidly in the PRP -injected group. (Figure 2). According to this result, we found that healing was faster in the PRP-injected group ($p<0.05$).

Discussion

For treating inferior turbinate hypertrophy, which causes nasal obstruction, radiofrequency has come to the fore with its local application, function preservation, and low complication rate (10). Karakurt et al. (11) demonstrated the effectiveness of this method objectively by providing a significant decrease in nasal resistance and a significant increase in nasal volume at the postoperative 6th month. Additionally, it has been observed in the literature that the mucociliary transport time is shorter in the early postoperative period in patients who underwent radiofrequency (12). In our clinic, we prefer this method because it can be applied locally, has a short duration, has low morbidity, long-term effectiveness, and is a mucosal preservation surgery.

In the study of Gunhan et al. (13), it was found that intranasal steroid therapy and radiofrequency ablation were similarly effective in improving the quality of life in patients with allergic rhinitis. We excluded patients with a diagnosis of allergic rhinitis in our study and selected our patients from patients who had symptoms of nasal obstruction due to isolated inferior turbinate hypertrophy and did not respond to 3-month intranasal corticosteroid therapy. All of these patients benefited significantly from the procedure according to the NOSE score at day 21.

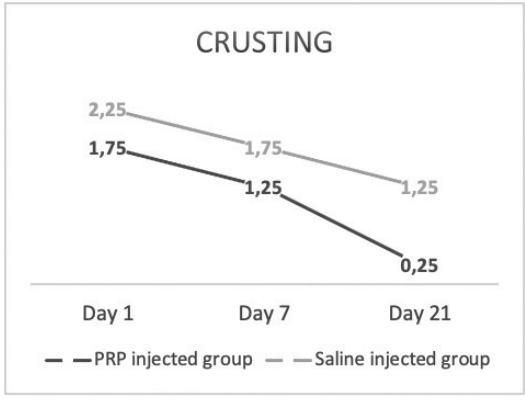

Figure 1. Changes in the amount of crusting between the two groups by day

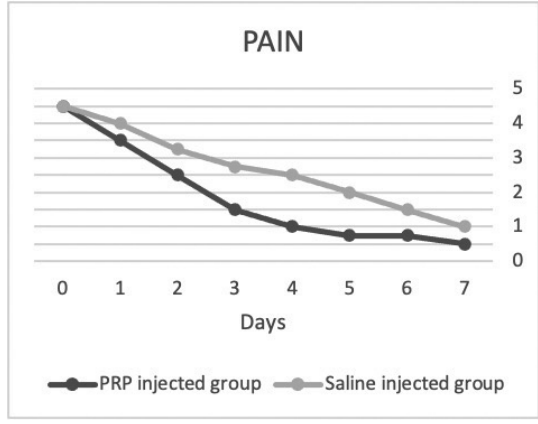

Figure 2. Changes in the amount of pain between the two groups by day

Table 2. The amount of crusting between the two groups by day

	Saline-injected group		PRP-injected group		p[1]	p[2]
	Mean ± SD	Median	Mean ± SD	Median		
Crusting, day 1	2.23±0.88	2.00	1.71±0.67	2.00	**0.011**	0.109
Crusting, day 7	1.69±0.63	2.00	1.26±0.66	1.00	**0.009**	
Crusting, day 21	1.09±0.56	1.00	0.34±0.48	0.00	**<0.001**	

[1]Mann-Whitney U test, [2]Repetitive measurements analysis (SD: Standard deviation). Bold values indicate significance ($p<0.05$)

Table 3. The amount of pain between the two groups by day

	Saline-injected group		PRP-injected group		p[1]	p[2]
	Mean ± SD	Median	Mean ± SD	Median		
Pain, day 0	4.60±2.43	5.00	4.49±2.52	4.00	0.789	0.030
Pain, day 1	3.94±2.42	4.00	3.57±2.37	4.00	0.469	
Pain, day 2	3.23±2.40	4.00	2.43±1.79	3.00	0.079	
Pain, day 3	2.71±2.08	3.00	1.63±1.44	2.00	**0.021**	
Pain, day 4	2.51±2.13	2.00	0.91±1.44	0.00	**0.001**	
Pain, day 5	2.03±2.12	2.00	0.66±1.53	0.00	**0.001**	
Pain, day 6	1.57±1.85	2.00	0.66±1.39	0.00	**0.007**	
Pain, day 7	0.94±1.64	0.00	0.43±1.14	0.00	0.067	

[1]Mann-Whitney U test, [2]Repetitive measurements analysis (SD: Standard deviation). Bold values indicate significance ($p<0.05$)

In the literature, there were only minimal adverse reactions reported, such as pain, crusting, adhesion, dryness, or nasal bleeding (14). We did not detect any dryness, adhesions, or postoperative bleeding in our patients. Bleeding was seen only during surgery, and there was no significant difference between the amount of bleeding in both groups during the procedure. Various amounts of crusting were detected in all our patients until the 21st day and the pain until the 8th day. To avoid these problems, PRP, known to accelerate wound healing, was injected submucosal following ITP. Crusting and pain were significantly less in the PRP-injected group.

There are only limited studies on postoperative wound healing of the nasal mucosa. Khalmuratova et al. (15) guided further studies on the healing stages. The positive effects of PRP on wound healing by secreting various growth factors and cytokines have been shown in various studies (16-18). Therefore, the hypothesis of this study was that PRP would reduce crusting in the nasal mucosa and have a positive effect on postoperative pain.

Pomerantz and Dutton (19) investigated the curative properties of PRP after endoscopic sinus surgery. The results revealed that PRP is beneficial in wound healing in nasal surgery; however, the patient population in the studies was severely limited (19). As in these studies, we found PRP to be effective in crusting and pain.

As an unexpected and unexplained result in the histopathological nasal mucosa study of Yildirim et al. (20), the number of ciliary cells in the PRP-injected group was found to be significantly lower than that in the saline-injected group. In our study, we found no difference between these two groups in terms of mucociliary transport time.

Study Limitations

The main limitation of this study is the need for further studies with larger case numbers. Additionally, adding patients diagnosed with allergic rhinitis to a group and performing long-term postoperative evaluations with rhinomanometric measurements may increase the value of the study.

Conclusion

This study is important because it is the first study on PRP injection into the inferior turbinates after inferior turbinate radiofrequency. Submucosal injection of PRP after inferior turbinate radiofrequency significantly reduced postoperative pain and crusting in the early postoperative period, but had no effect on intraoperative bleeding. With these features, it can be concluded that this procedure reduces nasal congestion and pain due to crusting, accelerates recovery, and increases patients' comfort in the early postoperative period.

Ethics Committee Approval: The study was reviewed and approved by the University of Health Sciences Turkey, İstanbul Training and Research Hospital Local Ethics Committee (approval number: 2803, date: 16.04.2021).

Informed Consent: Informed consent forms were obtained from all the patients.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices - O.Ö., N.S., Ö.Y.; Concept - O.Ö., N.S., A.Ç.; Design - O.Ö., N.S., Ö.Y.; Data Collection or Processing - O.Ö., N.S., A.Ç.; Analysis or Interpretation - O.Ö., N.S., A.Ç.; Literature Search - O.Ö., N.S., Ö.Y.; Writing - O.Ö., N.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Swieringa F, Spronk HMH, Heemskerk JWM, Heemskerk JWM, van der Meijden PEJ. Integrating platelet and coagulation activation in fibrin clot formation. Res Pract Thromb Haemost 2018; 2: 450-60.
2. Nurden AT. The biology of the platelet with special reference to inflammation, wound healing and immunity. Front Biosci (Landmark Ed) 2018; 23: 726-51.
3. Etulain J. Platelets in wound healing and regenerative medicine. Platelets 2018; 29: 556-68.
4. Alsousou J, Ali A, Willett K, Harrison P. The role of platelet-rich plasma in tissue regeneration. Platelets 2013; 24: 173-82.
5. Castillo TN, Pouliot MA, Kim HJ, Dragoo JL. Comparison of growth factor and platelet concentration from commercial platelet-rich plasma separation systems. Am J Sports Med 2011; 39: 266-71.
6. Li C, Farag AA, Leach J, Deshpande B, Jacobowitz A, Kim K, et al. Computational fluid dynamics and trigeminal sensory examinations of empty nose syndrome patients. Laryngoscope 2017; 127: E176-84.
7. Dogan R, Senturk E, Ozturan O, Yildirim YS, Tugrul S, Hafiz AM. Conchal contractility after inferior turbinate hypertrophy treatment:A prospective, randomized clinical trial. Am J Otolaryngol 2017; 38: 678-82.
8. Nease CJ, Krempl GA. Radiofrequency treatment of turbinate hypertrophy: a randomized, blinded, placebo-controlled clinical trial. Otolaryngol Head Neck Surg 2004; 130: 291-9.
9. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). Trends Biotechnol 2009; 27: 158-67.
10. Garzaro M, Landolfo V, Pezzoli M, Defilippi S, Campisi P, Giordano C, et al. Radiofrequency volume turbinate reduction versus partial turbinectomy: clinical and histological features. Am J Rhinol Allergy 2012; 26: 321-5.
11. Karakurt SE, Çetin MA, Apaydın E, İkincioğulları A, Ensari S, Dere HH. Does inferior turbinate outfracture provide additional benefit when combined with inferior turbinate radiofrequency ablation?. Eur Arch Otorhinolaryngol 2021; 278: 2869-74.
12. Akagün F, İmamoğlu M, Çobanoğlu HB, Ural A. Comparison of radiofrequency thermal ablation and microdebrider-assisted turbinoplasty in ınferior turbinate hypertrophy: a prospective, randomized, and clinical study. Turk Arch Otorhinolaryngol 2016; 54: 118-23.
13. Gunhan K, Unlu H, Yuceturk AV, Songu M. Intranasal steroids or radiofrequency turbinoplasty in persistent allergic rhinitis: effects on quality of life and objective parameters. Eur Arch Otorhinolaryngol 2011; 268: 845-50.
14. Abdullah B, Singh S. Surgical ınterventions for ınferior turbinate hypertrophy: a comprehensive review of current techniques and technologies. Int J Environ Res Public Health 2021; 18: 3441.
15. Khalmuratova R, Kim DW, Jeon SY. Effect of dexamethasone on wound healing of the septal mucosa in the rat. Am J Rhinol Allergy 2011; 25: 112-6.

16. Fréchette JP, Martineau I, Gagnon G. Platelet-rich plasmas: growth factor content and roles in wound healing. J Dent Res 2005; 84: 434-9.

17. Nurden AT, Nurden P, Sanchez M, Andia I, Anitua E. Platelets and wound healing. Front Biosci 2008; 13: 3532-48.

18. Gökçe Kütük S, Özdaş T. The impact of platelet-rich plasma therapy on short-term postoperative outcomes of pediatric tonsillectomy patients. Eur Arch Otorhinolaryngol 2019; 276: 489-95.

19. Pomerantz J, Dutton JM. Platelet gel for endoscopic sinus surgery. Ann Otol Rhinol Laryngol 2005; 114: 699-704.

20. Yildirim U, Kemal O, Aksoy A, Karaca E, Terzi O, Atmaca S. Effects of submucosal PRP injection on wound healing in endonasal surgeries: an experimental study. Eur Arch Otorhinolaryngol. 2020; 277: 1681-9.