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Research Article

Pre and Postoperative Rhinomanometric Assessment of Nasal Airway Resistance Following Dorsal Preservation Rhinoplasty

Ehsan Naeini[1], Mahdi Farid[1] and Parisa Mohammadi[2*]

[1]*Department of Oral and Maxillofacial Surgery, TeMS.c., Islamic Azad University, Tehran, Iran*

[2]*Department of Periodontology, Gilan University of Medical Sciences, Rasht, Iran*

***Corresponding author:** Parisa Mohammadi, Department of Periodontology, Gilan University of Medical Sciences, Rasht, Iran.

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Abstract

Introduction: Dorsal preservation rhinoplasty (DPR) is a conservative rhinoplasty technique that aims to maintain the native anatomy of the nasal dorsum while achieving both aesthetic and functional improvement. By preserving key structural components of the nose, this approach may have a positive impact on postoperative nasal airway function. Nevertheless, objective rhinomanometric data comparing nasal function before and after DPR remain limited.

Materials and Methods: Patients scheduled for DPR were included in this study. Nasal airway function was assessed preoperatively using active anterior rhinomanometry. The same measurements were repeated three months after surgery. The main parameters evaluated were total nasal airway resistance and nasal airflow. Preoperative and postoperative values were compared using appropriate statistical analyses, with statistical significance defined as $p < 0.05$.

Conclusion: DPR was associated with significant improvement in rhinomanometric outcomes, reflected by reduced nasal airway resistance and increased nasal airflow after surgery. These results indicate that preservation of the natural nasal framework during DPR may contribute to better postoperative respiratory function. Further investigations with larger cohorts and longer follow-up periods are required to validate these findings.

Keywords: Dorsal preservation rhinoplasty; Nasal airway resistance; Rhinomanometry

Introduction

Rhinoplasty is considered one of the most common aesthetic surgeries of the facial region. In addition to improving the external appearance of the nose, it plays an important role in enhancing respiratory function and patients' quality of life. In recent years, surgeons have increasingly focused on structure-preserving rhinoplasty techniques, as these approaches are associated with less damage to the supporting nasal structures compared with classical hump reduction techniques and may provide more stable functional and aesthetic outcomes [1, 2]. In traditional rhinoplasty techniques, direct resection of the osseocartilaginous hump and subsequent reconstruction of the nasal framework are often associated with extensive manipulation of the septum and

the internal nasal valve region, which may increase the risk of postoperative functional impairment and breathing difficulties [3]. In contrast, dorsal preservation rhinoplasty (DPR) has been introduced as a conservative approach aimed at preserving the natural anatomy of the nose. In this technique, instead of directly resecting the nasal hump, the dorsal structure is lowered as a single unit through techniques such as push-down or let-down. This approach helps preserve the osteocartilaginous continuity of the nose, reduces trauma to the keystone area, and better maintains the function of the internal nasal valve [4, 5]. Furthermore, in DPR, septal resection is more limited, and the need for extensive reconstruction using grafts is reduced. As a result, the likelihood of structural instability and delayed functional complications may be lower [6]. Recent studies have shown that preservation of the natural dorsal structure can reduce trauma to nasal tissues, maintain the natural dynamics of airflow, and improve postoperative respiratory outcomes [7]. Nasal airway obstruction (NAO) is one of the most common problems among patients seeking rhinoplasty. This condition may result from structural, mucosal, or combined factors. The most important structural causes include nasal septal deviation, internal nasal valve narrowing, external nasal valve weakness, and osteocartilaginous deformities, each of which can disrupt normal airflow and increase airway resistance [8, 9]. The internal nasal valve, as the narrowest part of the upper airway, plays a key role in regulating airflow, and even minor changes in this area can produce significant obstructive symptoms [10].

In addition, inferior turbinate hypertrophy, which is often observed as a compensatory response in patients with septal deviation, can lead to chronic nasal congestion and reduced breathing quality [11]. In some patients, nasal obstruction has a mucosal and inflammatory origin. Conditions such as allergic rhinitis, chronic inflammation of the nasal mucosa, and nasal polyps are among the important factors that impair normal nasal function through mucosal edema and narrowing of the nasal passages [12]. Moreover, in many patients, structural and mucosal disorders coexist, making accurate preoperative evaluation essential. Failure to correctly identify these problems before surgery may result in persistent respiratory symptoms or even worsening of nasal airway obstruction after rhinoplasty [13]. Therefore, comprehensive assessment of nasal function before surgery, including physical examination, evaluation of the nasal valves, and the use of objective methods such as rhinomanometry, is highly important for selecting the appropriate surgical technique and predicting postoperative functional outcomes [14, 15]. Many patients seeking rhinoplasty expect improvement in respiratory function in addition to aesthetic enhancement. However, some surgical techniques, if associated with excessive removal of the supporting nasal structures, may weaken the internal nasal valve and increase nasal airway resistance [16]. In this regard, various studies have attempted to investigate the relationship between patient-reported symptoms and objective indices of nasal resistance; however, the findings have not always been consistent [17]. Despite the increasing use of DPR in recent years, limited studies have evaluated the effect of this technique on the nasal airway. Therefore, the aim of the present study was to evaluate the effects of dorsal preservation rhinoplasty on nasal airway function before and after surgery.

Materials and Methods

This pre–post study was conducted between 2022 and 2023 on patients referred to the surgical department who were candidates for dorsal preservation rhinoplasty (DPR). Sampling was performed using a non-random convenience sampling method, and 40 surgical cases were included in the study. All participants signed written informed consent before enrollment in the study. Patients with functional obstruction caused by septal deviation, inferior turbinate hypertrophy, internal nasal valve narrowing, or mild to moderate nasal airway obstruction were also included if rhinoplasty was indicated. The exclusion criteria included a history of previous nasal or facial surgery, severe congenital nasal deformities, active chronic sinusitis, nasal polyposis, uncontrolled chronic respiratory diseases, systemic diseases affecting wound healing, and lack of patient cooperation during postoperative visits and follow-up. All patients underwent surgery under standard general anesthesia on the day of operation. All surgical procedures were performed by an experienced team of oral and maxillofacial surgeons.

In the DPR technique, unlike classical rhinoplasty methods that involve direct resection of the osseocartilaginous hump, the nasal dorsum was preserved, and hump reduction was achieved through controlled dorsal mobilization. After access to the nasal structures was obtained, limited subdorsal septal resection was performed to allow lowering of the dorsum. The osseocartilaginous nasal framework was then transferred downward as an integrated unit. In cases of septal deviation or structural asymmetry, limited and conservative corrections of the septum and lower nasal structures were performed. In addition, when necessary, limited reduction of the inferior turbinates was carried out to improve patients' respiratory function. The main goal of this technique was to reduce surgical invasiveness, preserve the physiological function of the nose, and decrease the likelihood of postoperative functional complications. To evaluate respiratory function, rhinomanometry was performed before surgery and three months postoperatively. Measurements were carried out using a rhinomanometer. Nasal airway resistance was recorded during the inspiratory phase and was used as the main index of nasal resistance. All measurements were performed under standardized environmental conditions and after stabilization of the patients' respiratory status.

Statistical Analysis

After data collection, the study data were analyzed using SPSS 11 statistical software. Initially, descriptive indices, including mean, standard deviation, frequency, and percentage, were calculated to describe quantitative and qualitative variables. The Kolmogorov–Smirnov test was used to assess the normality of data distribution. For variables with a normal distribution, the paired samples t-test was used to compare rhinomanometric parameters before and after surgery. All statistical tests were performed as two-tailed tests, and a significance level of $P < 0.05$ was considered statistically significant.

Results

Nasal airway resistance, including total nasal resistance, showed a significant decrease after surgery compared with the preoperative values. Total nasal airway resistance decreased 750 from to 350, indicating improved nasal airflow and demonstrating the positive effect of surgery on respiratory function (Figure 1).

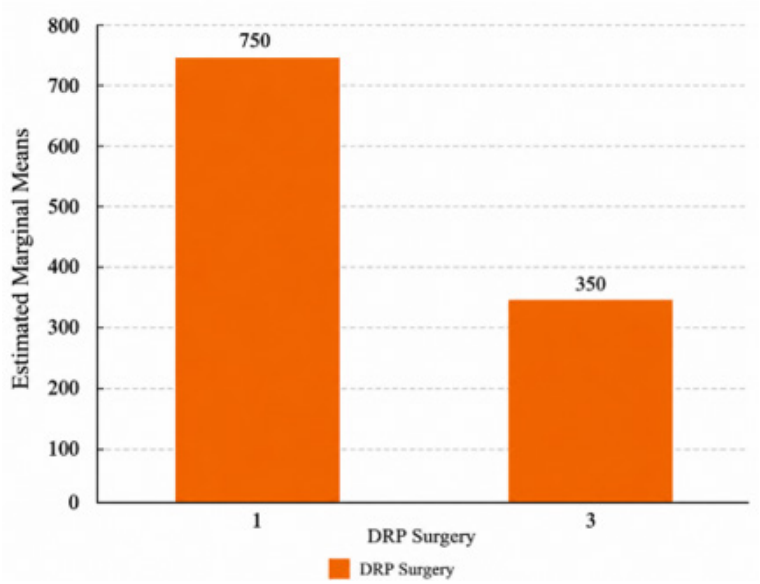

Figure 1: Preoperative and postoperative comparison of total nasal resistance measured one month before and three months after dorsal preservation rhinoplasty.

Also, total nasal airflow increased significantly after surgery, which further indicates a reduction in nasal airway resistance (Figure 2).

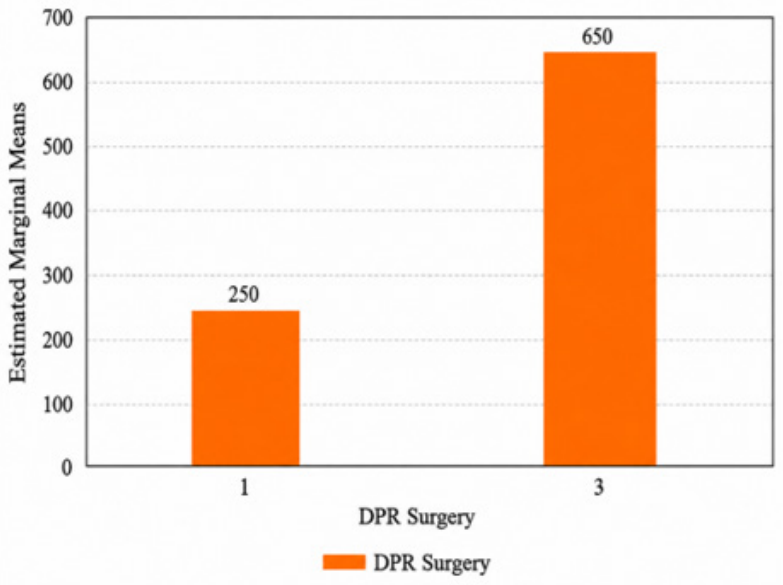

Figure 2: Preoperative and postoperative comparison of total nasal airflow measured one month before and three months after dorsal preservation rhinoplasty.

A greater increase in nasal airflow and a greater reduction in total nasal resistance may indicate better respiratory outcomes in some patients. Based on the results of the paired samples t-test, a significant decrease in nasal airway resistance and a significant increase in nasal airflow were also observed ($P < 0.001$) (Figure 3).

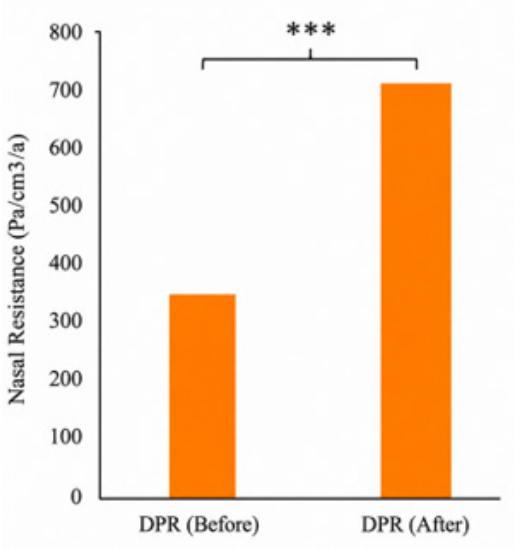

Figure 3: Bar chart comparing nasal resistance and nasal airflow before and after dorsal preservation rhinoplasty (DPR). This chart clearly demonstrates the reduction in nasal resistance and the improvement in airflow.

Discussion

The findings of the present study showed that dorsal preservation rhinoplasty (DPR) can lead to a significant improvement in patients' respiratory function. According to the rhinomanometric findings, a significant reduction in nasal airway resistance was observed after surgery, accompanied by an increase in nasal airflow. The improvement in respiratory function observed in this study is likely related to the structure-preserving nature of the DPR technique. In this method, unlike reduction rhinoplasty techniques, manipulation of the septum and internal nasal valve is reduced. Preservation of these structures may contribute to better stability of the nasal framework and reduce postoperative functional disturbances [18]. Furthermore, reduced trauma to the supportive nasal tissues in DPR may decrease the risk of internal nasal valve narrowing and disruption of physiological airflow [19]. From a physiological perspective, reduced nasal airway resistance directly leads to increased airflow through the respiratory pathway. In the present study, the reduction in total nasal resistance was accompanied by increased nasal airflow, which was consistent with the improvement in respiratory symptoms reported by the patients. These findings suggest that the simultaneous use of objective and subjective indices can provide a more accurate evaluation of the functional outcomes of rhinoplasty [20-22]. In some cases, patients may still perceive nasal obstruction despite acceptable findings on clinical examination; therefore, the use of standardized tools for assessing nasal function is of great importance [23]. In recent years, greater attention has been directed toward functional assessment after rhinoplasty, as surgical success is not limited to aesthetic outcomes and preservation of normal nasal function is also highly important [24]. The present study had some limitations. The relatively small sample size and short follow-up period were among the main limitations of this research. In addition, advanced airflow analysis methods were not used in this study, which could provide more detailed information about airflow changes in future investigations [25]. It is recommended that future studies evaluate a larger number of patients with longer follow-up periods and use complementary methods for assessing nasal function in addition to rhinomanometry.

Conclusion

Based on the findings of the present study, dorsal preservation rhinoplasty appears to be an effective technique for enhancing respiratory function in patients. These findings may assist surgeons in selecting the most suitable surgical approach according to each patient's individual anatomical and functional characteristics, while also contributing to the management of nasal obstruction and breathing difficulties.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This study received no specific financial support.

Ethics Approval

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all patients prior to participation, including

permission for the use of their clinical data for research and publication purposes. Patient confidentiality and anonymity were fully maintained throughout the study.

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Not applicable.

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