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Original Research Article

Changes in Nasal Function after Maxillary Displacement were Evaluated in Rhinoplasty Candidate Patients

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ABSTRACT

Introduction: According to previous studies, it is impossible to predict the functional parameters of the nose for each patient after maxillary surgery; But other studies have offered different hypotheses. Due to some discrepancies in the results of previous studies, in the present study we decided to evaluate nasal function by rhinomanometric tests before and after surgery according to the type of maxillary displacement**. Material and Methods:** This descriptive and longitudinal self-control study was performed during 2019 with the participation of rhinoplasty patients referred to Imam Reza Hospital in Tabriz. Changes in nasal function after maxillary displacement were evaluated in rhinoplasty candidate patients.**Results:** In all samples (regardless of group), the mean airflow in the tail was increased after surgery compared to before surgery, but the amount of increase was not significant. The mean airflow on exhalation was also increased after surgery compared to before surgery, but the amount of increase was not significant. The mean air resistance in the tail was reduced after surgery compared to before surgery, but the amount of reduction was not significant. The mean air resistance on exhalation was also decreased after surgery compared to before surgery, but the amount of reduction was not significant.**Conclusion:** It seems that if Lefort's osteotomy is performed in rhinoplasty surgery with the correct technique, it will not cause respiratory problems for the patient. However, more extensive studies are needed for a more accurate assessment.

Keywords: Rhinoplasty, Respiratory, Maxillary Displacement

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Introduction

Skeletal malformations require different treatments and techniques depending on their type and severity, and are often performed with a single operation on the mandible or maxilla or, if necessary, on both jaws. Initially, surgeons were only able to treat mandibular prognathism, and surgery on the maxilla was performed in a limited way, and most procedures only surgically removed a piece of the maxilla [1-3]. But today, surgical techniques are very widespread and maxillary dislocations are commonly included in treatment plans. Previous research has shown that complete maxillary surgery (Leforte I) can be performed without compromising the blood supply to the osteotomy, and since then Leforte surgery has been used as a technique to correct maxillary deformities. The increase in maxillary surgeries performed by maxillofacial surgeons has led to increasing attention to the effects of this technique on how to breathe [4]. If it is true that reduced nasal respiratory capacity causes the spread of facial abnormalities, especially increased vertical maxillary growth, orthognathic corrective surgery, which may increase airflow resistance, is questionable. Therefore, more extensive research and more accurate prediction is required before surgery [5]. The human upper respiratory system includes the nasal cavity, pharynx, larynx, and bronchi [6-8]. Displacement of the maxilla causes changes in the nasopharyngeal space of the posterior part of the nose and the upper part of the soft palate. In addition, Lefebvre I surgery and maxillary displacement affect the shape and position of the nose, examples of which include flattening of the nasal base. Also, after moving the maxilla down, the required amount is removed from the nasal septum to provide a space without interference to raise the maxilla [9-11]. It is clear that these anatomical changes in the nose also affect the function of the nose. As mentioned earlier, orthognathic surgery is of particular importance in improving the appearance of patients with jaw deformities. In most cases, the maxilla is in the treatment plan, which changes the anatomy of the nasal cavity. By changing this structure, the function of the nose is also affected [12-14]. Depending on the type of maxillary displacement, the nasal cavity space can be smaller or larger and, accordingly, the patient's nasal function and how he breathes and his quality of life are affected [15]. Since the introduction of the maxillary lowering technique in 1954 by Cupar and the standardization of this method by Bell in 1975, some researchers have evaluated its effects on the nasal airway [16-18].

Airway changes in form and function are unavoidable, especially when the maxilla is elevated. Logically, the upper displacement of the maxilla reduces the dimensions of the nose and leads to a relative reduction in nasal airflow due to its increased resistance; However, measurements of nasal airway resistance before and after Lefort 1 osteotomy have shown the opposite. In addition, no consistent relationship was observed between maxillary displacement and nasal airway resistance [19]. According to previous studies, it is impossible to predict the functional parameters of the nose for each patient after maxillary surgery; But other studies have offered different hypotheses [20]. Due to some discrepancies in the results of previous studies, in the present study we decided to evaluate nasal function by rhinomanometric tests before and after surgery according to the type of maxillary displacement [].

Material and Methods

This study was a descriptive and longitudinal control. Patients referred to the ENT surgery department between July and March 2019 who were candidates for rhinoplasty surgery, after signing the informed consent form, were included in the study for initial evaluation. Candidates for rhinoplasty surgery who had a single maxillary osteotomy in their treatment plan and did not have systemic disease or airway diseases such as asthma or allergic rhinitis, or patients who did not have rhinoplasty surgery before rhinoplasty surgery. they started studying. All patients included in the plan underwent orthodontic treatment before surgery. Patients underwent active anterior rhinomanometry and digital lateral cephalometry radiography one week before surgery and three months after its completion [22-24]. Patients were excluded from the study if there was no acne or body ache after surgery, patients did not present at the next follow-up, and problems and complications occurred during and after surgery. Rhinomanometry is a standard medical diagnostic device designed to objectively assess nasal respiratory function [25]. This device measures pressure and air flow through normal inhalation and exhalation through the nose. In active anterior rhinomanometry, the patient is asked to rest 30 minutes before the test. The patient should not have a cold or allergic rhinitis, and smoking is prohibited for patients who smoke before the test [26-28]. During the test, the patient should sit up straight and let the air out of his nose. The sensor tube is selected according to the size of the patient's nose and is placed in

one hole of the patient's nose and the other hole is left open and then the relevant mask is placed on the patient's face. It should be emphasized that controlled temperature and humidity of the surrounding environment, tight insulation of the face mask, good closure of other nostrils and prevention of mouth breathing are necessary to achieve reliable results [29-31]. The patient is asked to breathe with his mouth completely closed and a diagram is drawn based on the patient's breathing and this operation is repeated in both nasal cavities and finally the final diagram is drawn based on the average of both cavities and based on the obtained data. Lateral cephalometry before and after surgery was measured based on Nasion (N), Sella turcica (S) and the degree of change in angles [32-34]. Points A, ANS, PNS, palatal plane and also the type of maxillary displacement were determined and patients were grouped accordingly. 9 patients were in the maxillary advancement group, 7 patients were in the maxillary impaction group and 5 patients were in the maxillary impaction and pushback group [35-37]. Due to the lack of patient with downward displacement of the maxilla, the present study did not have this type of displacement. In data analysis, Shapiro-Wilk test was used to normalize the distribution of quantitatively variable data, as well as Wilcoxon, Kruskal-Wallis and paired t-tests, and a significant level of statistical tests of 5% was considered. This study was registered in the ethics committee of Tabriz University of Medical Sciences under the number IR.TBZMED.REC.1398.269. The samples participating in this study completed the informed consent form and then entered the study

Results

In this study, 21 people including 16 women (76.2%) and 5 men (23.8%) with a mean age of 24.57 97 4.97 years and an age range of 18 to 35 years in terms of changes in airflow variables in Inhalation and exhalation and changes in resistance in inhalation and exhalation were examined in three groups of anterior, upper and upper-posterior displacement surgeries. First, the normality of the variables was checked; Only the variable of air resistance in the tail in the group with anterior displacement did not have a normal distribution, but other variables had a normal distribution. The age range (maximum and minimum age) in the anterior displacement group was 18 to 35 years, in the upper displacement group was 20 to 24 years and in the upper-posterior displacement group was 21 to 30 years. The mean age was 26.67 ± 6.44 years in the anterior displacement group, 21.71 ± 1.50 years in the upper displacement group and 24.80 ±3.56 years

in the upper-posterior displacement group. There was no significant difference between the groups in terms of mean age (P = 0.140). The number of women in each of the anterior, upper and upper-posterior displacement groups was equal to 6 (66.7%), 5 (71.4%) and 5 (100%), respectively. In general, the distribution of sex in the study groups did not differ significantly (P = 0.453). Results shows that the mean airflow at the time of inhalation, before surgery, was higher in the upper-posterior displacement group than the other groups, but the difference was not significant. The mean airflow in the tail, after surgery, was higher in the upper displacement group than the other groups, but the difference was not significant. In the anterior displacement group, the airflow in the tail was increased after surgery compared to before surgery, but the amount of increase was not significant. In the upper displacement group, the airflow in the tail was increased after the operation compared to before the operation; But the amount of increase was not significant. In the upper-posterior displacement group, as in the previous two groups, the airflow in the tail was increased during the postoperative period than before the operation; But the amount of increase was not significant. Also, the most changes before and after the operation were related to the upper displacement group with 61 units and the lowest changes were related to the anterior displacement group with 1 unit; But in the end, the changes before and after the operation were not significantly different between the three groups. The mean airflow in exhalation, before surgery, was higher in the upper displacement group than in the other groups, but the difference between the groups was not significant. The mean airflow on exhalation, after surgery, was higher in the upper displacement group than in the other groups, but the difference between the groups was not significant. In the anterior displacement group, the airflow in postoperative exhalation was reduced compared to preoperative, but the amount of reduction was not significant. In the upper displacement group, airflow in exhalation was increased postoperatively compared to preoperatively, but the amount of increase was not significant. In the upper-posterior displacement group, the airflow in exhalation was increased after the operation compared to before the operation, but the amount of increase was not significant. Also, the most changes before and after the operation were related to the upper-posterior displacement group with 49 units and the least changes were related to the anterior displacement group with 1 unit, but in the end, the changes before and after the operation were not significantly different between the three groups. The mean air resistance in the tail, before surgery, was higher in the anterior displacement group than in the other groups, but the difference was not significant. The

mean air resistance in the tail, after the operation, was higher in the anterior displacement group than the other groups, but the difference was not significant. In the anterior displacement group, the air resistance in the postoperative tail was reduced compared to the preoperative one, but the amount of reduction was not significant. In the upper displacement group, the air resistance in the tail was reduced after the operation compared to before the operation, but the amount of reduction was not significant. In the upper-posterior displacement group, as in the previous two groups, the air resistance in the postoperative tail was reduced compared to the preoperative one, but the amount of reduction was not significant. Also, the most changes before and after the operation were related to the upper displacement group with 8 units and the least changes were related to the anterior displacement group with 1 unit, but in the end, the changes before and after the operation were not significantly different between the three groups.

Discussion

The aim of this study was to investigate the effect of maxillary displacement on nasal airway on 21 patients in three groups of anterior, upper and upper-posterior displacement, during which two variables of airway flow and resistance, each in inhalation and exhalation and It was measured before and after surgery [38]. After statistical analysis, it was found that the distribution of demographic variables such as age and sex were the same in all three groups and no significant difference was observed. In the statistical study, the variable nasal airflow in the tail increased before and after the operation in all three groups and this increase was more in the upper displacement group than the other two groups, but the resulting changes were not significant in any of the three groups. In the statistical study of the same variable in exhalation before and after surgery, the results were as follows: in the upper and upper-posterior displacement group, postoperative exhalation air flow increased, but in the anterior displacement group, this amount decreased, but in none in one of the three groups, the changes were not significant. Regarding the airway resistance factor, statistical analysis showed that resistance during inhalation as well as postoperative exhalation decreased in all three groups, but the obtained figures indicate that this is significant. There was no reduction [39]. The Lefort I osteotomy technique has a variety of applications in orthognathic surgery and can correct maxillary hypoplasia and hyperplasia, and even anterior skeletal open bite seen in patients with a long face. Correction of these deformities requires anterior, superior, or posterior displacement

of the maxilla, and a combination of these movements is often used. Due to the fact that in orthognathic surgery, the maxilla is displaced in different directions of anterior, posterior, upper and lower, these displacements are expected to affect the structure and position of the nose and secondarily affect the nasal breathing of patients. But the significance of these changes and the repetition of the trend of change seems unpredictable due to the combination of maxillary displacement directions and techniques. According to the results, it seems that the greatest improvement in nasal function occurs in the upper displacement group, which despite the smaller size of the nose, this event is probably due to the widening of the nasal floor. Since most of the breathing air passes through the nasal floor, this factor is probably more important than reducing the total volume of the nasal cavity, although there is a need to study with a larger sample size for possible differences. The least positive change in nasal function was related to the anterior displacement group, which had decreased airflow even after postoperative exhalation, which requires more studies to find the cause.

Conclusion

In the conventional treatment plan in maxillofacial surgeries, due to the more complex surgical procedure in the upper and upper-posterior maxillary displacement, there is a tendency for the minimum possible displacement. In anterior maxillary surgeries, however, the absolute amount of displacement is usually greater. It is possible that a large amount of this displacement affects the amount of airflow passing through and justifies a reduction in airflow during exhalation. Designing a study with a larger sample size that allows comparisons between different displacement values can be helpful. It seems that if Lefort's osteotomy is performed in rhinoplasty surgery with the correct technique, it will not cause respiratory problems for the patient. However, more extensive studies are needed for a more accurate assessment.

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