EFFECTS OF COSMETIC RHINOPLASTY ON NASAL FUNCTION

Ali Nowrouzi
Azad University of Medical Sciences, IRAN.
alinowrouzi@hotmail.com

KambizRezaei
Azad University of Medical Sciences, IRAN.
communitymedicineiran.health@gmail.com

ElnazAyatiAfin
Federal Tehran University of Medical Sciences, IRAN.
magdalen33@yahoo.com

ABSTRACT

Background: *Regarding to the high frequency of rhinoplasty as a cosmetic surgery, this study was performed to evaluate the changes in nasal dimensions after open rhinoplasty.*

Methods and Materials: *Pre-operative and post-operative nasal dimensions of 36 cases undergoing cosmetic rhinoplasty without preoperative complaint of nasal obstruction were evaluated using acoustic rhinometry. The measured variables were distance to first and second constriction (d1, d2), first and second minimal cross sectional area (MCA1, 2) and nasal volume.*

Results: *The mean age (SD) of cases was 24.63 (4.4) years. Septoplasty was performed in 12 cases (33.3%). After surgery bilateral d1 and both MCA2 decreased significantly; while, significant increase was observed in MCA1 postoperatively. Cases with septoplasty experienced more increase in MCA1 and less constriction in MCA2 postoperatively. In either of groups of rhinoplasty with and without septoplasty, placing a strut was beneficial for the patients. None of the patients had post-operative nasal obstruction.*

Conclusions: *The cross-sectional area of the nose is a major factor in determining the nasal airflow. Although our findings showed that rhinoplasty generated a mixed effect on rhinometry indices, it did not induce obstructive symptoms for the patients. Septoplasty even in deviated septums increased the nasal airway and placing a strut also improved the nasal function.*

Keywords: Rhinoplasty, Acoustic rhinometry, Septoplasty, Nose function

INTRODUCTION

Functional feature of nose is a matter of great attention in cosmetic nasal surgery. In this era, some new techniques have been developed; focusing on improvement of the function along with the appearance of the nose (1). Furthermore in modern respiratory medicine, objective measurement of airway patency is a necessity. Measurement of nasal cavity geometry has proven to be a great challenge for researchers (2). Human nose functioning is greatly dependent on nasal cavity's geometry. The most common method used in these measurements is acoustic rhinometry (AR), which is based on the analysis of reflected acoustic impulses (3, 4). The cross-sectional area of the nasal airway is measured by acoustic rhinometry and the area may be calculated using data from rhinomanometry (3, 5). Furthermore, several significant associations between nasal cavitydimensions and nasal airflow have been reported (6) and the most important benefit of acoustic rhinomanometry is being easy to perform and less cooperation required from the subject (7).

Few studies have addressed the nose function after cosmetic rhinoplasty (8-11). Most of these studies were performed in patients with abnormal nose function before surgery. However, nose geometry may be influenced by various factors such as race, age, sex, smoking habits, and anthropometric measurements (12, 13). In this study we evaluated the changes in nasal dimensions of healthy Iranian volunteers for cosmetic rhinoplasty who had no preoperative complaint of nasal obstruction using acoustic rhinometry and comparing differences in first and second minimal cross sectional areas (MCA), distances to each, and volume of each nasal cavity before and after surgery. In addition, factors that may influence these changes were studied.

METHODS AND MATERIALS

Seventy two nasal cavities were analyzed from 36 cases undergoing cosmetic rhinoplasty. The cases were all healthy, without any prior history of nose surgery, fracture, allergy or asthma, sinus disorders and had no complaint of nasal obstruction. All cases were aged at least 18 who were visited in ENT clinic of a teaching hospital between since 2008 to 2011. The surgeries included open rhinoplasty with or without septoplasty. Type of osteotomy (single versus double), placement of columellar strut or other variations of surgery were dependent on the surgeon's preference. All operations performed by a single experienced surgeon and septoplasty performed in case of moderate septal deviation.

Tests were conducted using an Eccovision Acoustic Rhinometer (HOOD Laboratories). The device consisted of a sound source (loudspeaker) distally positioned in relation to a 24 centimeter tube equipped with a microphone for acquisition in its proximal portion. A sound pulse was generated with a peak power of 146 dB sound pressure level with 50 millisecond duration. All measurements were performed after a short period of acclimatization and in a relatively quiet room at normal temperature (mean = 21.4ºC) to minimize artifacts from physical stress, environmental noise and temperature changes. The measurements were performed during a breathing pause while patients were in a sitting position. The nosepiece used in the measurements was 5 cm in length and was anatomically sculptured. To ensure a tight connection between the nosepiece and tip of the nose, a small amount of ultrasound transmission gel was applied to the edge of the nosepiece. Care was taken not to obstruct the nasal vestibule with gel or deform the nose during testing. The angle of the incident acoustic impulse was about 45º with respect to a line joining the base of the piriformapertura of the nose to the tragus. Measurement performed in either of two conditions without a decongestant and with a decongestant respectively. The first measurement was performed before surgery and the second measurement was performed 3 months after the operation. Each measurement repeated 3 times and the average value was recorded. The data analysis was performed by SPSS software (version 16.0). The used statistical method was Paired-sample T test to examine the geometrical difference in pre-operative and post-operative nasal cavities and the significance level was considered to be 0.05.

RESULTS

The data of 72 nasal cavities were analyzed. Mean age (SD) of cases was 24.63 (4.4) years, ranging from 18 to 40 years. Male to female ratio was 1:3. None of the cases had complaints of breathing problems before and after the surgery. Septoplasty was performed in 12 cases (33.3%). Mean (SD) geometric values of cases preoperatively with decongestant and without decongestant is demonstrated in Table 1. By the pair wise comparison of cases without decongestant, pre-operative and post-operative, right (R) d1, bilateral d2 and left (L) MCA2 did not change significantly after surgery. L d1, R MCA2 and bilateral volume (V) decreased significantly. Furthermore, bilateral MCA1 increased significantly. However, comparison of nasal dimensions with decongestant revealed that bilateral d2 and V did not changed significantly postoperatively. Bilateral d1 and both MCA2 decreased significantly; while significant increase was observed in MCA1 postoperatively (Table 2).

Table 1.Mean value of nostril geometry before surgery

	Mean (SD)	*Mean (SD) with decongestant*
L d1	3.22 (1.29)	3.38 (1.10)
R d1	3.33 (10.95)	3.48 (1.23)
L MCA1	.52 (.25)	.52 (.19)
R MCA1	.51 (.23)	.51 (.22)
L d2	2.90 (.77)	2.93 (.74)
R d2	2.77 (.73)	2.66 (.63)
L MCA2	.54 (.13)	.53 (.14)
R MCA2	.55 (.16)	.54 (.16)
L V	3.92 (.68)	4.05 (.63)
R V	4.10 (.83)	4.08 (.79)

Table 2.Difference in geometry of nostrils after surgery*

	Mean (SD) difference	*Mean (SD) difference with decongestant*
Difference in L d1	1.27 (1.65)**	1.55 (2.09)*
Difference in R d1	3.43 (10.68)	1.35 (2.25)*
Difference in L MCA1	-.25 (.44)*	-.27 (.43)*
Difference in R MCA1	-.21 (.46)*	-.24 (.41)*
Difference in L d2	.05 (.90)	-.13 (.95)
Difference in R d2	-.048 (1.07)	-.27 (87)
Difference in L MCA2	.062 (.45)	.12 (.18)*
Difference in R MCA2	.145 (.16)*	.11 (.18)*
Difference in L V	.349 (.93)*	.16 (1.02)
Difference in R V	.351 (1.02)*	-.005 (1.04)

* Positive and negative values respectively demonstrate decrease and increase in dimensions.
** Significant difference ($P<0.05$)

In order to assess the result of septoplasty, patients were divided into 2 groups of rhinoplasty plus septoplasty and rhinoplasty alone. The comparison of the findings showed that cases with septoplasty would experience more increase in MCA1 (increase in MCA1 was significant and much more in decongested state of group with septoplasty) and less constriction in MCA2 postoperatively (significant constriction were observed in both groups. However, the amount of this constriction was more prominent in the group without septoplasty) (Table 3).

Table 3- Difference in geometry of nostrils after surgery in cases underwent rhinoplasty alone and cases with rhinoplasty and septoplasty

Mean difference	*Rhinoplasty*		*Rhinoplasty+ Septoplasty*	
	Without decongestant	*With decongestant*	*Without decongestant*	*With decongestant*
Left d1	1.52 *	1.13	1.15 *	1.75 *
Right d1	1.98 *	1.10	4.15	1.47 *
Left MCA1	-.37 *	-.01	-.20	-.39 *
Right MCA1	-.41 *	-.08	-.11	-.32 *
Left d2	.21	-.13	-.02	-.13
Right d2	-.35	-.16	.10	-.33
Left MCA2	.15 *	.18 *	.01	.09 *
Right MCA2	.17 *	.12	.13 *	.10 *
Left V	.02	.64	.51 *	-.06
Right V	.10	.50	.47 *	-.24

* Significant difference ($P<0.05$). Positive and negative values respectively demonstrate decrease and increase in dimensions

In cases of rhinoplasty without septoplasty, increase in MCA1 was only significant in group of single osteotomy without decongestant. Although changes in MCV2 were significant in both with and without decongestion groups of double osteotomy but the net effects were not clinically significant comparing single osteotomies. Table 4 demonstrates that cases with rhinoplasty alone would benefit from double osteotomy in MCA1.

Table 4- Effect of osteotomy on geometry of nose in cases without septoplasty

Mean difference	*Double osteotomy n=8*		*Single osteotomy n=4*	
	Without decongestant	*With decongestant*	*Without decongestant*	*With decongestant*
Left d1	1.39	1.89 *	1.79	.19
Right d1	1.29	1.65	3.38 *	.42
Left MCA1	-.48 *	.09	-.15	-.14
Right MCA1	-.42 *	.01	-.39	-.21
Left d2	.43	-.68	-.22	.55
Right d2	-.13	-.56	-.80	.32
Left MCA2	.16*	.17*	.13 *	.20
Right MCA2	.17 *	.20*	.18 *	.03
Left V	-.29	.98	.65	.21
Right V	-.12	1.10	.56	-.25

* Significant difference (P<0.05). Positive and negative values respectively demonstrate decrease and increase in dimensions

Effect of osteotomy on patency of nose in cases with septoplasty is shown in Table 5. It is more prominent at the level of MCA1. Placing a columellar strut in group of cases of rhinoplasty plus septoplasty has significant effects both at MCA1 and MCA2 levels (Table 6). In cases of rhinoplasty alone placing a columellar strut caused greater amount of increase in MCA1. MCA2 after decongestion increased significantly in group without columellar strut, but it did not change in group with replacing a columellar strut. Regression analysis of difference after surgery in MCA1, MCA2 and V revealed no fix significant effect for septoplasty, osteotomy and placing a columellar strut (Table 7).

Table 5- Effect of osteotomy on geometry of nose in cases with Rhinoplasty plus Septoplasty

Mean difference	*Double osteotomy (n=5)*		*Single osteotomy (n=4)*	
	Without decongestant	*With decongestant*	*Without decongestant*	*With decongestant*
Left d1	1.39	1.89 *	1.79	.19
Right d1	1.29	1.65	3.38 *	.42
Left MCA1	-.48 *	.09	-.15	-.14
Right MCA1	-.42 *	.01	-.39	-.21
Left d2	.43	-.68	-.22	.55
Right d2	-.13	-.56	-.80	.32
Left MCA2	.16*	.17 *	.13 *	.20
Right MCA2	.17 *	.20 *	.18 *	.13
Left V	-.29	.98	.65	.21
Right V	-.12	1.10	.56	-.25

* Significant difference (P<0.05). Positive and negative values respectively demonstrate decrease and increase in dimensions

Table 6- Effect of placing a strut on geometry of nose in cases with Rhinoplasty +Septoplasty

Mean difference	*With strut n=7*		*Without strut n=5*	
	Without decongestant	*With decongestant*	*Without decongestant*	*With decongestant*
Left d1	1.55	1.49 *	1.48	.69
Right d1	1.31	1.21 *	2.93 *	.97
Left MCA1	-.50 *	-.03	-.18	.01
Right MCA1	-.48 *	-.05	-.31	-.12
Left d2	.65	-.32	-.40	.10
Right d2	.37	-.28	-1.38 *	-.02
Left MCA2	.13 *	.14 *	.18	.24
Right MCA2	.15 *	.13	.21	.11
Left V	-.41	.53	.63 *	.78 *
Right V	-.21	.67	.55	.28

* Significant difference (P<0.05). Positive and negative values respectively demonstrate decrease and increase in dimensions

Table 7- Effect of placing strut on geometry of nose in cases with only Rhinoplasty

Mean difference	*With Strut n=11*		*Without Strut n=13*	
	Without decongestant	*with decongestant*	*Without decongestant*	*with decongestant*
Left d1	2.07 *	1.35	.37	1.98 *
Right d1	1.42	.13	6.47	2.25 *
Left MCA1	-.61 *	-.38	.14 *	-.39 *
Right MCA1	-.30 *	-.19	.05	-.40 *
Left d2	-.02	.05	-.02	-.25
Right d2	.28	-.01	-.04	-.51
Left MCA2	-.06	-.02	.08	.16 *
Right MCA2	.13 *	.00	.12 *	.16 *
Left V	.17	-.72 *	.79 *	.32
Right V	-.07	-.65	.94 *	-.00

* Significant difference (P<0.05). Positive and negative values respectively demonstrate decrease and increase in dimensions

DISCUSSION

Multi-drug resistant tuberculosis is an increasing problem in developing countries and so its diagnosis is necessary to prevent the more distribution of drug-resistant species in the society. Variation in the geographic and ethnic distribution of tuberculosis is the main motivation for more studies in different geographical regions to determine the burden of multi-drug resistant tuberculosis in each region, separately.

This study demonstrated that the most common findings in the imaging were calcified lymph node, hillar calcified lymph node, bronchiectasis, cavity, and nodular infiltration and the findings were not related to age and sex among the patients. Cha et al (7) evaluated 68 patients in South Korea and reported that nodule, reticulonodular infiltration, cavity, and consolidation were the most common imaging findings. They found that as higher as the drug resistance was seen, the imaging findings were not differed. The nodules and cavities were also among most common findings in our study.

Another study by Yeom et al (8) in South Korea in 2009 among 78 subjects showed that consolidation, parenchyma involvement, and cavity are the most common findings among patients with MDR tuberculosis that is similar to our findings about only the cavities. Fishman et al (9) in United States in 1998 evaluated 100 patients and reported the consolidation as the most common imaging finding that was only found in 39 percent of our patients. Also they reported no typical finding in nearly one-third of the patients.

Lee et al (10) performed a study in South Korea in 2010 and demonstrated that nodules and consolidation are the most common findings that our study showed similar results. Goldman et al (11) in United States in 2007 reported that imaging findings are good indicator of drug-resistant tuberculosis.

Totally, according to the obtained results and comparison with other studies, it may be concluded that especial radiographic findings are seen in patients with drug-resistant tuberculosis. Hence performing radiographic evaluation is recommended in such patients. However further studies should be carried out to obtain more definite results especially with considering control group without drug-resistant tuberculosis.

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