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Preoperative Planning for Rhinoplasty, in Relation to the Gender and Ethnicity

Pawel Szychta[1,2], Ken J. Stewart[2] and Jan Rykala[2]
[1]*Plastic and Reconstructive Surgery Department, St John's Hospital, Livingston*
[2]*Plastic, Reconstructive and Aesthetic Surgery Department, 1st University Hospital, Lodz*
[1]*Great Britain*
[2]*Poland*

1. Introduction

The nose plays an important role in the respiratory tract and is one of the most visible organs on the face due to its central position. It emphasizes the shape of the eyes, is an integral part of the face, and co-decides for its aesthetics as a whole. In clinical practice, there is no universal concept of the 'perfect face', nor is there a specific shape of the nose, considered a model of beauty. Normal range of the values describing nasal shape varies depending on race and gender. In order to achieve a very good result of aesthetic surgery for an each individual patient, surgeon must include to the preoperative planning of rhinoplasty the differences of nasal shape in relation to gender and ethnicity.

2. Anthropometry for individual analysis of the nasal shape

Precise preoperative planning is essential in obtaining good results after rhinoplasty, judged subjectively by the patient and surgeon. Anthropometric measurements of the nose can be helpful in preoperative objective analysis. They serve both to highlight the parameters that require correction, as well as pointing to some of the correct proportions, which should be preserved during surgery (Szychta et al. 2010).

2.1 Devices for measuring the nasal shape

Until recently, anthropometric measurements were carried out directly on the patient using rulers and anthropometric calipers or indirectly on standardized photographs. These methods cannot be used in routine clinical practice as they are time-consuming and inaccurate.

An innovative method for measuring the surface of the human body is three-dimensional imaging. It involves taking standardized pictures of the analyzed region using specialized equipment connected to the computer, and then analyzing the three-dimensional digital model. The advantages of this method include accuracy, speed and automation of the calculations. Analysis with a 3D scanner was developed with relevant analytical software by one of the authors adds an additional 2 minutes to the time spent with patient (Szychta et al, 2010a). The invested time is minimal, taking into account the possibility of obtaining relevant, objective clinical data that may provide significant help in planning rhinoplasty. Reliability of measurements with a 3D scanner using the anatomical points has already

been confirmed in the previous studies. The drawbacks of the currently available 3D scanners are their high, one-time cost and very low availability of the equipment adapted for clinical use.

2.2 Outline of the analytical method of the nasal shape assessment

The authors propose an algorithm including linear measurements, angles and indices, which allow to depict the differences among people of both sexes and of different races (Szychta et al, 2010b). Assessment is based on 18 anthropometric nasal points (7 separate for left and right side of the body), including points describing the nostrils: anterior (naL, naR), posterior (npL, npR), lateral (nlL, nlR) and medial (nmL, nmR), as well as subalare (sbalL, sbalR) and alare (alL, alR), and also 7 single points of the nose: pronasale (prn), subnasale (sn), nasion (n), glabella (gl), rhinion (rh), labiale superius (ls) and columellar point (cp) (Figure 1).

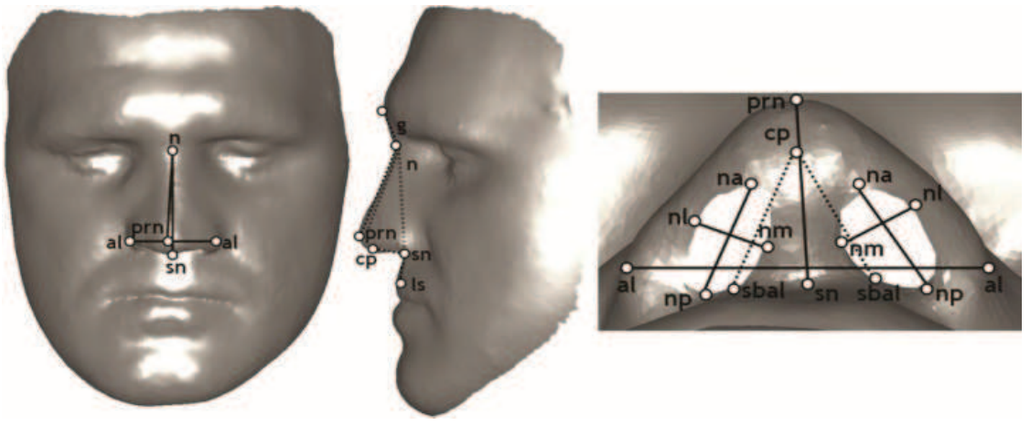

Fig. 1. Anatomical points used in the study together with indices of proportions (solid lines) and angles (dashed lines), shown on a sample three-dimensional model of the face in a patient after posttraumatic rhinoplasty. Views: a) front, b) profile, c) from below

By using selected anatomical points, the following 8 linear measurements are carried out: length and width for both nostrils (naR-npR, naL-npL, nlR-nmR and nlL-nmL, respectively), nasal height (n-sn), nasal length (n-prn), nasal width (al-al) and the nasal prominence (sn-prn). On the basis of linear measurements, two ratios of nasal proportions are determined: index of the prominence to the nasal width (sn-prn/al-al * 100) and nasal index (al-al/n-sn * 100).
The survey consists of 4 angles defining the shape of the nose: interaxial (sbalR-cp-sbalL), nasofrontal (gl-n-prn), nasolabial (cp-sn-ls) and nasofacial (prn-n-sn).

3. Ethnic differences in parameters describing facial and nasal shape

The aesthetic beauty of a nose is subjective and varies according to specific cultural and ethnic population (Table 1). A characteristics of the proper nasal shape depends on the race: the Caucasian nose (called leptorrhine - 'long and narrow'), the African nose (platyrrhine - 'a wide and flat') and the Asian nose (called mesorrhine – ‘borderline’) (Krzeski, 2005).
The Caucasian nose is characteristic of people of European descent, and its features are often used as a model for comparison with other races. The Caucasian nose is narrower than the

Table 1. Parameters describing the shape of the nose in relation to gender in healthy white, black and Asian race, compared with our results of rhinoplasty in group of Europeans (Szychta et al. 2011)

Parameter of the nose		Sex	Our study, (Caucasian race) n=54		Caucasian race (Farkas, 1994a), n=50		Caucasian race (Leong et al., 2006), n=50		Negroid race (Ofodile & Bokhari, 1995), n=69		Mong	
											Chinese (Farkas et al., 1994b), n=60		Sing (Aung
			mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean
Width (mm)		F	32.15	3.73	31.40	1.90	36		40.00	0.4	37.20	2.10	37.63
		M	34.89	4.35	34.70	2.60	36		43.50	0.39	39.20	2.90	39.49
Height (mm)		F	55.81	4.36	48.90	2.60			49.30	0.42	51.70	2.30	46.93
		M	60.02	4.23	53.00	3.50			52.40	0.44	53.50	2.80	50.15
Length (mm)		F	45.66	5.58							44.30	3.70	40.04
		M	49.02	6.60							46.20	2.80	43.65
Prominence (mm)		F	19.29	3.96	19.30	1.90			20.40	0.32	15.40	1.80	16.69
		M	20.66	2.95	20.60	2.20			23.10	0.36	16.10	1.50	17.68
Right nostril	Width (mm)	F	9.63	1.96									
		M	10.47	2.09									
	Length (mm)	F	15.61	2.14									
		M	16.25	1.92									
Left nostril	Width (mm)	F	9.49	1.81									
		M	10.25	1.94									
	Length (mm)	F	15.92	2.48									
		M	16.71	1.93									
Nasofrontal angle (°)		F	132.95	5.99	134	7.40	137.5	4.8	131.9	6.8	135.6	4.40	139.0
		M	131.05	5.10	130.5	8.10	129.3	12.1	135.6	5.4	134.5	7.00	137.4
Nasolabial angle (°)		F	104.23	11.21	99.1	8.70	101.1	8.6	91	9.3	88.5	11.20	97.71
		M	103.67	10.31	98.9	8.00	95.6	10.2	83.5	10.5	86.9	12.20	99.91
Interaxial angle (°)		F	69.02	11.89									80.67
		M	66.32	13.21									75.07
Nasofacial angle (°)		F	33.06	4.16			37.2	5.4					
		M	31.64	3.01			36.7	7.8					
Nasal index (%)		F	57.72	5.93	64.21				81.70				79
		M	58.25	6.92	64.85				83.80				81
Index of prominence to width (%)		F	60.49	13.95	61.46				51.5				45
		M	59.56	7.89	59.36				53.8				45.77

The African nose is characterized by a wide base, short and concave bridge and nasofrontal angle of 130-140 degrees. It is said to be pear-shape. Relatively short tip projection is often encountered, as well as posteriorly extended alae and round nostrils. Very thick skin of the nose is observed. Black people have the widest and most prominent nose compared with other ethnic groups. Within Europe of course interracial nasal differences are recognized by all (Patrocinio LG & Patrocinio JA, 2007).

The Asian nose has intermediate characteristics between representatives of Caucasian and African. The skin of the nose is quite thick and the bridge is wide. Analyzing cartilaginous-osseous skeleton, nasal bones are usually short. Nasal tip is rounded off with an insufficient projection, rotation and recessed columella. Typically, the nostrils are slightly rounded. The shape of the nose is similar in representatives of the Mongoidal race: Chinese, Singaporeans and Koreans, with clearly more prominent nose in the last group (Table 1) (Farkas et al., 1994b; Aung et al., 1995; Hwang & Kang, 2003; Lam, 2009).

Additionally, patients can sometimes seek to conform to culturally accepted perceptions of an attractive nose. For example, Black or Asian patients living in predominantly Caucasian societies not uncommonly seek surgery to enhance nasal projection (Niechajev & Haraldsson, 1997).

4. Differences in normal values of the nasal shape in relation to gender

The range of values of the anthropometric parameters defining the 'ideal aesthetic face' and ‘ideal aesthetic nose' is different for male and female (Table 2). These differences must be

Anatomic nasal parameter	Anthropometric nasal parameter	Women	Men
Height	Height	Smaller	Larger
Dorsum width	Nasal index	Narrower	Wider
Alae width	Nasal width	Narrower	Wider
Nostrils	Length and width of both nostrils	Smaller	Larger
Projection	Fronto-nasal angle, Naso-facial angle	Smaller	Larger
Nasal tip	Naso-labial angle	More cranial rotation	More caudal rotation
Nasal root	Nasion-glabella lenght	Superior eyelid crease or just below	Superior eyelid crease or just above
Line of the nasal dorsum	Angle of deviation between cartilaginous and osseous vault	Straight or a bit concave; acceptable small depression of the nasal dorsum	Straight or a bit convex; acceptable small nasal hump
Soft tissues layer		Thinner	Thicker

Table 2. Overall, comparative characteristics of the normal nasal shape in women and men (Krzeski, 2005)

taken into account when planning the surgery. During each preoperative evaluation of the nose, the proportions of the nose must create harmony with the rest of the individual face. It is commonly held view that women have larger eyes, smaller noses, fuller lips, a smaller distance between lips and chin, a smaller lower lip and a gently outlined maxilla. In contrast, an attractive man has close and deep placement of eyes, bigger nose, pronounced cheekbones and jaw, as well as clearly outlined non-prominent ears (Gunter et al., 2007).
Rhinoplasty techniques for men and women are identical, differing only within the scope of the resection. Lack of understanding of differences in the shape of the nose in relation to gender may lead to adverse aesthetic outcome (e.g. feminization of the male nose), which is not a rare complication of rhinoplasty.

4.1 Our study

The authors examined the usefulness of the proposed method of anthropometric assessment of the nose, evaluating 43 patients treated in the Plastic, Reconstructive and Aesthetic Surgery Department (Medical University of Lodz, Poland) (33 men and 10 women) aged 18 to 45 years (mean 27 years) for the aesthetic results of posttraumatic rhinoplasty (Szychta et al. 2011). The results were compared with previously described values of anthropometric parameters for the healthy population. In order to standardize the study group, only Caucasians of both genders have been included to the research. All patients underwent partial resection and reposition of the nasal septum, placing it in the median plane of the body. Simultaneously, the osteotomy of the nasal skeleton was performed. Three-dimensional images using 3D scanner were performed at 6 months after surgery. Subsequently, the anthropometric measurements of the three-dimensional facial model were carried out with a computer program. Linear measurements were performed with an accuracy of about 0.1 millimeter.
The shape of the nose in men and women showed significant differences (Table 1). According to the results obtained in previous studies, women had narrower and shorter nose (width: 32.15 ± 3.73 mm and 34.89 ± 4.35 mm, height: 55.81 ± 4.36mm and 60.02 ± 4.23mm, respectively). In women, the nostrils were rounder, with similar width and shorter length in comparison to men (width of the nostrils: $p > 0.05$, length of the right and left nostril: $p = 0.0457$, $p = 0.0207$, respectively). For both sexes we observed the same ratio between width and height of the nose as well as between its prominence and width. We did not notice differences in the position of the nasal tip in relation to the whole face.
In conclusion, the nose was usually smaller in women. We obtained good results of rhinoplasty, which were similar to healthy Caucasian population in majority of the linear parameters. However, the nasal index was lower compared with the control group due to the surgical narrowing of nasal tip. Moreover, in the present study, slightly more obtuse nasolabial angle than in the healthy population was associated with the surgical shortening of the nasal tip. Increased nasofrontal angle and the associated reduced nasofacial angle versus the comparison group resulted from osteotomy and the related shift of the nasal root (nasion).
Further studies are planned to determine whether the introduction of the presented method to clinical practice improves the aesthetic outcome of rhinoplasty. The comparative assessment of pre- and postoperative results after posttraumatic rhinoplasty with use of 3D scanner has been reported elsewhere (Szychta et al. 2010).

5. The individual aspect of rhinoplasty

Individualized nasal analysis should into account normative values based on patient's gender and race, as well as consideration of the individual shape of the face. The nose is an integral part of the face and must be adjusted in size and shape to the whole. Therefore, it is essential to obtain harmony between the parameters of the nose during posttraumatic rhinoplasty (Gunter et al., 2007). Even in healthy people with an aesthetically attractive appearance of the face, a number of parameters differ from the usual aesthetic standards. A long or oval face looks attractive with a longer and narrower nose. Similarly, a round or square face is more harmonious with the shorter and broader nose (Figure 2). During the preoperative assessment the surgeon should show understanding for the individual nasal proportions for each patient, treating the so called 'aesthetic proportions' only as a guideline and not seeking to achieve standard 'aesthetic ideal' (Tebbetts, 2008).

Fig. 2. Differently shaped faces with harmonious noses; a) and b) long face with long thin nose, c) round face with harmonious short, wide nose

Almost every human face among the healthy population has a significant asymmetry between the two sides of the body. Asymmetrical shape of the face can be interesting. It is also important that before the posttraumatic rhinoplasty the surgeon supports the patient with information regarding risks of postoperative deviations from perfect symmetry (Tardy, 1997).

In our opinion, knowledge of the normal range of values of parameters for a given gender and ethnicity is important to better understand the general principles of the correct nasal shape, along with the desire to obtain a perfect postoperative result, individually tailored by the operation.

6. Conclusions

The aesthetic characteristic of the nasal shape in a healthy Caucasian population is significantly different compared with the noses of other races. In the preoperative planning

and evaluation of treatment results, knowledge of anthropometric differences between people of different races and both sexes appears equally important as the individual differences in relation to the whole face. Following the above mentioned guidelines in the study, we achieved similar aesthetic results of posttraumatic rhinoplasty to the relevant population with normal parameter values of the nasal shape.

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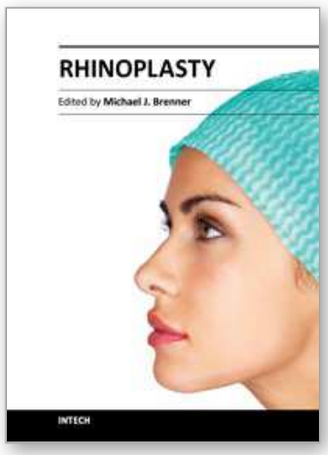

Rhinoplasty

Edited by Dr. Michael Brenner

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Rhinoplasty is one of the defining procedures of plastic and reconstructive surgery. Its roots stem from early efforts in nasal reconstruction to the emergence of modern rhinoplasty. This book describes the latest clinical and research perspectives in rhinoplasty and balances structural correction with aesthetic refinement. With treatises on rhinoplasty from a diverse set of thought leaders from around the world, the collective experience of this books' authors cover cosmetic and reconstructive approaches with a wealth of proven and innovative approaches ranging from minor refinement to major reconstruction. This diversity reflects the inherent complexity of the art and science of rhinoplasty. Discussion of structural approaches is balanced by consideration of judicious resection and refinement. The overarching goal is to instill an understanding of the subtleties of nasal structure and how the natural complexities of nasal anatomy can be adapted to maximize both function and natural appearance.

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

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