

Nasal Skin Thickness Measurements Using Computed Tomography in an Adult Saudi Population

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Background: Rhinoplasty is one of the most challenging operations in plastic surgery, and nasal skin thickness is a significant factor in determining rhinoplasty success. Only a few studies have measured nasal skin thickness before rhinoplasty. The present study was designed to measure nasal skin thickness to shed light on its importance to successful rhinoplasty.

Methods: Altogether, 60 patients underwent measurements of nasal skin thickness at 4 aesthetic points: nasion, rhinion, nasal tip, columella. The thickness was measured using computed tomography (CT), an objective, reliable tool for this purpose. Universally adopted Hounsfield unit measurement using in house software (Consultant Radiology Center, Riyadh, Saudi Arabia) was performed using CT scan.

Results: The study group included 32 women and 28 men. Age range was 18–68 years, but most of the patients (53.3%) were within the 20–30-year age range. CT results showed that the mean nasal skin thickness was 3.96 ± 1.08 mm at the nasion, 1.86 ± 0.62 mm at the rhinion, 3.32 ± 0.78 mm at the nasal tip, and 3.32 ± 0.73 mm at the columella. When the nasal skin thicknesses were compared between men and women, a significant difference was observed only at the columella ($P = 0.016$).

Conclusions: The nasal skin is thickest at the nasion, thinner at the rhinion, and again thicker at the nasal tip and columella. Our data could be useful for plastic surgeons who could take the patient's own nasal area thickness into consideration when planning his or her rhinoplasty. (*Plast Reconstr Surg Glob Open* 2019;7:e2450; doi: 10.1097/GOX.0000000000002450; Published online 30 September 2019.)

Rhinoplasty is a challenging operation even with the advances that have been made in this area of plastic surgery. Despite its complexity, it remains one of the most common aesthetic operations performed by plastic surgeons globally, particularly in the United States.¹ Nasal skin thickness is considered a significant risk factor in determining its success.² Several factors have been suggested to contribute to the variations in nasal

skin thickness, including the patient's sex, race, genetics, and ethnicity. The exact etiology is yet to be confirmed. People with extremely thick nasal skin generally have a more porous overall skin quality, which could affect the nasal appearance after surgery, whereas those with thinner nasal skin more clearly show the shape of the underlying cartilage and the structure of the nose. Thus, slight irregularities of the reconstructed nasal skeleton could cause visible, undesirable changes.^{3,4} Nasal anatomy and point of its location is important in rhinoplasty. Nasion is the junction of the nasal and frontal bones at the most posterior point on the curvature of the bridge of the nose. The rhinion is the top of the nose where nasal bones meet with the cartilage part of the nose. Columella is the midline prominence of the nose, extending from the nasal root to the tip.

The Caucasian nose has thick skin over the nasofrontal angle that becomes thinner over the rhinion, thickens again at the tip, and becomes thinner over the columella.² Another study of Caucasian noses reported thicker nasal skin over the nasofrontal angle, becoming thinner over

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the rhinion, again thicker in the nasal tip, and then thinner over the dome.⁵ In contrast, the Korean nose has a thick-skinned bulbous shape.^{6,11}

The most popular tools used to measure nasal skin thickness include plain radiography, the micrometer screw gauge, Harpenden calipers, ultrasonography, and computed tomography (CT), among others.⁷ The skinfold caliper is the most widely used site-specific technique for measuring skin thickness because of its accessibility, high feasibility, and low cost,^{7,8} although its accuracy has been challenged.⁶ Ultrasonography has also been explored for this purpose but is not a substantial improvement over skinfold calipers. Among these techniques, CT is the most sensitive because it can measure slight attenuation, and it depicts soft tissues with more clarity. It is thus a useful tool for measuring nasal skin thickness.⁶

Only a few studies have examined the impact of nasal skin thickness on the aesthetic results of rhinoplasty. We therefore planned the present study to measure the thickness of Saudi nasal skin at 4 aesthetic points (nasion, rhinion, nasal tip, columella) using CT. We hypothesized that the data could be useful for the plastic surgeon to recognize the nasal thickness before planning and performing the rhinoplasty procedure, thereby contributing to the success of the surgery.

METHODS

Altogether, 285 patients underwent rhinoplasty at Ajmal Specialized Plastic Surgery Center, Riyadh, Saudi Arabia from August 2017 to January 2019. Among them, 60 (28 men, 32 women; ages 18–68 years) who were evaluated using preoperative CT and underwent tip surgery were enrolled in this study. The distribution of participants with respect to age showed that 53.3% of patients were in the 20–30-year age group.

During recruitment for the study, the inclusion and exclusion criteria were followed strictly. Patients with a history of skin disease (eg, skin tumors, other chronic skin disease) were excluded from the study. Patients of Saudi nationality and similar ethnicity were recruited to avoid genetic risk factors.

The standard CT protocol for evaluating the paranasal sinuses was performed with axial, sagittal, and coronal reconstruction. Individual thin cuts (recon slice thickness 1 mm) of soft tissue were obtained, and sagittal reconstruction was performed in the soft tissue window for measurements of skin thickness at the midline. Universally adopted and reliable Hounsfield unit (HU) measurements using in house software (Consultant Radiology Center, Riyadh, Saudi Arabia) were performed using CT scan (Toshiba 16 multislice CT scanner). HU is widely used dimensionless unit in CT scan to express CT numbers in a standardized and convenient manner.^{9,10} Skin thickness was then measured at the midline in the nasion, rhinion, nasal tip, and columella; after rhinoplasty, the patients returned for follow-up at 1 week and 1, 3, 6, and 12 months.

Statistical Analysis

All statistical analyses were performed with SSPS for Windows, version 16.0 (IBM, Armonk, NY, Chicago,

Table 1. Distribution of Participants with Respect to Sex

Sex	Frequency (N = 60)	Percentage (%)
Male	28	46.7
Female	32	53.3

N = number of participants.

IL). The data were presented as means ± SD. Unpaired Student’s *t*-test was applied to compare quantitative data. One-way analysis of variance was applied to study the hypothesis that there are significant differences in nasal skin thickness. A value of *P* < 0.05 was considered to indicate statistical significance.

RESULTS

There were more women (53.3%) enrolled than men (Table 1). The data were analyzed to determine the distribution pattern of the patients based on age. It showed that the maximum number (53.3%) of patients were in the 20–30-year age group (Table 2). Nasal skin thickness was measured using CT at 4 aesthetic points: nasion, rhinion, nasal tip, columella, as shown in Figure 1. The thickness was measured in millimeters (mm). The mean nasal thickness was 3.96 ± 1.08 mm at the nasion, 1.86 ± 0.62 mm at the rhinion, 3.32 ± 0.78 mm at the nasal tip, and 3.32 ± 0.79 mm at the columella (Fig. 2). A comparison of the nasal skin thickness between men and women revealed a significant difference at the columella (*P* = 0.016). The mean thicknesses at the other 3 points measured (nasion, rhinion, nasal tip) were greater in men, but none of the differences reached a level of significance (Fig. 3). There were also no significant differences in the mean nasal skin thickness among the various age groups (Table 3). One-way analysis of variance was applied to determine if there were significant differences between or within the age and sex groups. The results showed no significant differences (Table 4).

DISCUSSION

Describing the nasal skin thickness as thick, thin, or medium by plastic surgeons lacks reliability and validity because it varies according to the observer’s sense and judgment. The anatomy of the nose plays an important role in the physical appearance of the nose. Therefore, it is essential that the nose’s anatomy be accurately assessed, to develop a realistic and rational surgical plan. It needs skill and experience. In this study, we obtained CT measurements of nasal skin thickness that are more scientific, accurate, and reliable.

Table 2. Distribution of Participants with Respect to Age of the Patients

Age (years)	Frequency (N = 60)	Percentage (%)
<25years	9	15
25–30 years	30	50
31–35 years	7	11.7
>35 years	14	23.3

N = number of participants.

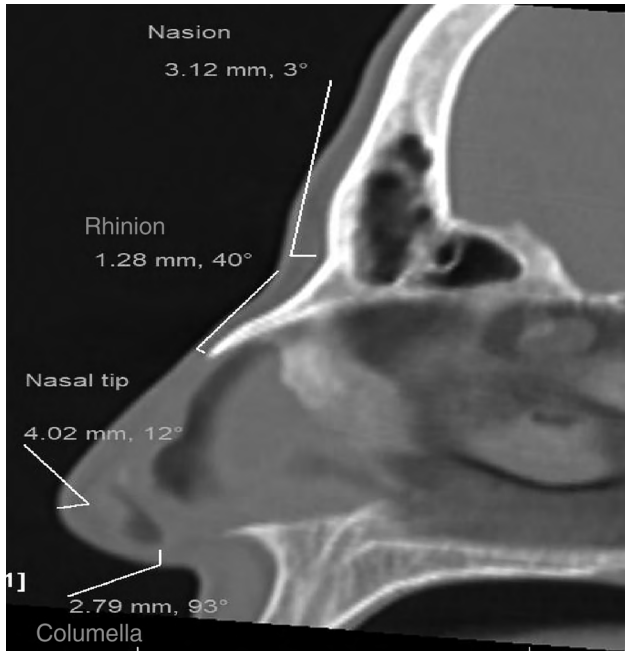


Fig. 1. Reflects the measurement of nasal skin thickness using CT at four aesthetic points: nasion, rhinion, nasal tip, columella. The thickness was measured in millimeters.

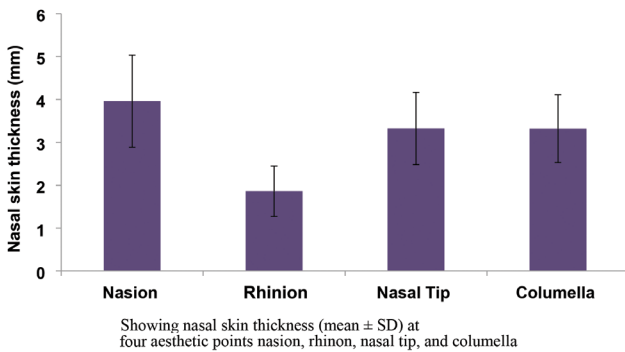
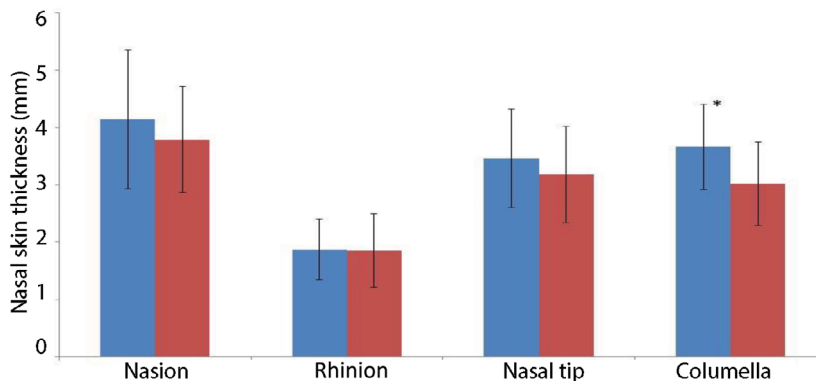


Fig. 2. Showing nasal skin thickness (mean ± SD) at four aesthetic points nasion, rhinion, nasal tip, and columella.



Showing nasal skin thickness (mean ± SD value) at four aesthetic points nasion, rhinion, nasal tip and columella in male and female, * shows the significant value at $p < 0.05$

Fig. 3. Showing nasal skin thickness (mean ± SD value) at four aesthetic points nasion, rhinion, nasal tip, and columella in male and female. *Shows the significant value at $P < 0.05$.

We showed that the nasal skin in Saudis undergoing rhinoplasty was thickest over the nasion, followed by the columella, nasal tip, and rhinion (Fig. 2). Our findings are similar to those in previous reports where the Caucasian nose skin was thickest at the nasion, thin over the rhinion, and again thick at the nasal tip.⁵ We observed that the thickness at the nasion (3.96 ± 1.08 mm) and nasal tip (3.32 ± 0.78 mm) was thicker than that of the Korean nose (3.33 and 2.90 mm, respectively). At the rhinion, however, the nasal skin thickness in our study was 1.86 ± 0.62 mm, which was less than that of the Korean rhinion (2.4 mm).⁶ We therefore concluded that the differences in nasal skin thickness with respect to age and sex are likely due to chance and are relatively the same for various ages and between the sexes. Most patients in our study were 20–30 years of age, ie, Saudis at a young age are more inclined to rhinoplasty than those in older age groups.

In a study conducted in cadavers ($N = 60$), the authors reported a mean nasal thickness of 1.25 mm.¹¹ Later on, when they measured nasal skin thickness in three cadavers, the mean thicknesses were 1.22 mm at the nasal tip and 0.73 mm at the nasal dorsum.¹² These cadaver values are quite low (indicating thin skin) compared with values derived from live nasal skin thickness. Thus, comparing nasal skin thickness of cadaver skin with that of living skin cannot be justified scientifically because of the difference in physiology of living and nonliving skin.⁶

Furthermore, when a comparison of nasal skin thickness was made between men and women at 4 aesthetic points, the mean values at the nasion, rhinion, nasal tip, and columella were higher in the men than in the women (Fig. 3). The difference was significant, however, only at the columella (Table 5). Cho et al.⁶ reported similar results in Koreans. They found that the skin at the nasion, rhinion, and nasal tip was significantly thicker in men than in women.

Many studies have reported that thick skin creates a challenge for plastic surgeons during rhinoplasty. It has also been reported that thick skin and subcutaneous tissue can mask tip projection.¹³ Whitaker and Johnson⁴ spoke clearly about the role of the quality of the overlying skin and subcutaneous tissue during preoperative planning.

Table 3. Comparison of the Mean Nasal Skin Thickness among the Different Age Groups

Nasal Points	<25 years	25–30 years	31–35 years	>35 years
Nasion	3.873 ± 0.570	4.003 ± 1.146	3.842 ± 1.321	3.977 ± 1.157
Rhinion	1.808 ± 0.465	1.954 ± 0.692	1.797 ± 0.219	1.740 ± 0.684
Nasal tip	3.035 ± 0.895	3.492 ± 0.692	2.845 ± 0.904	3.354 ± 0.778
Columella	3.378 ± 0.581	3.356 ± 0.722	3.274 ± 0.949	3.236 ± 0.774

Table 4. Comparison of Nasal Skin Thickness between Age Groups and among the Age Groups

Nasal Points	Age Groups	Sum of Squares	df	Mean Square	F	P
Nasion	Between groups	0.225	3	0.075	0.061	0.98
	Within groups	68.612	56	1.225		
	Total	68.837	59			
Rhinion	Between groups	0.52	3	0.173	0.441	0.725
	Within groups	22.026	56	0.393		
	Total	22.547	59			
Nasal tip	Between groups	3.209	3	1.07	1.809	0.156
	Within groups	33.124	56	0.592		
	Total	36.333	59			
Columella	Between groups	0.182	3	0.061	0.11	0.954
	Within groups	31.046	56	0.554		
	Total	31.228	59			

Table 5. Comparison of Nasal Skin Thickness between Male and Female

Regional Skin Thickness	T	df	P	Mean Difference	Std. Error Difference
Nasion	1.258	58	0.214	0.349	0.278
Rhinion	0.17	58	0.866	0.0273	0.161
Nasal tip	1.426	58	0.159	0.287	0.201
Columella	3.723	58	0.001*	0.635	0.17

CT for measuring facial soft tissue thickness is considered a reliable method for establishing average values.^{8,14} One report, however, described the limitations of CT for measuring the width of thin structures. Further studies with a more significant number of patients from various ethnicities are needed to measure nasal skin thickness using CT.

CONCLUSIONS

The present findings indicate that the nasal skin thickness pattern in a Saudi population is similar to that of Caucasians but different from that of Koreans. Our findings could be helpful in the understanding of the relations between patients' anatomy and surgical outcomes for rhinoplasty in this case, in Saudis. The regional skin thickness may be an important prognostic factor for rhinoplasty success.

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