ORIGINAL ARTICLE

Nasal Skin Thickness and Its Correlation with Age

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Background: Nasal skin thickness (NST) is a factor that can impact the aesthetic outcome of rhinoplasty. A comprehensive understanding of NST and predicting its changes with age can help surgeons maximize the aesthetic outcome.

Objective: To estimate NST and analyze its correlation with age-related changes.

Materials and Methods: The present study was a cross-sectional descriptive study that reviewed computerized tomography images of 183 Thai patients. NST was measured at four locations, the nasion, rhinion, nasal tip, and columella. Correlation between NST and age was analyzed. Subgroup analysis was performed based on gender.

Results: Out of the 183 patients, 89, or 48.63%, were male. The mean age was 51.36±18.47 years, ranging from 18 to 87 years. The NST at the nasion was 2.77±0.71 mm, rhinion 1.75±0.63 mm, nasal tip 3.23±0.91 mm, and columella 2.4±0.78 mm. Significant negative correlations with age where the nasal skin was thinner with increasing age, were identified at the nasion (r= –0.193), rhinion (r= –0.213), and nasal tip (r= –0.167). Subgroup analysis showed that NST was significantly higher in males than in females at all sites. Negative correlations were found in females, at the nasion (r= –0.236), rhinion (r= –0.261), and nasal tip (r= –0.395). No significant correlations were identified in males.

Conclusion: NST at the nasal tip was the thickest area in the entire population, as well as in male and female subgroups. Negative correlations with age were identified at the nasion, rhinion, and nasal tip. The same correlations were identified in females. No correlations were identified at the columella or in males.

Keywords: Nasal skin thickness; Correlation between nasal skin thickness and age; Computerized tomography analysis

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Rhinoplasty is recognized globally as a popular cosmetic surgical procedure. However, the intricate nature of achieving desired results, particularly for the patients with thick nasal skin, presents an ongoing challenge[1]. The anatomy of the nose significantly influences its physical appearance. Thus, an accurate assessment is imperative in formulating a comprehensive plan for rhinoplasty. The structure of the nose is composed of three layers, the skin and soft tissue envelope (SSTE), the nasal framework that includes the cartilaginous or bony vault, and the internal lining. The SSTE layer includes the skin, subcutaneous tissue, and superficial musculoaponeurotic system (SMAS)[2]. Skin thickness and sebaceous glandularity vary among different areas of the nose and among different races. Typically, the thickest areas are the nasion, sellion, supratip, or nasal tip, which differ among races, while the thinnest area is usually located at the rhinion[3]. The thickness of the nasal skin is associated with aesthetic outcome of rhinoplasty. An overly thick nasal skin can increase the risk of postoperative edema, ecchymosis, and visible scar formation[2,4-7], which impacts optimal postoperative outcomes. A study by Jang et al. showed that thick nasal skin impeded the post-surgery tip projection[5]. On the contrary, thin nasal skin presents its own set of challenges. It increases the risk of post-operative contour deformities due to visibility of slight irregularities. In addition, thin nasal skin may be further compromised by rhinoplasty. Therefore, the application of any graft, especially a synthetic graft, in rhinoplasty should be used with caution[6]. The optimal nasal skin thickness camouflages minor irregularities and maintains enough thinness to reveal the sculpted contours of the underlying nasal skeletal structure. The comprehensive understanding of nasal skin thickness and predicting how it changes

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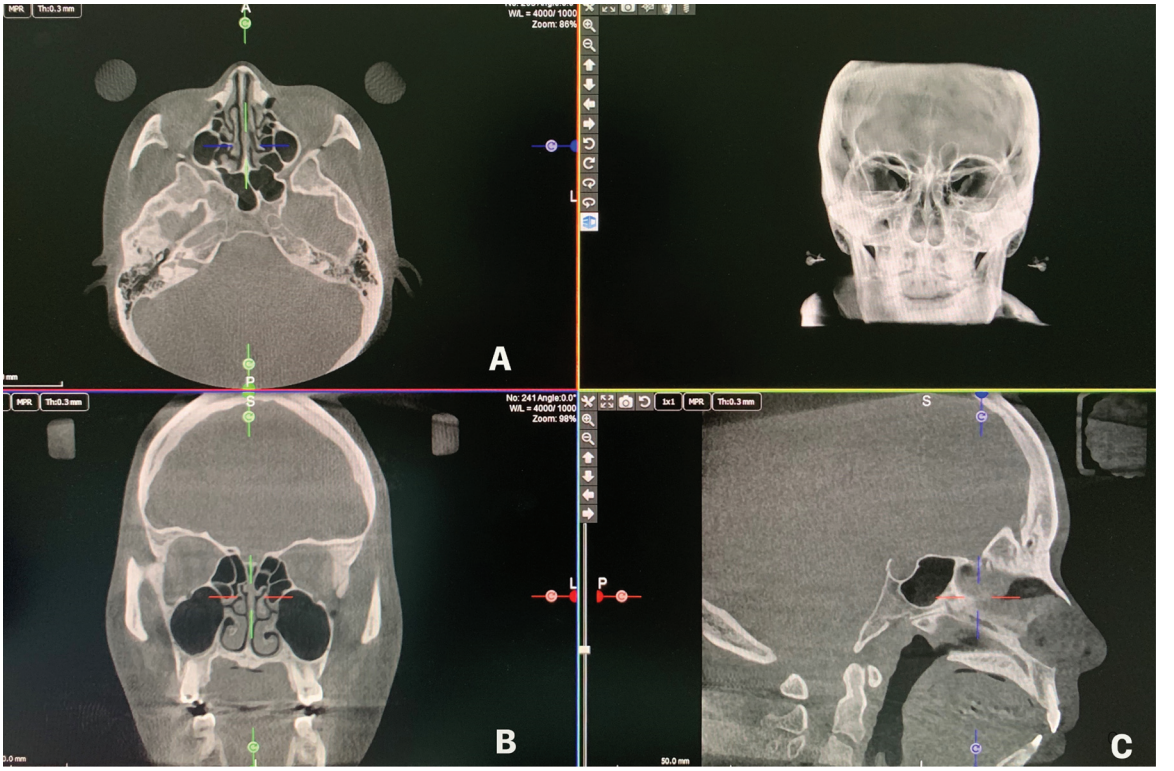

Figure 1. A true midline plane in axial (A), coronal (B), and sagittal view (C).

with age can help surgeons strategically modify the thickness before or during the surgery to maximize the aesthetic outcome. The aim of the present study was to measure nasal skin thickness and analyze its correlation with age.

Materials and Methods

The present study was a cross-sectional descriptive study conducted at a tertiary medical center. The study reviewed paranasal sinus cone beam computerized tomography (CBCT) images of 183 eligible patients, between July 2019 and July 2021, at the Endoscopic Nasal and Sinus Surgery Excellence Center, Chulalongkorn Hospital. The inclusion criteria were patients aged 18 years or older who underwent paranasal sinus CBCT imaging. Patients were excluded if they had a tumor in the nose or paranasal sinus area, a history of trauma or surgery in the nose or paranasal sinuses. Patients with any skin lesion on the nose or face that appeared on the imaging or was documented on the patient's record on the study date were excluded. Primary outcomes were the measurements of nasal skin thickness at four different locations, the nasion, rhinion, nasal tip, and columella. Secondary outcomes were correlations between nasal skin thickness of each area and age. Subgroup analysis was performed based on gender. The study protocol was approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University (IRB No.171/62).

The nasal skin thickness was measured perpendicularly to the underlying structures at the true midline plane in the sagittal view. The true midline was defined as a vertical line from the base of the Crista Galli downward through the perpendicular plate of the ethmoid bone and directed to the maxillary crest in the coronal plane (Figure 1). The skin was defined as epidermal and dermal layers. The measurement was taken from the uppermost part of the epidermis downward to the plane superficial to the subcutaneous layer. Subcutaneous fat was identified by tracing the Hounsfield unit (HU) range from –190 to –30 HU (Figure 2, 3). The nasal skin thickness was measured at four areas as the nasion, rhinion, nasal tip, and columella. The thickness was measured by an operator who underwent training to ensure accurate measurements. The accuracy was assessed using the intraclass correlation coefficient (ICC), where an ICC of 0.8 or greater was considered acceptable.

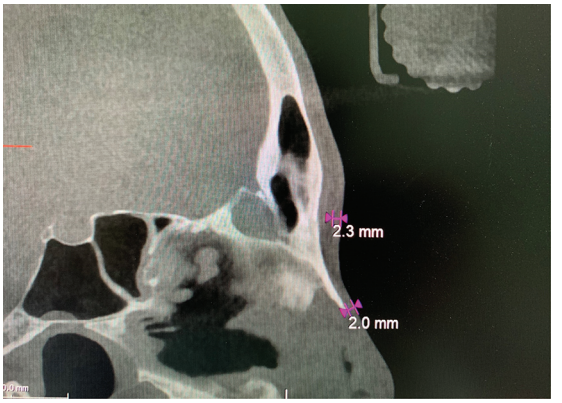

Figure 2. The measurement of nasal skin thickness at nasion and rhinion.

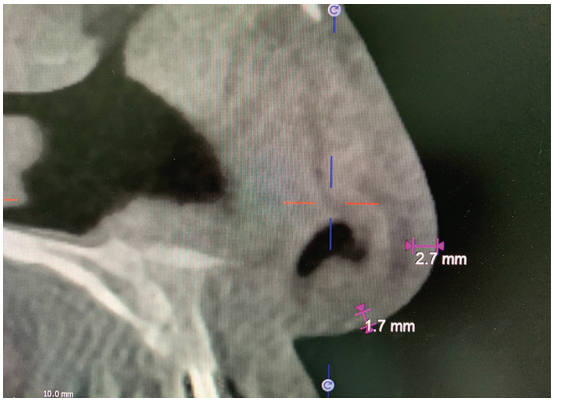

Figure 3. The measurement of nasal skin thickness at nasal tip and columella.

The sample size was determined using a formula for sample size calculation. The sample size (n_0) was calculated using Z=1.96, which represented the abscissa of the normal curve that cut off an area α at the tail. The desired level of precision (e) was set to 0.2 for the present study. Based on the previous study by Alharethy et al.[8], the value of 1.38 was used as σ in the equation, where σ^2 represents the variance of an attribute in the population. A sample size of 183 was calculated.

Statistical analysis was performed using the IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA) and Stata Statistical Software, version 15.1 (StataCorp LLC, College Station, TX, USA). Continuous data were presented as mean ± standard deviation (SD). Linear relationship between nasal skin thickness and age was analyzed using the Pearson's correlation coefficient[9]. The level of significance was set at p-value less than 0.05.

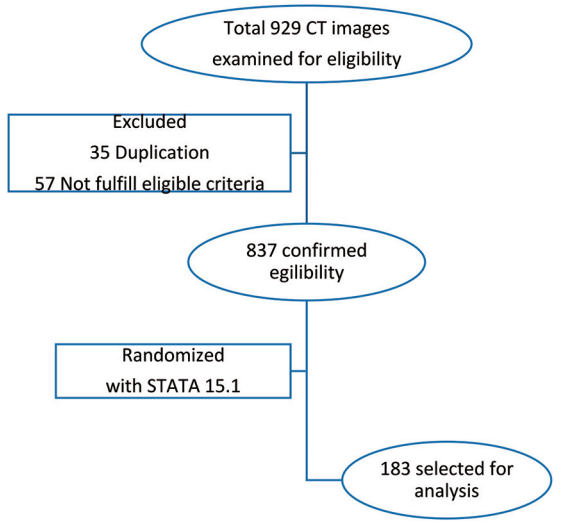

Figure 4. A diagram illustrating the process of subject selection.

Results

Nine hundred twenty-nine subjects were initially screened. After removing 35 duplicate entries and 57 subjects who did not meet the eligibility criteria, 837 participants remained. The 183 participants were randomly selected from these 837 eligible subjects for analysis (Figure 4), using the sample function in Stata v.15.1, ensuring approximately equal numbers of patients in ten-year age brackets.

Out of the 183 patients, 89 patients (48.63%) were male, and 94 patients (51.37%) were female. The age of the participants ranged from 18 to 87 years and the mean age was 51.36±18.47 years. There was no missing or incomplete data among the selected subjects. The nasal skin thickness at the nasion was 2.77±0.71 mm, rhinion 1.75±0.63 mm, nasal tip 3.23±0.91 mm, and columella 2.4±0.78 mm. The ranking of thickness from thickest to thinnest areas was nasal tip, nasion, columella, and rhinion. Subgroup analysis by gender also showed the same order of thickness, from the thickest to the thinnest areas, in both male and female subgroups. The mean thickness was different between subgroups. The mean thickness of the male subgroup was significantly higher than those of the female subgroup at all sites. The differences in thickness between males and females were for the nasion at 0.28±0.10 (95% CI 0.08 to 0.48, p=0.007), rhinion at 0.37±0.09 (95% CI 0.20 to 0.55, p<0.001), nasal tip at 0.55±0.13 (95% CI 0.30 to 0.80, p<0.001), and columella at 0.28±0.11 (95% CI 0.06 to 0.51, p=0.014) (Table 1).

There were significant negative correlations

Table 1. The results of nasal skin thickness in all participants, including male and female subgroups, along with the mean difference between the subgroups

Age	n	Nasion	Rhinion	Nasal tip	Columella
Total (n=183); mean±SD					
18 to 30 years	30	2.78±0.69	1.8±0.6	3.31±0.89	2.48±0.8
31 to 40 years	30	3.18±0.68[a]	2.05±0.68[a]	3.63±0.85[a]	2.78±0.75a
41 to 50 years	30	2.66±0.53	1.8±0.61	3.31±0.78	2.22±0.79
51 to 60 years	31	2.81±0.63	1.76±0.53	3.2±0.74	2.13±0.43a
61 to 70 years	31	2.5±0.64[a]	1.43±0.58[a]	2.91±1.02[a]	2.45±0.88
>70 years	31	2.69±0.87	1.64±0.63	3.04±1.04	2.36±0.83
All	183	2.77±0.71	1.75±0.63	3.23±0.91	2.4±0.78
p-value		0.006*	0.004*	0.038*	0.022*
Male (n=89); mean±SD					
18 to 30 years	15	2.79±0.6	2.05±0.59	3.28±0.7	2.56±0.78
31 to 40 years	12	3.41±0.46	2.13±0.64	3.79±0.8	2.93±0.73
41 to 50 years	15	2.95±0.5	1.91±0.5	3.75±0.75	2.48±0.75
51 to 60 years	19	2.88±0.7	1.93±0.54	3.47±0.74	2.23±0.38
61 to 70 years	13	2.68±0.64	1.76±0.7	3.31±1.35	2.74±1.22
>70 years	15	2.84±0.8	1.85±0.69	3.53±1.22	2.53±0.9
All	89	2.91±0.65	1.94±0.6	3.51±0.94	2.55±0.81
p-value		0.091	0.687	0.615	0.273
Female (n=94); mean±SD					
18 to 30 years	15	2.77±0.79	1.55±0.51	3.35±1.06	2.4±0.83
31 to 40 years	18	3.02±0.77	2.01±0.72[a,b]	3.53±0.89[a,b]	2.68±0.77a
41 to 50 years	15	2.37±0.4	1.69±0.7	2.87±0.53	1.97±0.77a
51 to 60 years	12	2.7±0.52	1.5±0.41	2.78±0.54	1.97±0.47
61 to 70 years	18	2.36±0.62	1.18±0.33[a]	2.62±0.59[a]	2.25±0.45
>70 years	16	2.56±0.94	1.43±0.51[b]	2.58±0.55[b]	2.19±0.76
All	94	2.63±0.73	1.56±0.6	2.96±0.8	2.27±0.72
p-value		0.058	0.001*	0.001*	0.044*
Mean difference between males and females					
Mean±SD		0.28±0.10	0.37±0.09	0.55±0.13	0.28±0.11
95% CI		0.08 to 0.48	0.20 to 0.55	0.30 to 0.80	0.06 to 0.51
p-value		0.007*	<0.001*	<0.001*	0.014*

SD=standard deviation; CI=confidence interval

[a] ANOVA test and [b] multiple comparisons by Bonferroni test, * p<0.05

between age and skin thickness of three areas, the nasion (r= –0.193, p=0.009), rhinion (r= –0.213, p=0.004), and nasal tip (r= –0.167, p=0.024), but no significant correlation was found at the columella (r= –0.083, p=0.261). Subgroup analysis by gender showed significant negative correlations with age in the female subgroup at the same areas, the nasion (r= –0.236, p=0.022), rhinion (r= –0.261, p=0.011), and nasal tip (r= –0.395, p<0.001), but no correlation was found at the columella (r= –0.152, p=0.142). In the male subgroup, no significant correlations were observed between age and nasal skin thickness at any of the four areas (p>0.05) (Table 2).

Discussion

The results of the present study showed the nasal skin thickness followed a consistent pattern, with the nasal tip being the thickest, followed by the nasion, columella, and rhinion. This order was observed in the entire study population as well as in both male and female subgroups. The nasal skin thickness was different between subgroups. The measurements of all sites in the male subgroup were significantly higher than those of the female subgroup. The analysis revealed negative correlations between age and nasal skin thickness of three areas, the nasion, rhinion, and nasal tip, in all participants and in the female subgroup. However, the correlations were not

Table 2. The correlation between nasal skin thickness and age in all participants, including male and female subgroups (Pearson's correlation coefficient)

Location	Group					
	Total participants		Male subgroup		Female subgroup	
	r	p-value	r	p-value	r	p-value
Nasion	–0.193	0.009*	–0.148	0.167	–0.236	0.022*
Rhinion	–0.213	0.004*	–0.179	0.094	–0.261	0.011*
Tip	–0.167	0.024*	0.025	0.816	–0.395	<0.001*
Columella	–0.083	0.261	–0.02	0.855	–0.152	0.142

r: Pearson's correlation coefficient, * $p<0.05$

identified at the columella and in the male subgroup at any sites.

The negative correlation with age may be explained by the physiologic change of aging. As individuals age, the skin experiences a decrease in dermal cells, extracellular matrix of dermis, and epidermal thickness, flattening of dermo-epidermal junction[10,11], loss of underlying fat, and soft tissue atrophy[12,13]. Moreover, estrogen deficiency contributes to cutaneous phenomena including thinning of the skin[14,15]. This may explain the older women have significantly thinner skin than older men. Nevertheless, this phenomenon is applied to skin without specific area. No existing theory can explain why columellar skin does not follow that pattern. Further study is needed. Based on the findings of the present study, the surgeon can be mindful that the areas with negative correlation with age may pose a risk of visible contour or material extrusion of the implant as the patient ages, especially in female patients.

The study of Luebberding et al. concluded that the stratum corneum of male significantly decreased with age[16]. However, the present study included other layers of epidermis and dermis in the analysis. This may be the reason that the present study results did not demonstrate any significant correlations in men. Moreover, a study by Dey et al. suggested a correlation between higher body mass index and thicker SSTE[17]. Comparing nasal skin thickness among different races is also challenging due to the distinct characteristics within each race.

The association between nasal skin thickness and rhinoplasty outcome can be a crucial factor in surgical planning. Studies reported that patients with thicker nasal skin require a specialized surgical technique with a stronger underlying framework to provide structural support[18,19]. Aldosari et al. reported higher degrees of periorbital edema and ecchymosis in patients with thicker nasal skin, but the results did not reach statistical significance[20]. For post rhinoplasty outcome, Cho et al. found an excellent outcome in thin nasal tip and columella skin, but a poor outcome in those with thick nasal tip and columella skin. The nasion and rhinion skin thicknesses were not associated with postoperative outcomes[7]. On the other hand, one study found that nasal skin thickness was not a crucial factor affecting patient satisfaction[8]. Overall, patients with thicker nasal skin may have more challenges in achieving satisfactory aesthetic outcomes after rhinoplasty.

There are several techniques for skin thickness measurements, such as visual examination, palpation, the use of a micrometer screw gauge, skin fold calipers, and radiographic modalities, including ultrasound and computed tomography[2,4]. The strength of our study was that the nasal skin thickness was assessed by CT measurements, which offered superior clarity, accuracy, and reliability[7,21]. The present study limitation was that the study population was homogenous with only Thai patients. Therefore, it does not entirely represent the rich diversity of global patient demographics. The authors propose that future studies should involve larger, diverse patient populations.

Conclusion

The nasal skin thickness in Thai population followed a consistent pattern, with the nasal tip being the thickest, followed by the nasion, columella, and rhinion. This was the same in both male and female subgroups. Negative correlations with age were identified at the nasion, rhinion, and nasal tip, in all participants and the female subgroup. This correlation was not identified at the columella and in the male subgroup.

What is already known on this topic?

Nasal skin thickness is associated with rhinoplasty outcome. An overly thick nasal skin can increase the

risk of postoperative edema, ecchymosis, and visible scar formation[2,4-7]. On the contrary, thin nasal skin can increase the risk of post-operative contour deformities due to visibility of slight irregularities.

What does this study add?

The results of this study showed a correlation between the skin thickness and age within the Thai population, which has not been previously reported. This unique dataset not only fills a critical knowledge gap but also holds practical implications, particularly for surgeons involved in rhinoplasty procedures. The correlation between nasal skin thickness and age becomes a valuable tool for surgeons to engage in more informed and personalized discussions with the patients. By understanding how the nasal skin changes with age, surgeons can effectively communicate potential changes, enabling patients to make more informed decisions about the long-term outcomes of the procedure. This research not only advances scientific understanding but also enhances the patient-surgeon dialogue, promoting transparency and tailored approaches in aesthetic medical practices.

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