Nasal Skin Thickness Measured Using Computed Tomography and Its Effect on Tip Surgery Outcomes

Gye Song Cho, Jeoung Hyun Kim, Nam-Kyung Yeo, Soo Hyun Kim and Yong Ju Jang

Otolaryngology -- Head and Neck Surgery 2011 144: 522 originally published online 14 February 2011
DOI: 10.1177/0194599811398936

The online version of this article can be found at:
http://oto.sagepub.com/content/144/4/522
Nasal Skin Thickness Measured Using Computed Tomography and Its Effect on Tip Surgery Outcomes

Gye Song Cho, MD1, Jeoung Hyun Kim, MD2, Nam-Kyung Yeo, MD3, Soo Hyun Kim1, and Yong Ju Jang, MD, PhD1

Abstract

Objective. Skin thickness can be a major factor affecting rhinoplasty outcomes. However, few studies have examined the impact of nasal skin thickness on rhinoplasty aesthetic results. The aim of this study is to determine the effect of nasal skin thickness on the tip surgery outcome objectively.

Study Design. Case series with chart review.

Setting. Academic tertiary care medical center.

Subjects and Methods. The study involved 77 patients who were evaluated using preoperative computed tomography scans and underwent rhinoplasty including tip surgery. Surgical outcomes were classified as excellent, good, or poor. Nasal skin thickness was measured at nasion, rhinion, nasal tip, and columella using computed tomography scans and was analyzed according to surgical outcomes.

Results. The mean nasal skin thickness was 3.3 mm for nasion, 2.4 mm for rhinion, 2.9 mm for nasal tip, and 2.3 mm for columella. Postoperative outcomes were classified as excellent, good, or poor. Nasal skin thickness was measured at nasion, rhinion, nasal tip, and columella using computed tomography scans and was analyzed according to surgical outcomes.

Skin thickness can be a major factor affecting rhinoplasty outcomes.1 Patients with extremely thick skin tend not to show a definite change in their tip after surgery, whereas thin-skinned patients also present a particular challenge in rhinoplasty because even slight irregularities of the reconstructed nasal skeleton can be visible.2 However, until recently, few studies have examined the impact of nasal skin thickness on rhinoplasty aesthetic results.

For typical white noses, it is reported that the nasal skin is thickest over the nasofrontal angle, thins over the rhinion, is thick again in nasal tip, and thins out over the dome.3 Nasal tip skin thickness varies greatly among individuals, as the subcutaneous tissue is thicker and sebaceous glands are prominent in this region. Although Koreans are considered to have a thick-skinned bulbous-shaped nose, there are no objective data to support this contention.

The present study measured nasal skin thickness in Korean patients undergoing tip surgery. The study also examined whether skin thickness was linked to aesthetic outcomes of tip surgery. Skin thickness was measured using computed tomography (CT) scans.

Subjects and Methods

Study Subjects

This study was approved by the institutional review board of the Asan Medical Center. Of the 134 patients who underwent rhinoplasty at the Asan Medical Center between July 2008 and February 2009, 77 patients (55 males, 22 females) who were evaluated using preoperative CT and underwent tip surgery

Keywords

rhinoplasty, skin thickness, tip surgery

Received November 3, 2010; revised December 20, 2010; accepted January 11, 2011.
were enrolled in the study. The follow-up period ranged from 13 to 26 months (mean, 17.8 months). Patient age ranged from 14 to 68 years (mean, 28.0 years). No patient had a history of skin disease or skin tumors. All operations were performed by the corresponding author of the study.

Skin Thickness Measurement and Analysis According to Age and Gender

Nasal skin is composed of 3 primary layers (epidermis, dermis, and subcutaneous fat). On CT scans, fat tissue was identified using a fixed attenuation range from –190 to –30 Hounsfield units (HU) as the standard reference. Nasal skin thickness from the epidermis to the fat layer was defined and measured by tracing the CT scan Hounsfield units (Figure 1). Several studies have shown the reliability of Hounsfield unit measurements using in-house software (PetaVision; Asan Medical Center, Seoul, Korea). Four subsites of the external nose were studied: the nasion, rhinion, nasal tip, and columella regions. Images were acquired using either a 16-slice scanner (LightSpeed 16, General Electric Healthcare, Milwaukee, Wisconsin) or a 64-slice scanner (LightSpeed 16, General Electric Healthcare), using a soft-tissue algorithm, contiguous 3-mm direct axial, coronal, sagittal scan. Measurements were performed using the midsagittal view, which shows the greatest dimension of the nasal septum. Skin thicknesses at the 4 sites were analyzed according to age and gender.

Analysis of the Effect of the Skin Thickness on Tip Surgery Outcomes

Surgical outcomes were assessed by 2 otolaryngologists who were not involved in any of present surgery. Assessment was based on reviews of preoperative and 6-month postoperative photographs. Based on their consensus, tip surgery postoperative outcomes were classified as excellent, good, or poor. Aesthetic changes in the tip were analyzed in terms of projection and definition. When postoperative photos showed no change or aggravation of tip projection or definition, the outcome was rated as poor. When a patient’s tip demonstrated slight to modest improvement in projection and definition, outcome was defined as good. Excellent outcome refers to cases when the tip showed prominent and outstanding improvement in tip aesthetics. The mean skin thicknesses of these 3 outcome groups were determined.

Statistical Analysis

Data are expressed as mean ± standard deviation. Differences in skin thickness between males and females were analyzed using the Mann-Whitney U test. Associations between skin thickness and age were determined using the Spearman rank correlation test. The relationship between outcomes (ie, excellent, good, or poor) and skin thickness or surgical technique was examined using 1-way analysis of variance and Pearson chi-square tests, respectively. Statistical analyses were performed using SPSS software (version 12.0, SPSS, Chicago, Illinois). A P value <.05 was considered to indicate significance.

Results

The 77 patients had mean nasal skin thicknesses of 3.3 ± 1.3 mm at the nasion, 2.4 ± 1.0 mm at the rhinion, 2.9 ± 0.6 mm at the nasal tip, and 2.3 ± 0.5 mm at the columella (Figure 2). The 55 male patients had mean nasal skin thicknesses of 3.7 ± 1.1 mm at the nasion, 2.6 ± 1.0 mm at the rhinion, 3.0 ± 0.6 mm at the nasal tip, and 2.3 ± 0.5 mm at the columella. The 22 female patients had mean nasal skin thicknesses of 2.2 ± 1.1 mm at the nasion, 1.7 ± 0.6 mm at the rhinion, 2.7 ± 0.6 mm at the nasal tip, and 2.1 ± 0.4 mm at the columella. The skin was thicker in males than females at the nasion, rhinion, and nasal tip (P < .0001, P < .0001, and P = 0.03, respectively). There was a weak positive correlation between nasion skin thickness and age (ie, the skin was thicker with increasing age; correlation coefficient = 0.24, P = .04). No correlations were found between age and skin thickness at the rhinion, nasal tip, or columella (P > .05).

Patient demographic data and the surgical techniques used according to the 3 outcomes are shown in Table 1. Surgical outcomes were excellent in 45 (58.4%) patients, good in 17 (22.1%), and poor in 15 (19.5%) (Figures 3-5). In males, there were 30 (54.5%) excellent, 14 (25.5%) good, and 11 (20.0%) poor outcomes. In females, there were 15 (68.2%) excellent, 3 (13.6%) good, and 4 (18.2%) poor outcomes. Nasal tip and columella nasal skin thickness were found to be associated with outcomes (P < .0001 and P = .01, respectively) (Table 2). The nasal tip and columella skin thicknesses

Figure 1. Measurement of nasal skin thickness using computed tomography (CT). The measurements of Hounsfield unit data using inhouse software (PetaVision; Asan Medical Center, Seoul, Korea) were performed using CT scans. Four nose skin sites were investigated on the midsagittal view: nasion, rhinion, nasal tip, and columella.

[Image of Hounsfield unit mean and nasal tip thickness]
were thinnest in the excellent group (nasal tip = 2.8 mm, columella = 2.2 mm), intermediate in the good group (nasal tip = 3.1 mm, columella = 2.4 mm), and thickest in the poor group (nasal tip = 3.4 mm, columella = 2.6 mm) (Table 2). Nasion or rhinion skin thicknesses were not found to be associated with outcomes (P = .70 and P = .43, respectively).

During the follow-up period, complications were encountered in 2 patients (2.6%), and these comprised a sepal hematoma and infection in 1 patient and unexpected tip graft rotation in 1 patient. The latter patient underwent revision rhinoplasty 1 year after the first rhinoplasty. It was not possible to determine a relationship between the occurrence of complications and skin thickness due to the low number of complications.

**Discussion**

Using CT scan measurements, we found that skin thickness in Koreans undergoing tip surgery is greatest over the nasofrontal angle, thins over the rhinion, thins again in the nasal tip, and thins again over the columella. These findings are similar to those reported for white noses. We also found that thick nasal skin correlated with poor surgical outcomes.

Several studies have examined nasal skin thickness. One study of 60 cadavers reported mean thicknesses of 1.25 mm at the nasion and 0.6 mm at the rhinion. Another study of 3 cadavers reported mean thickness of 1.22 mm at the nasal tip and 0.73 mm at the nasal dorsum and reported that the nasal tip was 3.30-fold thicker than the upper eyelid, making it the site of the thickest facial skin. The present study found mean skin thicknesses of 3.3 mm for the nasion, 2.4 mm for the rhinion, and 2.9 mm for the nasal tip. Although a direct comparison of thickness between living skin and skin from a cadaver cannot be totally valid, our data suggest that the nasal skin of Koreans is thicker than that of whites.

We found that males and females differed in terms of skin thickness at the nasion, rhinion, and nasal tip. These findings are similar to those of a study that examined soft tissue thickness in 173 males and 127 females from northwest India. That study reported mean nasion skin thicknesses of 5.86 mm in males and 5.76 mm in females and mean end of nasal bone (rhinion) thickness of 2.07 mm in males and 2.03 mm in females; there was a significant difference at the end of nasal bone (rhinion) between males and females.

Thick-skinned patients present a very difficult challenge to rhinoplastic surgeons. Jang et al reported that tip projection after surgery was reduced by thick skin and subcutaneous tissue. Whitaker and Johnson reported that the quality of the overlying skin and subcutaneous tissue cover must be carefully considered in preoperative planning. However, no previous study has examined the prognostic effect of skin thickness on tip surgical outcomes. We found that skin thickness in the nasal tip and columella was associated with surgical outcomes. In particular, thick skin in the nasal tip and columella was associated with poor surgical outcomes. Thin-skinned patients also present a challenge to rhinoplastic surgeons. There is an increased opportunity for graft contact with thin skin and subcutaneous tissue, so naturally thin skin may be further attenuated by graft materials. Therefore, graft materials, especially synthetic ones, must be used carefully in rhinoplasty.

However, the present study found no relationship between thin skin and unfavorable postoperative outcomes nor an increased complication rate due to thinner skin. Only 2 (2.6%) of 77 patients experienced complications; 1 underwent revision rhinoplasty because of unexpected tip contour change 1 year after the first rhinoplasty. Notably, however, the revision rhinoplasty may have been attributable to relatively thin skin (nasion, 1.4 mm; rhinion, 1.1 mm; nasal tip, 2.6 mm; columella, 2.1 mm) compared with the mean values for 22 female patients (nasion, 2.2 mm; rhinion, 1.7 mm; nasal tip, 2.7 mm; columella, 2.1 mm).

The present study examined 77 patients who wanted, and underwent, rhinoplasty. Hence, this population may not be representative of typical Koreans, and therefore the regional nasal skin thicknesses reported here may not be applicable to the

| Table 2. Surgical Outcome and Regional Nasal Skin Thickness |
|-------------------------------|----------------|----------------|----------------|--------------|
|                               | Excellent (n = 45) | Good (n = 17) | Poor (n = 15) | P Value      |
| Skin thickness, mm            |                 |                |               |              |
| Nasion                        | 3.2             | 3.5            | 3.4           | .70          |
| Rhinion                       | 2.3             | 2.5            | 2.6           | .43          |
| Nasal tip                     | 2.8             | 3.1            | 3.4           | <.0001       |
| Columella                     | 2.2             | 2.4            | 2.6           | .01          |

Nasal tip and columella skin thickness differed between the 3 groups (P < .0001 and P = .01, respectively).
Another limitation of this study is the subjective rating of surgical outcomes. The description of the subjective assessment of excellent, good, and poor results may be too simple and could lack reliability and validity. Although the analysis method is not sophisticated, we found that it worked well in our previous research.14

There are several methods of measuring skin thickness, including the use of radiograph, micrometer screw gauge,
Harpenden calipers, and ultrasound. CT is more sensitive to slight differences in attenuation than standard radiography and therefore depicts the soft tissues with great clarity. CT scanning can detect a specific layer of lean body tissue, and thus it is a useful tool for measuring skin thickness. Therefore, CT measurement of facial soft tissue thickness is considered to be a reliable method in the acquisition of normal values. However, one report described limitations in measuring the width of thin structures using CT scans. CT scans were the only method used to measure skin thickness in the present study. Hence, measurements using other tools or cadaveric skin tissue are likely to be needed to confirm the present findings.

In conclusion, the present findings indicate that nasal skin is thicker in Koreans than in whites. In addition, we found that thicker skin at the nasal tip and columella was associated with poor surgical outcomes. These findings are likely to assist in the understanding of the relationship between patient anatomy and surgical outcomes in rhinoplasty.

Conclusions
Korean nasal skin was thickest over the nasofrontal angle, became thinner over the rhinion, was thick again in the nasal tip, and thinned out over the columella. Thick skin in the nasal tip and columella was associated with poor surgical outcomes. Therefore, regional skin thickness appears to be an important prognostic factor for tip surgery success.

Author Contributions
Gye Song Cho, data analysis, conception, article revision; Jeoung Hyun Kim, data analysis, conception; Nam-Kyung Yeo, conception and design; Soo Hyun Kim, data analysis, design; Yong Ju Jang, conception, design, article revision, and final approval.

Disclosures
Competing interests: None.
Sponsorships: None.
Funding source: None.

References

Figure 5. Example of a poor surgical outcome. (A) Preoperative view of a 21-year-old man with a deviated nose and bulbous tip. (B) Three-month postoperative view after surgical treatment with a septal extension graft, bilateral spreader graft, and a shield graft.


