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Rationale for osteotome selection in rhinoplasty

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Abstract

Proper selection of an osteotome for nasal osteotomy is important for minimizing soft tissue trauma. Radiographic analysis of the facial bony lateral wall thickness was performed to suggest a guideline for an appropriate osteotome size for Asians. Facial bone computed tomography (CT) of 100 patients (50 male, 50 female) were studied. The thickness of the facial bony lateral wall at three points along the track of a lateral osteotomy, and two points along the track of a medial osteotomy and intermediate osteotomy were measured. The average bony thickness along the track of a lateral osteotomy was 2.61 ± 0.66 mm at the low level, 2.75 ± 0.76 mm at the middle level, and 2.72 ± 0.53 mm at the high level in subjects. The average bony thickness along the track of an intermediate osteotomy were 1.26 ± 0.34 mm at the low level, and 1.31 ± 0.32 mm at the high level in the subjects. The average bony thickness along the track of the medial osteotomy were 2.54 ± 0.31 mm at the low level, and 2.77 ± 0.30 mm at the high level in subjects. These results may provide a guideline for choosing an osteotome of appropriate size for the Asian population.

Key words: Osteotomy; Tomography, X-ray Computed; Rhinoplasty

Introduction

Lateral osteotomy in rhinoplasty is undertaken to correct an asymmetric lateral nasal wall contour, and to narrow the nose. Using an osteotome of an inappropriate size can contribute to excessive intranasal soft tissue trauma, resulting in destabilization, excessive haemorrhage, echymosis, and post-rhinoplasty aesthetic deformity and asmmetry. Therefore, selection of an osteotome that is the appropriate size for bone thickness along the path of an osteotome is important.[1]

Besides pre-operative patient assessment and precise technique, proper selection of an appropriate osteotome can minimize post-operative complications by preserving the maximum amount of mucosa and periosteum. However, there have been no studies on the thicknesses of nasal bone and facial bone in Asians, and selection of an appropriate osteotome has depended largely on the surgeon's experience. Osteotome selection based on the nasal bone and facial bone thicknesses in Asians would contribute to the minimization of soft tissue trauma.[2]

The aim of this study was to suggest guidelines for the selection of an appropriate osteotome size for Asians through radiographic analysis of nasal and facial bone thickness.

Materials and methods

Patients

One hundred patients (50 male and 50 female) who had facial bone CT scans taken at the Korea University Hospital between January 1999 and December 2000 were studied. Axial views of the CT scans taken at 3 mm intervals were analysed radiographically. The patient's ages ranged from 20 to 67 years with a mean of 32.8 years. In this study, all patients underwent a pre-operative CT scan prior to surgery for head injury. Specific exclusion criteria included documented maxillofacial trauma, known congenital anomalies, and previous nasal surgery.

Measurement of the nasal bone and facial bone thickness

The bone thickness at three points (low, intermediate, high) along the path of an osteotome were measured. The bone thicknesses were measured using the Scion Image programme (National Institute of Health, Bethesda, MD). For lateral osteotomy, the low level was selected as the cut immediately cephalic to the piriform aperture, the middle level was selected as the cut immediately caudal to the infraorbital rim, and the high level was selected as the cut immediately cephalic to the infraorbital rim. The bone thickness was measured at

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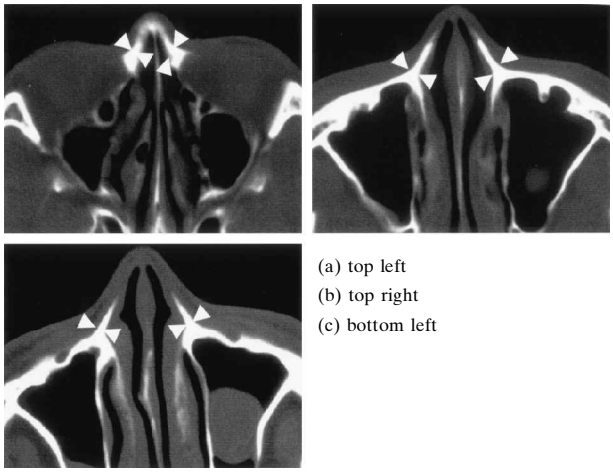


(a) top left
(b) top right
(c) bottom left

FIG. 1

Axial CT scan of facial bone demonstrating the point at which high (a), middle (b), and low level (c) measurements were taken for lateral osteotomy (arrowheads).

the point half the length of the nasal bone seen on the images selected (Figure 1). For medial osteotomy, the low level was selected as the cut immediately cephalic to the infraorbital rim, and the high level was the cut immediately caudal to the nasofrontal suture (Figure 2). For intermediate osteotomy, the low level was selected as the cut immediately caudal to the image first showing the emergence of the nasal bone from the facial bone, and the high level was selected as the cut immediately cephalic to the infraorbital rim (Figure 3).

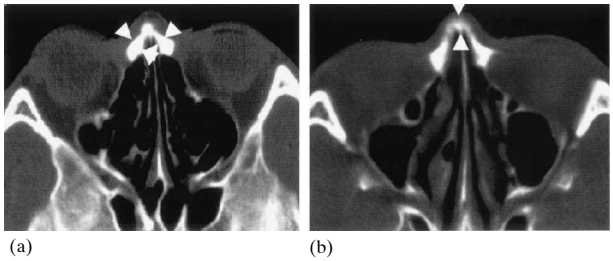
Statistical analysis

All data were expressed as mean ± standard deviation. Differences between the variables were evaluated with the Student's *t*-test and $p<0.05$ was considered as significant.

Results

Bone thickness along the track of a lateral osteotomy

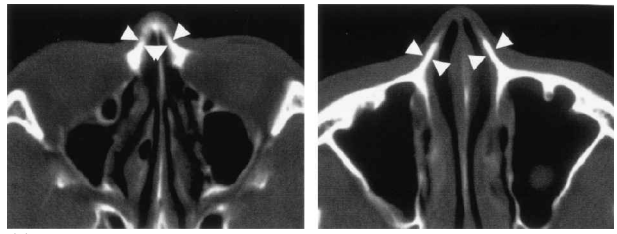
In male subjects, the bone thicknesses were 2.68 ± 0.67 mm at the low level, 2.82 ± 0.82 mm at the intermediate level, and 2.80 ± 0.55 mm at the high level. For female subjects, the thicknesses were 2.54 ± 0.65 mm at the low level, 2.69 ± 0.64 mm at the intermediate level, and 2.65 ± 0.53 mm at the high level. The mean bone thickness for all subjects were 2.61 ± 0.66 mm at the low level, 2.75 ± 0.76 mm at the intermediate level, and 2.72 ± 0.53 mm at the high level (Table I). Differences between the sexes and between the left and right sides were not statistically significant ($p>0.05$).



(a) (b)

FIG. 2

Axial CT scan of facial bone demonstrating the point at which high (a) and low level (b) measurements were taken for medial oesteotomy (arrowheads).



(a) (b)

FIG. 3

Axial CT scan of facial bone demonstrating the point at which high (a) and low level (b) measurements were taken for intermediate osteotomy (arrowheads).

Bone thickness along the track of a medial osteotomy

In male subjects, the thicknesses were 2.63 ± 0.33 mm at the low level, and 2.78 ± 0.31 mm at the high level. For female subjects, the thicknesses were 2.47 ± 0.30 mm at the low level, and 2.76 ± 0.28 mm at the high level. The mean thicknesses for both levels were 2.54 ± 0.31 mm in males, and 2.77 ± 0.30 mm in females (Table II). Differences between the sexes and between the left and right sides were not statistically significant ($p>0.05$).

Bone thickness along the track of an intermediate osteotomy

In male subjects, the thicknesses were 1.29 ± 0.35 mm at the low level, and 1.33 ± 0.36 mm at the high level. In female subjects, the thicknesses at the low level and the high level were 1.24 ± 0.31 mm and 1.29 ± 0.31 mm, respectively. The mean thicknesses for both levels were 1.26 ± 0.34 mm in males, and 1.31 ± 0.32 mm in females (Table III). Differences between the sexes and between the left and right sides were not statistically significant ($p>0.05$).

TABLE I

MEASUREMENT VALUES FOR BONY LATERAL NASAL WALL THICKNESS ALONG TRACT OF LATERAL OSTEOTOMY

Patients	Low (mm)	Middle (mm)	High (mm)
Male (n = 100)			
Mean	2.68	2.82	2.80
SD*	0.67	0.82	0.55
Female (n = 100)			
Mean	2.54	2.69	2.65
SD	0.65	0.64	0.53
Total (n = 200)			
Mean	2.61	2.75	2.72
SD	0.66	0.76	0.53

*SD = standard deviation

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TABLE II
MEASUREMENT VALUES FOR BONY LATERAL NASAL WALL THICKNESS ALONG TRACK OF MEDIAL OSTEOTOMY

Patients	Low (mm)	High (mm)
Male (n = 50)		
Mean	2.63	2.78
SD*	0.33	0.31
Female (n = 50)		
Mean	2.47	2.75
SD	0.30	0.28
Total (n = 100)		
Mean	2.54	2.77
SD	0.31	0.30

*SD = standard deviation

TABLE III
MEASUREMENT VALUES FOR BONY LATERAL NASAL WALL THICKNESS ALONG TRACK OF INTERMEDIATE OSTEOTOMY

Patients	Low (mm)	High (mm)
Male (n = 100)		
Mean	1.29	1.33
SD*	0.35	0.36
Female (n = 100)		
Mean	1.24	1.29
SD	0.31	0.31
Total (n = 200)		
Mean	1.26	1.31
SD	0.34	0.32

*SD: standard deviation

Discussion

Osteotomies are typically performed blindly, using tactile guidance. There is an ever-present risk of injuring the supporting mucosa and perichondrium.[3–6] Therefore, when peforming an osteotomy, it is important to obtain adequate mobilization of the bony skeleton, while at the same time minimizing trauma to the supporting soft tissue in order to avoid excessive narrowing.[5] An ideal osteotomy delivers precise, predictable, and reproducible aesthetic and functional results while minimizing soft tissue damage. Excessive damage to the intranasal mucosa or perichondrium can lead to post-operative destabilization, excessive haemorrhage, prolonged oedema, echymosis, and asymmetry, resulting in post-rhinoplasty aesthetic deformity and excessive narrowing.[7–9]

It is not always necessary for the osteotome blade to cut through the entire thickness of bone to achieve fracture because partial-thickness fractures produce microfracture of the remaining thickness.[1] Thus osteotomes that are smaller than the patient's nasal bone thickness can be used, and some researchers advocate performing greenstick fractures by applying digital pressure to complete the fracture line produced by an osteotome.[10] Greenstick fractures mobilize the nasal bone to narrow the lateral nasal wall or enable precise, predictable correction of the deviated nose. One can obtain a smooth contour along the lateral nasal wall with a greenstick fracture. However, prior nasal trauma or unusually thick nasal bone make greenstick less predictable. In such cases, full-thickness fractures with an osteotome are required for optimal results.[10] Therefore, selection of a proper osteotome is dependent on the bone thickness along the path of an osteotomy.

There are many shapes and sizes of osteotomes on the market. Guarded osteotomes with an edge larger than 4 mm allow the surgeon to palpate the position of the osteotome, but only at the expense of soft tissue trauma. Unguarded osteotomes may slip in less experienced hands.[1]

Becker *et al.*[1] measured the bony thickness along the path of a lateral osteotomy and found them to be 2.30 ± 0.47 mm at the low level, 2.46 ± 0.52 mm at the middle level, and 2.36 ± 0.56 mm at the high level. These values were slightly less than those obtained for Asians in our study. A study by Chung *et al.*[2] of the Asian nasal bone thickness showed the thicknesses to be 2.90 ± 1.40 mm at the low level, 2.60 ± 1.30 mm at the middle level, and 3.40 ± 1.50 mm at the high level. These values correlated well with those gathered in our study.

The measurements of the present study show that for the Asian physique, trauma to the surrounding soft tissue can be minimized by using 2.5 mm or 3.0 mm osteotomes. However, since there are variations in nasal bone thickness, physical examination suggestive of strong, thick nasal bones may warrant the use of a larger osteotome. Conversely, smaller osteotomes may be sufficient for a patient of slender build.

Conclusion

This study presented statistical data for the nasal bone and facial bone thickness in Asians. These data can provide a guideline for choosing an osteotome of an appropriate size in the Asian population, thereby contributing to the reduction of post-operative complications associated with osteotomy.

Acknowledgements

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References

1 Becker DG, McLaughlin RB Jr, Loevner LA, Mang A. The lateral osteotomy in rhinoplasty: Clinical and radiographic rationale for osteotome selection. *Plast Reconstr Surg* 2000;**105**:1806–16
2 Jung DH, Paik SI, Kang HS, Lee JG. Facial bone measurements for lateral osteotomies in rhinoplasty. *Korean J Otolaryngol* 1996;**39**:638–46
3 Tardy Jr MA, Denneney JC. Micro-osteotomies in rhinoplasty. *Facial Plast Surg* 1984;**1**:137–41
4 Ford CN, Battaglia D, Gentry L. Preservation of periosteal attachments in lateral osteotomies. *Ann Plast Surg* 1984;**13**:107–11
5 Kuran I, Ozcan H, Usta A, Bas L. Comparison of four different types of osteotomies for lateral osteotomy: A cadaver study. *Aesthetic Plast Surg* 1996;**20**:323–6
6 Rees TD. Anesthetic Plastic Surgery. Philadelphia: WB Saunders; 1980

https://doi.org/10.1258/002221502761698739 Published online by Cambridge University Press

7 Murakami CS, Younger RAL. Managing the postrhinoplasty or post-traumatic crooked nose. *Facial Plast Surg Clin North Am* 1995;**3**:421

8 Rohrich R, Minoli JJ, Adams WP, Hollier LH. The lateral nasal osteotomy in rhinoplasty: An anatomic endoscopic comparison of the external versus the internal approach. *Plast Reconstr Surg* 1997;**99**:1309–12

9 Webster RC, Davidson TM, Smith RC. Curved lateral osteotomy for airway protection in rhinoplasty. *Arch Otolaryngol* 1977;**103**:454

10 Harshbarger RJ, Sullivan PK. Lateral nasal osteotomies: Implication of bony thickness on fracture patterns. *Ann Plast Surg* 1999;**42**:365–70

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