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Original Article

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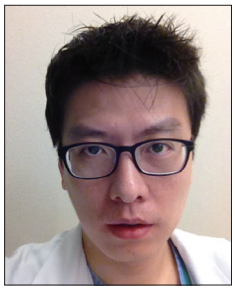

공정식 · 김양우 · 전영우

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Bony Deformity after Augmentation Rhinoplasty with Silicone Implant

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Silicone implants for augmentation rhinoplasty have been used by many surgeons over the past few decades. However, no clinical evaluation of the nasal bones beneath the silicone implant has been conducted to date. Between 2010 and 2012, we reviewed patients' facial computed tomography scans and finally selected 13 patients according to the exclusion criteria. To evaluate the extent of bone resorption, we measured the angle (θ) of the deformed portion. And we measured the thickness of nasal bones to evaluate the bony resorption.A total of 13 patients had some evidence of bone resorption or bony deformity on their computed tomography. An evaluation of the CT scan of the nasal bones showed deformity of the bones underneath the implant. The bones had lost the dome shaped convexity and showed flat configuration under the implant. The values of the angle (θ) ranged from 45to 75 degrees (mean 58.1 degree). The thickness of nasal bone showed statistically significant results at the tip of bony vault. This study has demonstrated of bone deformation beneath the silicone implants in humans.

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Key Words: Rhinoplasty, Bone resorption, Silicones

I. INTRODUCTION

Silicone implants for augmentation rhinoplasty have been used by many surgeons over the past few decades. Different materials have been tried for augmentating the nasal dorsum in the past, but solid silicone implants have gained wide popularity and has become the commonest implants in use. Although silicones are bio-inert, they have been known to have a number of adverse outcomes after implantation such as extrusion, displacement, infection and bone resorption. A special concern has been raised about bone resorption or bone deformity beneath these implants. After the first report about this phenomenon by Robinson et al, many authors reported their clinical or experimental results that showed the relationship between the silicone implant and underlying bones.[1-4] However, no clinical evaluation of the nasal bones beneath the silicone implant has been conducted to date except prior reports which were mainly about the mandible beneath the chin silicone implant. In this study, we hypothesized that adverse outcomes would also occur to the nasal bones under the silicone implant and retrospectively reviewed patients who underwent augmentation rhinoplasty with silicone implants up to 17 years after the implant insertion. The purpose of this paper is to evaluate the extent to which silicone implants for augmentation rhinoplasty affect the underlying nasal bone resorption or deformity and to discuss the causation of resorption and the long-term effect of implants on the nasal bones.

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II. MATERIALS AND METHODS

A retrospective review was performed according to the institutional guidelines. During the period between 2010 and 2012, we reviewed patients' facial computed tomography scans and found 31 patients who received augmentation rhinoplasties with implants and selected 21 patients who showed bony deformity under the implant. And 8 of 21 selected patients were excluded according to the exclusion criteria and finally 13 patients were analyzed. Exclusion criteria included the patients who or had histories of nasal bone trauma or received nasal osteotomies. Because trauma on the nasal bones could influence the bony deformity beneath the implant, the patients who displayed nasal bone trauma before or after augmentation rhinoplasties were excluded. We excluded the patients who received nasal osteotomies because this procedure also could result in bony deformity with or without nasal implants. All the selected rhinoplasties were performed with silicone implants. All of these patients had received rhinoplasties by other surgeons up to 17 years ago and all of them needed computed tomography scans due to several reasons such as facial trauma or diagnosis of soft tissue mass. After finding the patients who met the review criteria, we collected more details from the patients by telephone interviews. Patients' details including demographics are shown in Table 1. To evaluate the extent of bony deformity, we performed an overall evaluation based on the shape of the arch formed by both nasal bones beneath the implant and measured the angle (θ) of the deformed portion (Fig. 1). Angles close to 0 degree was considered to have a normal bony shape. And also, to evaluate the extent of bone resorption, we measured the thickness of the nasal bone at two different points, 10mm inferior from the nasofrontal angle and tip of bony vault.

III. RESULTS

A total of 13 patients had some evidence of bone resorption or bony deformity on their computed tomography. These patients comprised of 9 women and 4 men with their age ranging from 22 to 59 years (mean 36.5 years). The time interval after the surgery was from 3.8 to 17.2 years (means=11.1 years). Eleven (85%) patients underwent an open rhinoplasty and the remaining 2 (15%) a closed approach. All of them underwent primary rhinoplasty. Evaluation of the CT scans of the nasal bones showed deformity of the bones underneath the implant. The dome shaped convexity was lost and flat configuration was evident under the implant. Their axial CT scan showed trapezoid shaped nasal bone deformity beneath their silicone implants (Fig. 2). The value of angle (θ) ranged from 45 to 75 degrees (mean 58.1 degree). The extent of bone resorption was evaluated by comparing the thickness of nasal bone with the patients who were not received rhinoplasties. The points that we measured the thickness were the point 10 mm inferior from the nasofrontal angle (point A) and the tip of bony vault (point B). To obtain the normal value, we measured the thickness of nasal bone of 30 patients who were not received rhinoplasties. The value of thickness at point A ranged from 1.75 mm to 3.1 mm (mean 2.39±0.68 mm) in patients' group and from 2.01 mm to 4.18 mm (mean 2.75±0.92) in control group respectively (p>0.05). At point B, the value ranged from 1.72 mm to 2.45 mm (mean 1.95±0.30) in patients' group and from 2.01 mm to 2.90 mm (2.35±0.45) in control group respectively (p<0.05). Although the results showed some differences of thickness, there was statistically significant difference between the groups at point B only (p<0.05). Patient details and results are illustrated in Tables 1 and 2.

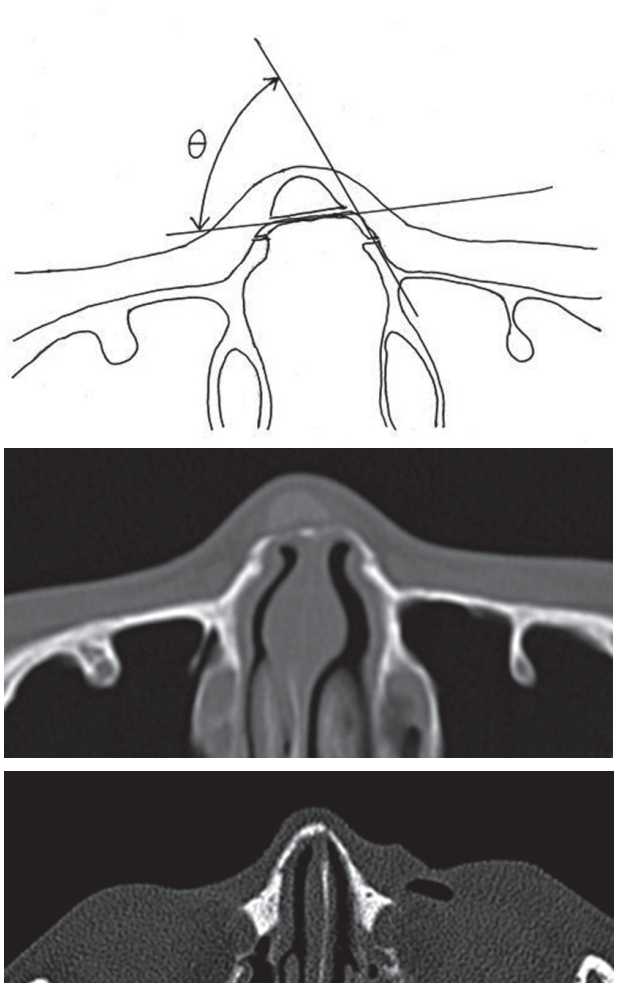

Fig. 1. (Above, Center) Schematic and computed tomographic scan image of a nasal bone with silicon implant. The angle θ between the deformed nasal bones is used for evaluation. (Below) computed tomographic scan image of normal nasal bones.

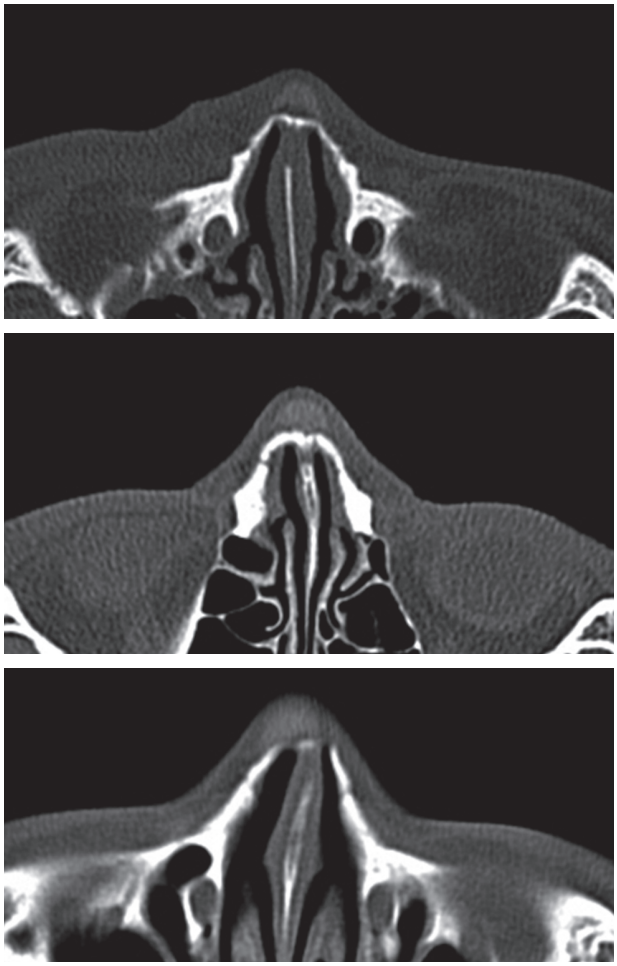

Fig. 2. (Above) Patient 2. Axial CT scan shows deformed nasal bones. (Center, Below) Patient 6 and patient 7. Axial CT scan also shows deformed nasal bones. Both cases show the loss of the dome shaped configuration and the trapezoid shape can be seen under the implant.

Ⅳ. DISCUSSION

In the wake of Wolff's publication in the late 1880s, osseous tissue has been viewed as a self-optimizing structure that adapts to exogenous load conditions.[5] Pauwels also proposed that changes in the magnitude of the habitual mechanical stimulation would lead to the 'atrophy' of the osseous structure.[5] That is to say, bone is a tissue that is subjected to continuous cycles of resorption and formation. Under normal conditions of bone remodeling, no overall changes can be observed due to the balance in resorption and formation. However, according to Pauwels, prolonged stress levels below the normal range lead to a net decrease or increase in bone mass, causing deformation of the bony structure.

Robinson was the first to report about the bone changes beneath alloplastic substances in humans in 1969.[6] He reported series of patients with bone resorption under silicone or acryl chin implants. Areas of bone resorption up to 5mm in depth were found in 10 out of 14 patients who had subperiosteal silastic or acrylic implants 2~6 years ago. In his opinion, pressure by the implant was the reason for bone resorption. After his work, many articles in search for the factors that influence the bony deformation beneath the implant have been reported.[1,3] Several etiological factors including pressure, type of the material, duration of implantation and position of the implant in relation to the periosteum have been suggested. Adams et al. felt that oversized implants in nasal and chin augmentations were subjected to more mentalis stress, leading to higher rates of resorption.[7]

Although there have been several clinical reports about bone resorption or bone deformity underneath the silicone implant,

Table 1. Patient Details

No.	Age	Sex	Operation date	Implant type	Duration (years)	Approach	θ (°)	Diagnosis
1	29	M	March, 05	Silicone	6.7	Open	60	Zygomatic arch fracture
2	23	M	February, 08	Silicone	3.8	Open	50	Cellulitis, forehead
3	30	F	September, 02	Silicone	9.3	Open	55	Facial contusion
4	42	F	May, 03	Silicone	8.3	Closed	45	Facial contusion
5	48	F	June, 01	Silicone	10.5	Open	55	Facial contusion
6	43	F	April, 00	Silicone	11.7	Open	75	Cellulitis, forehead
7	27	M	July, 04	Silicone	7.5	Open	75	Facial contusion
8	25	F	May, 04	Silicone	7.6	Open	45	Facial contusion
9	39	F	December, 96	Silicone	15	Open	58	Cellulitis, chin
10	59	F	November, 97	Silicone	16.1	Closed	65	Zygomatic arch fracture
11	28	F	January, 03	Silicone	8.9	Open	50	Facial contusion
12	38	F	April, 99	Silicone	12.7	Open	55	Facial contusion
13	56	F	October, 94	Silicone	17.2	Open	67	Facial contusion

Table 2. Thickness of Nasal Bone (mm)

Points	Patients (mean±SD)	Control (mean±SD)	*p*-value
10 mm inferior from the nasofrontal angle	2.39±0.68	2.75±0.92	0.0699
Tip of bony vault	1.95±0.30	2.35±0.45	0.0467

all the prior clinical reports were associated with the relationship between silicone chin implants and the underlying mandible. Our study is the first to investigate such phenomenon of the nasal bones beneath the silicone implant. One interpretation that arose from of these clinical observations is that the pressure on the bones generated by the distention of overlying soft tissues and periosteum may be the greatest cause of the resorption.

The nasal bone has an arched shape when viewed on cross section. On frontal view, it is angled more accurately in the area of the nasofrontal angle and then more obtusely inferior.[8,9] To evaluate the bony deformity of nasal bone, we measured the angle (θ) of the deformed portion on cross section. Because the normal nasal bone shows linear continuity on cross section, this angle that was created beneath the implant indicates the bony deformity of nasal bone. And, to evaluate the bony resorption, we also measured the thickness of nasal bone of the patients at two different points, 10mm inferior from the nasofrontal angle and tip of bony vault. And we compared the value with the control group. Although the results showed some differences of thickness, there was statistically significant difference between the groups at point B only (p>0.05). To minimize the false selection for the study, we made exclusion criteria which included the patients who had histories of nasal bone trauma or received nasal osteotomies.[10]

In spite of radiologic deformity of the nasal bones under the implant, none of the patients had complained of any cosmetic change. This is probably due to the fact that the resorption or deformity occurred over a long period and the extent was minimal. However, a few patients complained of the increased supratip break. Although this could have been caused by other factors such as additional nasal tip plasty or problems of the nasal dorsum, we think that the phenomenon described above could result in such problem.

Even though there is no evidence that the bony change is in any way detrimental and it is impossible to reach definitive conclusions because of the small number of enrolled subjects in the current study, this phenomenon must be recognized and considered by surgeons when employing such materials in augmentation rhinoplasty.

Because we did not show a detailed relationship between the resorption and other factors such as periosteal plane, implant size, type of the material, duration of implantation and so on, more experimental or clinical studies with increased number of patients and a long follow up period are needed before any firm conclusions can be drawn.

V. CONCLUSION

No definite conclusion can be drawn from such a small series of cases. Moreover, this series is not representative and a control group is not included in this study. However, we demonstrated the presence of bone deformation beneath the silicone implant in humans. Such alterations occur meaningfully that their effect should be considered when alloplastic implants are to be employed over the bones.

REFERENCES

1. Richard PJ, Ronald I, Lars V: Bone deformation beneath alloplastic implants. *Plast Reconstr Surg* 51: 169, 1973
2. James AL, Lars MV, Richard PJ: The long-term effects of hard alloplastic implants when put on bone. *Plast Reconstr Surg* 58: 14, 1976
3. Saleh HA,Lohuis PJ, Vuyk HD: Bone resorption after alloplastic augmentation of the mandible. *Clin Otolaryngol Allied Sci* 27: 129, 2002
4. Pearson, DC, Sherris DA: Resorption beneath silastic mandibular implants. Effects of placement and pressure. *Arch Facial Plast Surg* 1: 261, 1999
5. Mellal A, Wiskott HWA, Botsis J, Scherrer SS, Belser UC: Stimulating effect of implant loading on surrounding bone. *Clin Oral impl Res* 15: 239, 2004
6. Robinson M, Shuken R: Bone resorption under plastic chin implants. *J Oral Surg* 27: 116, 1969
7. Adams JS: Grafts and implants in nasal and chin augmentation. *Otolaryngol Clin North Am* 20: 913, 1987
8. Sullivan PK, Varma M, Rozelle AA: Optimizing Bone-graft nasal reconstruction: A study of nasal bone shape and thickness. *Plast Reconstr Surg* 97: 327,1996
9. Cho IC, Lee YH, Lew JD: Anatomical observations on the nasal bones and cartilages of Korean adults. *J Korean Soc Plast Reconstr Surg* 8: 231, 1981
10. Choi SM, Choi HJ, Kim CH, Ahn HS, Kang SG, Jung SG: Characteristics of nasal trauma in the implanted nasal prosthesis. *J Korean Soc Plast Reconstr Surg* 35: 597, 2008