

# Management of Nasofrontal Angle in Rhinoplasty

SB Pousti<sup>1</sup>, M Jalessi<sup>1</sup>, A Asghari<sup>1\*</sup>

<sup>1</sup>Department of Otolaryngology, Head and Neck Surgery, ORL-HNS Research Center, Iran University of Medical Sciences, Tehran, Iran

## Abstract

Radix or nasofrontal angle has a special concern in rhinoplasty. Minimal changes in the position of nasofrontal angle can produce a different image of nasal and midfacial length in the profile view. In a patient with high radix, the profile of the forehead continues into the nose in a straight line and the nose appears too long. On the other hand, deep nasofrontal angle makes the illusion of a short nose. The ideal position of this angle has always been a matter of discussion and various methods have been introduced regarding its correction by deepening or augmenting the radix area. In this article, we first review the ideal position of nasofrontal angle and then discuss different procedures used to correct it.

**Keywords:** Radix; Nasofrontal angle; Nasion; Augmentation

## Introduction

The radix or root of the nose is the most narrow and back-sited point of the nose which differentiates the nose from the forehead and determines two important angles of the face,<sup>1</sup> nasofrontal and nasofacial angles. Therefore, any alterations in the horizontal and vertical position of this region can induce prominent changes in the appearance of the face and nasal projection. The ideal position of the nasion in terms of its height and level has been a subject to discussion and so the surgical procedures intend to alter it. These procedures aim to correct of latitude of the nasion and its projection. They can be divided into two categories: augmentation procedures used in cases with suboptimal radix projection to heighten the radix and make the bony profile more prominent, and reduction procedures used in cases with high radix and shallow nasofrontal angle where the aim of surgery is to decrease the projection and deepen the angle, which is a challenge in rhinoplasty.

The present review discusses the ideal position of the radix and different surgical procedures to correct it.

## Anatomy and Ideal Position of the Nasion

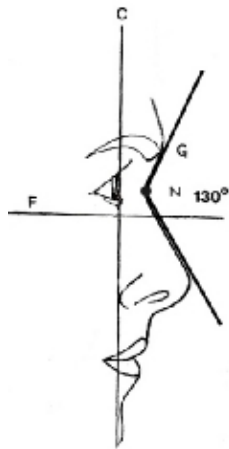
Nasion is the deepest point of the nasofrontal groove. As a soft tissue landmark and an anthropometric reference point, the nasion is the midpoint of the fronto-nasal suture and upper part of the nasal bones which is compatible with the most concave point of the nasal dorsum.<sup>2</sup>

From the lateral view, the forehead has a posterior inclination of  $10\pm 4$  degree in men and  $6\pm 5$  degree in women, so it makes an angle with the dorsum named the nasofrontal angle (Figure 1). Nasofrontal angle is located between a line drawn from the radix tangential to the glabella and a second line from the same point tangential to the nasal tip.<sup>2</sup> The latter can be tangential to the nasal dorsum as well.<sup>3</sup> A normal nasofrontal angle is  $130\pm 7$  degree in men and  $134\pm 7$  in women.<sup>2</sup>

The location of the nasion can be considered from two aspects: the vertical position or latitude (or level) which is defined as the vertical distance of the nasion to Frankfort line, and the horizontal position or depth (or height) of the nasion (or radix projection) which is defined as the horizontal distance between the nasion and glabella or the nasion and the corneal plane (Figure 1).

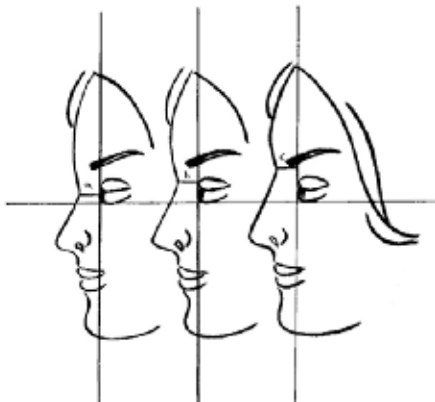
The ideal vertical position of the nasion is between the supratarsal fold and the lash line of the upper eyelid.<sup>4</sup> However, Guyuron,<sup>5</sup> suggested its ideal position to be at the level of the lower margin of the upper eyelid

\*Correspondence: Alimohammad Asghari, MD, Assistant Professor of Otolaryngology, Head and Neck Surgery, ENT Research Center, Iran University of Medical Sciences, Tehran, Iran. Tel: +98-21-66504294, Fax: +98-21-66525329, e-mail: [asghari@dr-asghari.com](mailto:asghari@dr-asghari.com)  
Received: March 20, 2009 Accepted: March 20, 2009



**Fig. 1:** Nasofrontal angle and nasion position; N: nasion, C: corneal plane; F: Frankfort line, G: glabella

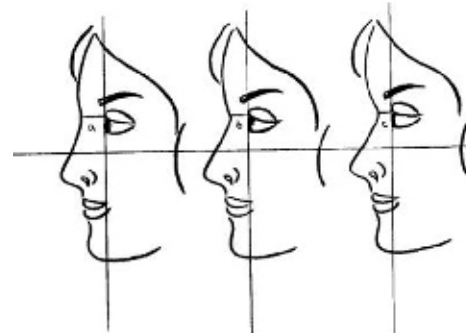
in forward gaze. In some cases, it can be acceptable even at the level of pupils which make the profile more softened.<sup>6</sup> Changes in the vertical position of the nasion can change the illusion of the nasal length in the profile view (Figure 2). When the vertical position of the nasion is closer to the Frankfort line, the nose appears shorter and more projected and when this distance increases, the nose seems longer.



**Fig. 2:** Various vertical positions with fixed horizontal position.

The horizontal position of the nasion has been described in two different ways. It can be defined according to the glabella or the corneal plane. The ideal horizontal position of the nasion should be 4-6 mm from the glabella,<sup>2</sup> and 9-14 mm from the corneal plane.<sup>1</sup> Changes in the horizontal position of the

nasion have also some effects on the illusion of the nasal length and projection (Figure 3).



**Fig. 3:** Various horizontal position of nasion with fixed vertical position.

Byrand Hobar<sup>1</sup> introduced a useful method for determining the beautiful ratio between the tip projection, nasal length and radix projection. They believe that the ideal nasal length is  $\frac{2}{3}$  of the mid facial height and the ideal tip projection should be  $\frac{2}{3}$  of the nasal length where the radix projection measured from the junction of the nasal bones with the orbit should ideally be 0.28 of this nasal length. They considered the corneal plane as the reference point for the radix projection.

It should be kept in mind that subtle changes in the position of the nasion or nasofrontal angle can produce a different image of the nasal and midfacial length in the lateral view (Figure 4).



**Fig. 4:** Augmentation of radix

### Radix Reduction

Deepening the nasofrontal angle is indicated when a

high radix is encountered (Figure 5). Occasionally, both the bone and soft tissue should be addressed. In the radix area, the thick soft tissue of the glabella gradually changes to the thin skin of the dorsal area and eyelids.<sup>4</sup> The radix soft tissue consists of fat and procerus muscles. The mean thickness of the soft tissue of the nasion as measured in cephaloxerogram is 7 mm in women and 7.5 mm in men with a range of 3.5-9 mm.<sup>4</sup> The total amount of retraction after bone removal in this area has been mentioned to be only 25%.<sup>7</sup> In order to reduce the soft tissue thickness of the radix, it is sometimes mandatory to correct the muscle and subcutaneous tissue, although it should be kept in mind that it can be replaced by scar tissue.<sup>3</sup>



Fig. 5: Reduction of radix

### Preoperative Evaluation

After assessment of the the glabella, the nasofrontal angle should be deepened in accordance with the planned dorsal and tip projection.<sup>4</sup> Another approach is to define the ideal nasion and thereafter by achieving an ideal nasofacial angle of 36 degrees, the amount of alteration of tip projection can be estimated.<sup>4</sup> Tardy,<sup>8</sup> believed that the depth and position of the nasofrontal angle are second only to tip projection as definitive guide to the extent of hump removal.

The radix projection measured by the distance from the nasion to corneal plane should be rechecked by the distance from glabellar plane. This is of importance in cases with back-sited eyes. The vertical position of the nasion should also be defined.

### Surgical Procedures

Various techniques have been proposed for bone removal in the radix region including rasping, osteotomy,

and use of burr. Sharp osteotomy is the preferred method when dealing with a high radix together with moderate to severe bony hump. Its advantages include en bloc resection of the bone with a clear-cut and no bony particles. Over-resection and asymmetric bone removal are its drawbacks, although the bone can be easily replaced after correction. It is also possible to make a clear break or angle by osteotome.<sup>8</sup> Rasping can help step by step removal of the excess bone but it severely traumatizes the soft tissue and is not suitable when dealing with a very high radix. Another disadvantage of rasping is its inability to make an exact angle position.<sup>8</sup>

Different osteotomes have been used for deepening the nasofrontal angle. Flat osteotomes with or without percutaneous transverse osteotomies with 2 mm osteotomes for weakening of the bony root have been suggested.<sup>8</sup> Quisling and Rubin osteotomes have been designed to eliminate the need for percutaneous osteotomies but they do not have the high accuracy of percutaneous osteotomy.<sup>8</sup>

Parkes gouge can also be helpful for bone removal in the radix area. To show the exact place of the blade, Aiach,<sup>4</sup> *et al.* have described a T-shaped osteotome with a semi-rigid guide parallel to the blade which is placed on the skin and makes it easy to define the desired depth of osteotomy.

A guarded burr has been introduced by Guyuron,<sup>9</sup> for deepening the radix which makes the conservative bone removal rather possible. The complications regarding the use of burr were seroma and penetration of the frontal sinus. He suggested sequential removal of the bone rather than continuous burring to avoid seroma and side-to-side, rather than cephalo-caudal movement to avoid the latter.

As mentioned previously, the soft tissue of the radix should occasionally be addressed. In these cases, it is recommended to do the dissection superficial to the muscle and remove the bone with the attached procerus muscles.<sup>7</sup> It is mandatory to exert a constant pressure on the area for a few days to avoid hematoma, fibrosis and scar formation.<sup>8</sup> The use of specially designed splint can be considered.

### Radix Augmentation

Although in the past it was assumed desirable to lower the dorsum to the level of the radix, a natural and strong profile is now considered more pleasant. Therefore, anatomical deficiency in the radix area has

been recently of special concern.<sup>10</sup> Mowlavi *et al.*<sup>6</sup> in a recent survey of White North American men and women have shown that there are trends in radix augmentation during rhinoplasty especially among male patients. The subjects of both genders preferred a 10 mm project of the nasion and strongly disliked a deeper 7 mm height for the profile.

Radix augmentation can improve the angry look of the patient or ameliorate the appearance of a wide intercanthal distance or pseudohypertelorism.<sup>10</sup> A low radix can produce a flattened, wide and washed-out face; appropriate projection of this area by augmenting the profile and framing the eyes makes a more beautiful appearance.<sup>10</sup> Nasofrontal augmentation in some cases can correct the nasal dorsum without tissue removal. It can also be useful in correction of a short nose.<sup>11</sup> The nose appears longer when the nasofrontal angle is shallow and it seems shorter with a deep nasofrontal angle.<sup>12</sup>

## Surgical Technique

Besides various natural or synthetic materials used as the graft, its shape, size, and position should also be considered.

### Graft Material

Cartilage can be used as a graft material. It can be harvested from the nasal septum or auricle but there is a risk of partial absorption or displacement. Temporoparietal fascial graft is also suggested in depressed nasal radix.<sup>13</sup> Polytetrafluoroethylene (Gore-Tex) has also been used.<sup>10,14</sup> It seems that in contrast to its use in the lower part of the dorsum, Gore-Tex has no risk of infection or extrusion in the radix area but the mucosal layer should be kept intact and not opened.<sup>11</sup> Silicone implants, mostly in the form of prefabricated silicone rubber or sheets are the most commonly used materials for nasal augmentation in Asians.<sup>15</sup> Extrusion, foreign body reaction, infection and displacement are potential complications of synthetic materials but in new biomaterials these complications rarely occur.

### Size of Graft

The size of the graft can vary in different cases but its vertical length hardly exceeds 1.2 cm and the horizontal length of the graft never exceeds 2 cm.<sup>10</sup>

### Shape of Graft

Daniels,<sup>16</sup> reported overcorrection, visibility and junctional step-offs as the three most common technical problems with cartilage grafts. In order to prevent these problems, the cartilage graft should be tailored so the upper part becomes thicker than the lower part to be camouflaged with the dorsum and it should also be curved and scored in the lateral borders.<sup>10</sup> Lateral and inferior borders of the Gore-Tex should also be beveled.<sup>11</sup>

### Position of Graft

The pocket for graft should be developed in subperiosteal plane and exactly with the same size as the graft itself to prevent dislocation. Multilayer grafts can also be used. The graft should be positioned slightly upper than the desirable position because the procerus muscle's activity tends to push it downward. Therefore, the use of Butolinum toxin type A has also been suggested.<sup>10</sup>

If the size of the packet is big, suturing the graft to the overlying skin is suggested to eliminate the possibility of displacement. The absorbable suture should first be passed through the graft and then through the skin. The suture can be cut from its exit point few days later.<sup>8</sup> To prevent graft displacement, suturing of the graft to a strip of AlloDerm and positioning it as an onlay graft has also been proposed.<sup>10</sup> Taping can be used to help keep the graft in place.

## Conclusion

Nose is the most projected part of the face which is positioned in the center of it. From the aesthetic point of view, the radix is an area separating the nose from the forehead. Alteration of this region can induce prominent changes in the image of the nose, its length, and its projection. Anatomic analysis is an important first step in doing a good rhinoplasty and more attention should be paid to the deepening or augmenting of this area during these surgeries. In the future, new biomaterials may reduce the incidence of complications and prepare good contouring in the radix augmentation.

**Conflict of interest:** None declared.

## References

- 1 Byrd HS, Hobar PC. Rhinoplasty: a practical guide for surgical planning. *Plast Reconstr Surg* 1993;**91**:642-54. [8446718]
- 2 Mathes SJ. Plastic Surgery Vol 2, part 1 (2<sup>nd</sup> ed), Philadelphia, PA, Elsevier, 2006.
- 3 Conrad K, Gillman G. Refining osteotomy techniques in rhinoplasty. *J Otolaryngol* 1998;**27**:1-9. [9511112]
- 4 Aiach G, Laxenaire A, Vendroux J. Deepening the nasofrontal angle. *Aesthetic Plast Surg* 2002;**26 Suppl 1**:S5. [12454715] [doi:10.1007/s00266-002-4309-3]
- 5 Guerrerosantos J. Nose and paranasal augmentation: autogenous, fascia, and cartilage. *Clin Plast Surg* 1991;**18**:65-86. [2015751]
- 6 Mowlavi A, Meldrum DG, Wilhelmi BJ. Implications for nasal recontouring: nasion position preferences as determined by a survey of white North Americans. *Aesthetic Plast Surg* 2003;**27**:438-45. [15029456] [doi:10.1007/s00266-004-3083-9]
- 7 Guyuron B. Precision rhinoplasty. Part II: Prediction. *Plast Reconstr Surg* 1988;**81**:500-5. [3347658]
- 8 Tardy ME. Rhinoplasty: The art and the science. Philadelphia, Pa: WB Saunders Co, 1997.
- 9 Guyuron B. Guarded burr For Deepening of Nasofrontal Junction. *Plast Reconstr Surg* 1989;**84**:513-6. [2762410] [doi:10.1097/00006534-198909000-00023]
- 10 Becker DG, Pastorek NJ. The radix graft in cosmetic rhinoplasty. *Arch Facial Plast Surg* 2001;**3**:115-9. [11368664] [doi:10.1001/archfaci.3.2.115]
- 11 Johnson CM Jr, Alsarraf R. The radix graft in cosmetic rhinoplasty. *Arch Facial Plast Surg* 2001;**3**:120-1. [11368665] [doi:10.1001/archfaci.3.2.120]
- 12 Tardy ME Jr, Becker D, Weinberger M. Illusions in rhinoplasty. *Facial Plast Surg* 1995;**11**:117-37. [9046602] [doi:10.1055/s-2008-1064529]
- 13 Guerrerosantos J. Nose and paranasal augmentation: autogenous, fascia, and cartilage. *Clin Plast Surg* 1991;**18**:65-86. [2015751]
- 14 Godin MS, Waldman SR, Johnson CM Jr. Nasal augmentation using Gore-Tex. A 10-year experience. *Arch Facial Plast Surg* 1999;**1**:118-21. [10937089] [doi:10.1001/archfaci.1.2.118]
- 15 Wang JH, Lee BJ, Jang YJ. Use of silicone sheets for dorsal augmentation in rhinoplasty for Asian noses. *Acta Otolaryngol Suppl* 2007;**(558)**:115-20. [17882581] [doi:10.1080/03655230701624996]
- 16 Daniel RK. Diced cartilage grafts in rhinoplasty surgery: current techniques and applications. *Plast Reconstr Surg* 2008;**122**:1883-91. [19050542] [doi:10.1097/PRS.0b013e31818d2104]