Functional and Cosmetic Reconstruction of the Crooked Nose

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SUMMARY
The merits of septorhinoplasty, performed as a one-stage procedure to alleviate obstruction and improve the cosmetic appearance of a deformed nose, are described. The 2492 patients treated in an 8-year period attest to the frequency with which this defect presents in the community. An 80% improvement rate was achieved with the acquisition of skill, and no major defect was caused by the conservative methods employed.


The operation to be described was devised to correct deformities of the nasal pyramid and intranasal obstruction as a consequence of trauma. The object is to produce a normal functional result and a desirable cosmetic appearance.

In our view, this is best done as a one-stage procedure, except in a child, where conservative septal surgery is undertaken to correct a nasal obstruction and the cosmetic operation is deferred to a later stage, when the nose is fully developed. Others maintain that a child with a nasal deformity should be operated on regardless of age.

Previously this operation was performed as a two-stage procedure, with the ENT surgeon correcting the intranasal deformities, while the plastic surgeon corrected the external pyramid at a later date. On occasion the plastic surgeon had to deal with the postoperative sequelae of a radical submucous resection performed by his ENT colleague, when saddling of the dorsum and collapse of the internal nasal valves occurred.

The merits of a one-stage procedure are obvious. The patient is exposed to the trauma of surgical intervention once only, and bone and cartilage, removed from adeviated nasal septum, provide the best autograft material for the reconstruction of a deformed nose.

It is not the purpose of this article to perpetuate dissent between disciplines. Suffice it to say that the operation should only be performed by a surgeon who is equipped with the necessary skills through training.

HISTORY
Plastic surgery was performed in India and Egypt between 2500 and 600 BC. Over 2000 years ago, Sushruta, in the work Ayur-Veda, described the method used at the time to reconstruct noses and lips from skin obtained from the forehead, cheek and buttock. It is of interest to note that the work was assigned to a caste of potters, perhaps because of their sense of form and expression and their ability to create sculpture.

In Italy, Tagliacozzi developed a technique based on the Indian methods for nasal reconstruction around AD 1450. He stated that 'the reconstruction is not performed to please the eye, but rather to cheer the spirit of the one afflicted'.

Two German surgeons, Von Graefe and Dieffenbach, in the early part of the 19th century perfected the Italian and Indian methods. Dieffenbach predicted future developments in plastic surgery with the advent of general anaesthesia. The latter half of the 19th century saw the contributions of the American surgeons Roe, Ingals and Weir. At the turn of the century Ingals, Krieg, Freer and Killian introduced methods of approach to surgery of the nasal septum.

However, it was Jacques Joseph who finally placed corrective rhinoplasty in perspective, and his book is still a basic work in modern plastic surgery of the nose.

ANATOMY
The bony vault consists of two nasal bones which articulate with each other in the midline, with the nasal process of the frontal bone above, and the frontonasal process of the maxilla laterally. The perpendicular plate of the ethmoid articulates with the nasal bones on the posterior surface of their line of fusion, and the vomer behind, to form the bony nasal septum. The cartilaginous quadrilateral plate articulates with the anterior borders of the nasal bones to complete the major structure of the septum.

The upper lateral cartilages sprout like wings (Fig. 1) from the dorsal border of the quadrilateral plate, to which they are attached, and are tucked cephalad behind the nasal bones for as much as 1 cm i.e. 'the keystone area', with an intimate fusion of the perichondrium and periosteum. This firm adherence is of significance in fractures of the nasal bones, since any motion imparted to their fragments is reflected in the distortion of the upper lateral cartilages. Their caudal ends slip under the overlapping lower lateral cartilages where they are bound by dense connective tissue, which allows for expansion during respiration. Their curved scrolls contribute to the shape of the inner valve area of the nose, where it is...
covered by the squamous epithelium of the vestibule and where it meets with the respiratory epithelium of the nasal vault.

These relationships are established in early embryonic life, the nasal bones developing from the membrane on the surface of the cartilaginous nasal capsule, which forms on the inner aspect of the nasal bone and allows for expansion during respiration.

Caudal to the septal cartilage lies the membranous septum formed by two layers of mucocutaneous flaps packed with a layer of fibro-areolar tissue. The medial crura of the lower lateral cartilages lie anterior to these flaps, forming the cartilaginous support of the columella. Their lower ends embrace the caudal margin of the septum, above its articulation with the nasal spine of the maxilla. The C-shaped lateral crura of the alae provide support for the nasal tip and contribute towards its shape. They join the medial crura at the dome area. Dense fibroareolar tissue forms the rest of the nasal alae, fusing with cartilage and aponeurotic tissue, forming attachments to the anterior septal angle and to the pyramid of the nasal aperture.

The cartilaginous part of the nose is mobilized by the procerus quadratus anguli labii superioris and depressor septi nasalis muscles which depress and lengthen the nose and open the inner valve, while the pars transversa musculi nasalis compresses the inner valve area.

**PHYSIOLOGY**

The nose serves the purpose of warming, humidifying and filtering inspired air, and acts as the organ of olfaction and as a resonator of speech. The nasal cavity offers the greatest resistance to the air flow in the respiratory system, contributing 47 - 54% of the total airway resistance during quiet nasal breathing. Both external and internal variations in the shape of the nose affect its functions.

A deformity in the cartilaginous portion of the external nose, of either congenital or traumatic origin, especially in the internal valve area and the external nares, can result in marked airway obstruction.

Nasal airway resistance is a summation of the resistance offered in the various parts of the nasal cavity. The cross-section air space is not constant in the entire cavity, being altered by variations in the cavernous tissue of the turbinates, which can be affected by variations in temperature, humidity, emotion, or posture.

The efficiency of the nasal cavity as an air conditioner dictates that the surface area be of a wide extent, with a narrow width of airway, to ensure laminar flow. The cartilaginous portion contributes a certain degree of airway resistance and control to both the shape and degree of turbulence of the nasal air flow. In the normal nasal cavity the main current of flow is through the middle portion, making a parabolic curve.

In the long nose with plunging tip and an acute nasolabial angle, the main air current will extend higher in the nasal cavity, and in the nose with a larger labial angle or a saddle deformity, the main air current is lowered. A septal spur or scar contracture of the internal valve area will increase turbulence.

The anterior and posterior nares and the internal valve areas are the narrowest parts of the nose. A septal deviation or a spur that abuts against these areas or against the turbinates on one or other side of the nasal cavity, will cause marked obstruction.

The sensation of nasal obstruction is a subjective feeling caused by an increase of nasal airway resistance. Objective measurement of nasal airway resistance shows a wide individual difference in value because of variations in type of nose, organic changes in the external and internal nose, and reversible rapid change due to the filling of the intranasal cavernous bodies.

Nasal airway resistance can be measured objectively by rhinomanometry, or the holding of a mirror below the nostrils. While the former is more sophisticated, it is also tedious and impractical as a routine procedure. The use of careful rhinoscopic examination and a mirror should suffice in determining nasal airway resistance objectively.

**AETIOLOGY**

Trauma of various kinds, from the fractures obvious on radiographs and clinically to the not so obvious perinatal and childhood injuries causes septal cartilage displacements, missed until later years when minor distortions, previously unnoticed, become obvious external deformities due to scarring. In children, interference with growth centres of the external nose and septum before the age of 6 years may cause failure of growth of the middle third of the face, with a short nose and nasal bridge.

Deformities include external deviation of the cartilaginous vault, involving the septum and the upper and lower lateral cartilages, and C- and S-shaped external deviation of the entire nose involving bony and cartilaginous vaults. Distortion of the bony pyramid, widening, saddling, bulges and concavities, and separation of the lateral walls from the septum may be present. Profile convexities and concavities and shortening of the nose are commonly due to deformities of both the intranasal and external framework of the nose. There are various
types of septal deformity. Caudal dislocation, or absence of the caudal end may be due to a haematoma or abscess that leads to lack of support of the tip, with columellar retraction and widening of the columella and the septum in that area. Widening of the septum further back in the nose may take place with posterior obstruction due to spurs of the vomer or ethmoid plates, and the production of C- and S-shaped deviations of the septum. All these deformities produce nasal obstruction of a functional nature with a nasal and postnasal discharge, a high incidence of upper respiratory infection, occasionally anosmia, nasal neuralgia, paraosmia and snoring.

The shape of the nostrils and their slant, and the direction as well as the position of the columella on the anterior nasal spine, will determine the laminar flow as well as the flow curve. Thus a deviated tip, a retracted columella and the loss of tip projection will interfere with the flow. If there is interference beyond the internal valve, as in radical removal of turbinates, the laminar flow will be altered to a tubular flow and the Venturi effect, that is a sensation of obstruction, will be manifest.

Thus collapse and deviation of the nasal tip, when altered for cosmetic reasons, must be reconstructed from a functional point of view as well. One must provide for tip elevation and rotation to meet both cosmetic and functional requirements.

**SEPTORHINOPLASTY**

**Pre-operative Evaluation**

A full history is mandatory. As stated above, many patients are not aware of any predisposing cause for their disability. A defect due to a birth injury, or one sustained in early childhood, may not be obvious until later in life. To assist in the evaluation of the patient, photographs are taken in the five standard positions, to conform to the standards of the American Academy for Plastic and Reconstructive Surgery.

Psychological assessment is important, and the guidelines have been suggested by Anderson and Johnson and Wright and Wright. It must be explained to the patient that there are limitations to what can be achieved with surgery. Anderson quotes Wright's categorization that 'there are great noses, good noses, fair noses, poor noses, deformities and monstrosities', and that it is unusual for a nose to be upgraded more than one or two levels by rhinoplasty. It must be explained to the patient that the precise healing of rearranged tissue is seldom achieved. The patient who requests surgery is seeking to change his self-image, one of the cornerstones of his personality, a form of psychic surgery. Difficulties can, however, be avoided if the patient is taken into the surgeon's confidence, and close psychological support is maintained throughout the course of management. Pre-operative radiographs of the sinuses are taken as a routine to determine concomitant disease. While the bony septum is visible on the radiograph, a deviation of the cartilaginous portion cannot be demonstrated. Sinus lesions and nasal polyps can be dealt with during surgery, but a purulent sinusitis precludes surgery.

It must also be explained that defects which may be manifest after an operation have to be dealt with at a later stage, as a secondary procedure.

**Procedure**

All the operations in our series were performed under hypotensive anaesthesia.

A septrhinozyanoplasty is performed prior to the rhinoplasty. This allows us to deal with the cartilaginous and bony deformities, removing spurs and parts of the septum which cause obstruction; this autologous material can be used for further reconstruction.

A cartilaginous support is maintained anterior to the line extending from the lower border of the nasal bones to the anterior nasal spine. Where the cartilaginous septum has been previously fractured at an acute angle it is excised at this point. Where it is deviated, the mucoperichondrium is stripped from the concave side of the septum, maintaining the other side intact, to act as a splint and to preserve the viability of the cartilage. Anterior-posterior incisions are then made on the concave surface of the cartilage in order to straighten it, according to the Fry principle. If this does not suffice, the twisted cartilage is cross-hatched to facilitate straightening.

The septum is further mobilized where it rests on the maxillary spine, with all its borders. It must be noted that the 'keystone area', at the junction of the septum with the lower borders of the nasal bones, must be maintained. Interference in this region can cause saddling.

It is often noted that the crooked nose reverts back to the midline when the septum has been mobilized and straightened, requiring minimal changes in the superstructure to maintain its integrity.

The septoplasty is approached through a bilateral transcartilaginous incision which is extended into the caudal border of the nasal septum in a low transfixion. This provides good exposure of the upper and lower lateral cartilages and dorsum of the nose, and maintains the integrity of the nasal valve area. At the completion of the septoplasty, the alar cartilages are exposed, and cephalic borders as well as the dome areas are trimmed as required, thus facilitating the remodelling of the tip, its projection and rotation. The upper lateral cartilages are resected submucosally from their dorsal attachments to the quadrilateral plate of the septum. The scrolls and the dorsal borders are trimmed as required.

The skin of the dorsum of the nose is elevated subcutaneously by blunt dissection. The periosteum is elevated from the nasal bones with an elevator, and the hump is then removed with a chisel or a rasp. The nasal pyramid is mobilized by lateral osteotomies using a Parke's or similar osteotome and finger pressure. Medial osteotomies are seldom used to facilitate mobilization, since the latter manoeuvre disturbs the integrity of the articulation between the nasal bones and the upper lateral cartilages.

The dorsal borders of the cartilaginous nasal septum and the upper lateral cartilages are then trimmed. Any defect in this area can be filled with cartilage, either in
small pieces or in sections. When dealing with any defect on the bony dorsum of the nose, autologous material from the bony septum is preferred.

When indicated, the Skoog method is employed when the trimmed nasal hump is replaced in position.

The shape and position of the nasal tip in relation to the dorsum of the nose is assessed. The caudal border of the cartilaginous septum and its anterior angle are trimmed. Septocolumellar sutures are employed to maintain the position and angle of the columella.

The use of a cartilaginous stent, as described by Anderson, placed between the medial crura in the columella, is an invaluable adjunct in maintaining tip support.

Postoperative Care

Intransal splints of suitable plastic material have been used for short postoperative periods in maintaining the integrity of the cartilaginous nasal septum when much change was necessitated in re-alignment. An aluminium external splint, placed on Steri-strips, maintains the alignment of the nose postoperatively.

Internal nasal plugging has not been used as a routine. This obviates the immediate postoperative discomfort caused by its presence and subsequent removal, as well as the synchiae which follow the vigorous application of long lengths of this material. Its presence causes mechanical and chemical reactions which interfere with the ciliary action necessary for postoperative return to normal function. Little postoperative bleeding is encountered with this method.

During the immediate postoperative period, the patient is nursed with head elevated with iced eyepads applied for the first 6-8 hours. Analgesics are prescribed when necessary but they should not contain aspirin. Antibiotics are prescribed when internal nasal splints are used. The patient is advised to clean the crusts which form in his nasal vestibules, using a sodium bicarbonate and saline mixture. The splints and dressings are removed about a week after the operation, and strapping is applied to the dorsum of the nose for a few days to reduce oedema. The patient is shown how to assist by massaging the nose with his fingers.

The use of anti-inflammatory drugs, including corticosteroids, has not been shown to enhance the postoperative healing process.

The patient is seen at regular intervals postoperatively, when photographs are taken to observe the changes, and to encourage him, should he be depressed during this period.

RESULTS

The functional result is assessed on the subjective response of the patient and his ability to breathe through one or both sides of his nose as compared to his original disability. Our objective assessment was made by direct examination of the external and internal valves, and of any other objective feature such as septum or turbinates.

In the 8-year period under consideration, 2 492 patients were treated, of whom 2 152 were males and 340 females. Their ages ranged from 16 to 65, the majority being between 19 and 30 years old. One-quarter had had sports injuries, 25% motor vehicle and industrial accidents, and 33% injuries caused by other than the above; 17% were not aware of the cause of their disability, which might have been due to birth trauma or injury sustained in early childhood.

The desired cosmetic result was an improvement in the general appearance with straightening of a crooked nose and narrowing of a broad dorsum, together with an improvement in the configuration of the tip and supratip areas. Photographs of the pre-operative and postoperative states were mandatory in this assessment (Figs 2 and 3).

In the early part of the period under review, a 60% improvement rate was noted, while 15% of cases required later revision. Later on in this series, when greater skill had been acquired, improvement was noted in 80%, while only 3% were revised. The disparity between the revision and failure rates may be due to the reluctance of patients to submit themselves to further surgery (in spite of their having been warned in advance of this possibility) or because the patients' subjective assessment of improvement did not match the results of objective examination.

The absence of a serious complication in this series can be attributed to the conservative surgical technique employed throughout, guided by Beekhuis, Anderson and Wright.

DISCUSSION

While it is easier to assess the functional aspect, since the relief of a blocked nose is evident to both patient and surgeon, the cosmetic result is more difficult to evaluate. The aesthetics of rhinoplasty as described by Bernstein and Wright provide a guideline acceptable standards that can be achieved. It has been mentioned above that cognizance must be taken of the patient's psychological condition. With all due respect, surgeons are not psychologists and certainly not psychiatrists, and even the latter are vulnerable on occasion. How much greater is the risk the surgeon runs in this regard, when confronted by an irate patient with a personality disorder whose world has not changed for the better in keeping with the shape of his nose. It takes more than surgical skill to settle such a problem.

Defects dealt with in this series were for the most part caused by accident, and their amelioration provided gratification to both surgeon and patient. While the restoration of function and cosmetic improvement are desirable, the healing of tissue is unpredictable. The stresses involved in healing cartilage are discussed by Fry, and application of his principles generally produces a more successful result. All the strategies at the surgeon's command are needed to prevent a nose straightened after deviation to one side from healing with a deviation to the other. The challenge this operation presents to the surgeon sustains interest and inspires humility.

The results show that the lot of an individual handicapped by an obstructed and deformed nose can be
Fig. 2. Top: Pre-operative views of a patient with a crooked nose and a large hump. Bottom: The same patient, 3 years after plastic surgery.
alleviated by applying the principles in surgery initiated by our distinguished predecessors. It is an impediment which has bedevilled men over the millennia, and which is epitomized by Sushruta (200 BC):

"The love of life is next to our love of our face and thus the mutilated cry for help."

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REFERENCES