

The Birth of Plastic Surgery: The Story of Nasal Reconstruction from the *Edwin Smith Papyrus* to the Twenty-First Century

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Background: The nose is the central and most prominent feature on the human face; and on its shape, size, and appearance depends the relative facial beauty of the person. The objective of this article was to give a succinct and interesting account of the development of nasal reconstruction from antiquity to the present day.

Methods: The authors present the story of nasal reconstruction, including those contributions not often cited in the English literature using articles sourced from MEDLINE, ancient manuscripts, original quotes, techniques, and illustrations.

Results: The story of rhinoplasty is one of peaks of achievement by individuals such as Sushruta, Branca, Tagliocozzi, Roe, and Joseph. Since Roe introduced the concept of cosmetic rhinoplasty, the evolution of nasal reconstructive techniques has reached such a level that the expectation is not only to restore form and function, but also to achieve excellent cosmetic appearance.

Conclusions: Although repair of nasal injuries is the oldest form of reconstructive surgery, being cited in Egyptian papyrus inscriptions such as the *Edwin Smith Papyrus* dating back to 2500 to 3000 BC, its complexity continues to challenge surgeons today. This article is dedicated to those individuals who have devoted their lives and work to the advancement of the field of plastic surgery for the benefit of mankind. (*Plast. Reconstr. Surg.* 120: 327, 2007.)

THE SIGNIFICANCE OF THE NOSE

The nose is the most prominent feature on the human face, critically involved in appearance, both to oneself and to others, and it is involved significantly in the perception of beauty, both publicly and privately.¹ Because of its central location on the face, plane of projection, and relatively weak chondrocutaneous support structure, the nose is susceptible to injury, and deformities are readily apparent. Mutilation of the nose as a result of trauma, infection, or tumors is a problem that dates back to antiquity. This disfigurement imposes serious limitations on the work and social life of the patient. Since ancient times, the nose has been considered as the “organ of reputation”; thus, amputation of the nose, or *rhinokopia*, was aimed at stripping a man of his honor—the ultimate

humiliation.² Physiognomists emphasize the importance of the nose in the category of anatomical conformations that are indicative of special traits of character; regarding it as a measure of force in nations and individuals [Physiognomy (from *physis*, nature, and *gnosis*, knowledge) is a pseudoscience; a body of knowledge purported to be scientific that fails to comply with the scientific method. Physiognomy is based on the belief that the study and judgment of a person’s outer appearance, primarily the face, reflects their character or personality.]. The five classes recognized by physiognomists include the Roman (indicating strength), Greek (refinement), Jewish (commercialism), pug (weakness and lack of development), and celestial (weakness and inquisitiveness) noses. According to Herodotus, the Egyptian priests considered a large nose to be a symbol of wisdom. Greeks and Romans gave great importance to the beauty of the nose and preferred long sculptured noses, “*longus quadatusque nassive*” in the words of Cicero. Europeans in the nineteenth century liked Greek and Roman profiles and had a preference for long noses.³

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Tagliocozzi recommended the construction of large noses “*Millius est amptos gesture nares quam imminatus et deformes.*”⁴ Surgeons for many centuries have used their imagination, ingenuity, skill, and also courage in trying to reproduce this unique organ so important to facial aesthetics.⁵

THE STORY OF RHINOPLASTY

The first mention of the treatment of nasal injuries is dated circa 3000 BC, in the *Edwin Smith Surgical Papyrus*.⁶ This remarkable piece of literature, measuring approximately 5 yards, consists of 48 case reports, all of a surgical nature. This papyrus contains the first descriptions of the surgical management of facial trauma, including the treatment of mandibular and nasal fractures. Treatments at that time were simple: nasal manipulation followed by lint, swabs, and plugs of linen as absorbents. Splints were formed from thin wood padded with linen, with grease and honey often applied to fresh wounds.

The most famous forefather of modern day medicine, Hippocrates (fifth century BC), outlined measures to treat and restore injured noses. In his book, *Mochlicon*, he provided detailed case descriptions, classified nasal injuries from simple contusions to complicated fractures, and discussed treatments ranging from poultice application⁷ to reshaping of the nasal bones in the case of fractures or deviation (Hippocratic “poultice” recipes could be quite complicated, requiring many ingredients, some difficult to obtain. Different poultices were considered appropriate for different maladies. Figs, olives, lentils, and linseed were often used, macerated and combined with vinegar or wine).⁸

The Indian art and science of total nasal reconstruction constitutes the first chapter in the history of plastic surgery.⁹ Although the precise date is disputed by historians, the first recorded description of actual reconstructive plastic surgery may be traced back to the Sanskrit texts of ancient India. During this period, such surgery was in great demand, as acts of facial mutilation, especially of the nose (the organ of respect and reputation), were perpetrated commonly in India and its surrounding territories by vicious bands of marauders as a method of visible and lasting humiliation. The Hindu god Rama and his brother Laxman practiced the amputation of women’s noses for minor offenses, thereby giving divine sanction for the custom. Hindu husbands cut off the ears and noses of wives if they left the house without prior permission, and this method of stig-

matization was also practiced on adulterers, thieves, and other criminals.

The weaver cut off his wife’s nose because she did not respond and he considered her unfaithful.¹⁰

In northern India, during the sixth century BC, a lowly priestly class, the Koomas (potters), developed techniques for replacing skin of the nose. Sushruta, a member of this potter class, described a method of transferring skin from the forehead and skin from the cheek using personalized surgical instruments (Fig. 1); these were the first operative procedures for reconstructing noses.¹¹ He described this technique in his *Samhita* (encyclopedia). Whether this original “Indian” method used a pedicle cheek flap rather than a forehead flap remains unclear. It seems translations of the *Samhita* from its original Sanskrit indicate that the cheek was probably the preferred source for the nasal reconstruction flap:

*When a man’s nose has been cut off or destroyed, the physician takes the leaf of a plan He places it on the patient’s cheek and cuts out of this cheek a piece of skin of the same size in such a manner that the skin at one end remains attached to the cheek Then he freshens with his scalpel the edges of the stump of the nose and wraps the piece of skin from the cheek carefully around it and sews it at all the edges As soon as the skin has sewn together with the nose, he cuts through the connection with the cheek.*⁵

Whereas early research originally dated Sushruta’s work at approximately 600 BC, modern historians dispute this, placing its first writing anywhere from 400 BC to the first century AD. Whatever the true date, Sushruta unquestionably was an important early contributor of actual reconstructive technique to the specialty of plastic surgery. Although this method of nasal reconstruction persisted in India, it did not gain international acceptance, perhaps because of the lack of maritime commerce and communication.¹² Although the sharing of medical knowledge between Greek and Indian civilizations reportedly existed even earlier than Alexander the Great’s expedition to India in the fourth century BC, the transfer of such reconstructive technique before the seventh century BC, although likely, has never been confirmed. This remains an interesting question, considering that several Hellenistic and Roman physicians described the care and surgical correction of various facial defects in a manner similar to that of their Indian counterparts.

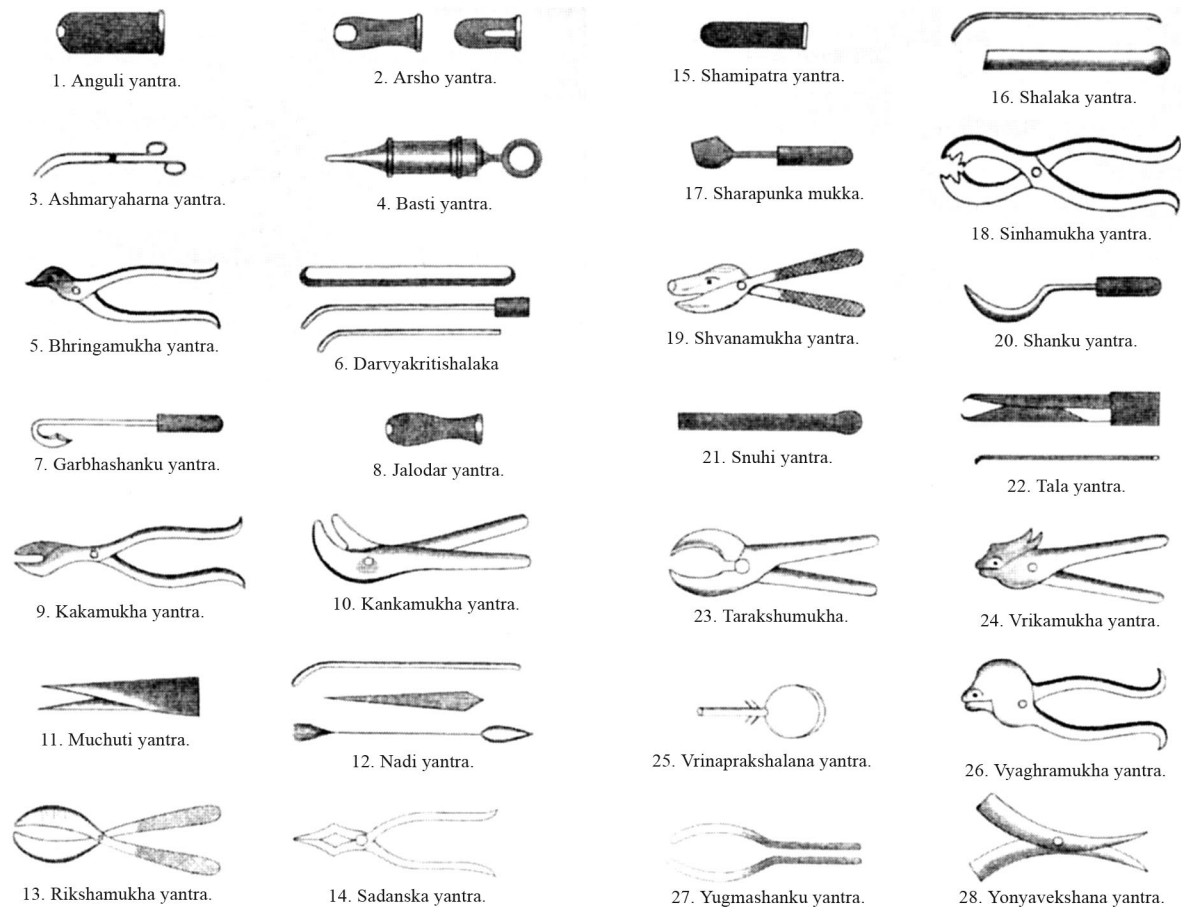


Fig. 1. A selection of surgical instruments described by Sushruta. (From *A Short History of Aryan Medical Science* by Sir Bhagvat Sinh Jee. London: Macmillan, 1896. National Library of Medicine.)

Aulus Cornelius Celsus, considered by many to be the greatest Roman medical writer, included similar techniques to repair mutilated lips, ears, and noses in his classic medical text of the first century, *De Medicina*. Emperor Justinian II of the Byzantine Empire, who we believe is depicted in the ancient marble Carmagnola statue,¹³ is said to have benefited from nasal flap reconstruction as early as the eighth century. Close examination of the statue reveals the presence of a forehead scar in addition to the reconstructed nose. Known as the *Rhinometus* or “the one with the amputated nose,” Justinian II was overthrown and his nose mutilated so that his disfigured appearance would prohibit him from regaining the status of emperor. These efforts were futile, as he subsequently returned to power after benefiting from nasal reconstruction.

The fall of Rome in the fifth century and subsequent spread of the barbarian tribes and Christianity through the middle ages brought a halt to the advancement of reconstructive surgery. With the

Islamic conquest of India in the tenth century, the Indian methods were probably passed to the Arabic culture,¹⁴ which in turn transferred this knowledge to the whole of Europe with the invasion and occupation of Sicily during the ninth to the twelfth centuries. In the thirteenth century, Pope Innocent III specifically prohibited surgical procedures.

The renaissance in the fourteenth century brought a rebirth of science and medicine and an end to the stagnation in the world of surgery. The middle ages had yielded few advancements in surgery, but the reconstructive principles of the early Indian, Hellenistic, and Roman pioneers had been kept alive, passed on from generation to generation and from one civilization to another. Nasal reconstruction was practiced in Europe as early as the fifteenth century, shrouded by secrecy. An Italian surgeon named Branca¹⁵ (1430s), in Catania, Sicily, and Heinrich von Pflazpaint¹⁶ (1450), a German surgeon, had profitable private practices in rhinoplasty. The famous Branca family guarded its techniques closely. The elder

Branca, a wound specialist, introduced the Indian method of nasal reconstruction in 1442. This technique was only passed down from father to son, and observers who might steal the technique were prevented from viewing the procedure.

Branca's son, Antonio, inherited the technique and made significant modifications, using a delayed skin flap from the arm as the source of tissue. This "Italian method," as it came to be known, was eventually transferred to other families, including the Viano family. Alessandro Benedetti is credited with first reporting the Italian method of nasal reconstruction in the Western literature¹⁷ almost 100 years before Tagliacozzi's publication in 1597.

Meanwhile, in mid-fifteenth century Germany, another surgeon was performing the art of nasal reconstruction. Pflzpaint was a Bavarian army surgeon who gave a detailed account of "how to create a new nose if it has been chopped off and the dogs have eaten it away" in his manual, *Wund-Arznei* (wound bandaging). This book was printed from hand writings in 1868 and is almost never referenced in the English literature. There are very few copies in existence. The arm flap described here predates Tagliacozzi by more than a century. Pflzpaint used a two-stage technique, cutting a flap from the biceps area, suturing it into the defect, and bandaging the arm to the head. After 8 to 10 days, he divided the

pedicle, inset the flap, and formed the nasal dorsum, alae, and septum. This technique was only passed on from master to pupil:

If one comes to you with a cut off nose, let no one watch and make him swear to tell nobody how you cured him (Wund-Arznei).

Back in sixteenth century Italy, the transformation of surgery into a scientific branch of medicine was beginning. Leonardo Fioravanti, a doctor in medicine from the University of Bologna, played a crucial role in disseminating knowledge and stimulating academic interest.¹⁸

On the way back from one of the last Crusades, he visited the Viano brothers in Calabria, posed as a squeamish and uninformed observer, and watched several nasal reconstructions. He therefore learned the technique that had been imparted by Branca over 100 years earlier. Fioravanti published his experiences in a manuscript entitled *Il tesoro della vita humana* that probably inspired his contemporary, Gaspare Tagliacozzi. Tagliacozzi (1597), an Italian surgeon and anatomy professor from the University of Bologna, introduced the principles and use of distant pedicled flaps and carefully delayed the arm flap of the Italian method. He experimented with the fabrication of

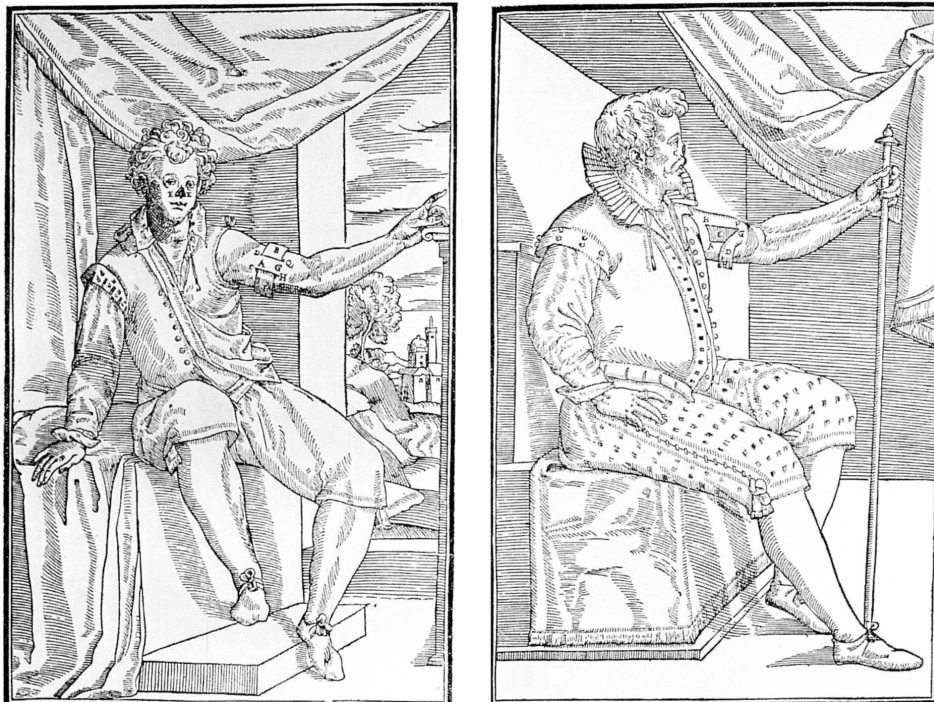


Fig. 2. From Gaspar Tagliacozzi's *De Curtorum Chirurgia per Insitionem* (1597), the first monograph on plastic surgery.

noses from the tissues of the upper arm and produced one of the earliest compendiums in plastic surgery, *De Curtorum Chirurgia per Insitionem*, which was over 100 pages in length (Fig. 2). His rhinoplasty technique was considerably longer than that of Pflazpaint, taking place in six stages over 4 months. Gaspare Tagliacozzi had few followers, least of all the Church, who regarded his work as interfering in the affairs of the Almighty. They excommunicated Tagliacozzi, and exhumed his corpse from its church grave after his death, placing it in unconsecrated ground. For the next 200 years in Europe, the field of rhinoplasty saw no significant advance. This had been related to the sympathetic theory, a belief at the time that tissues transplanted from one individual would survive only as long as the donor remained alive.

Gent. Mag. Oct. 1794, Pl. I, p. 883.



PLATE I

Fig. 3. From *Gentleman's Magazine*, London, October of 1794, plate 1, P. 883.

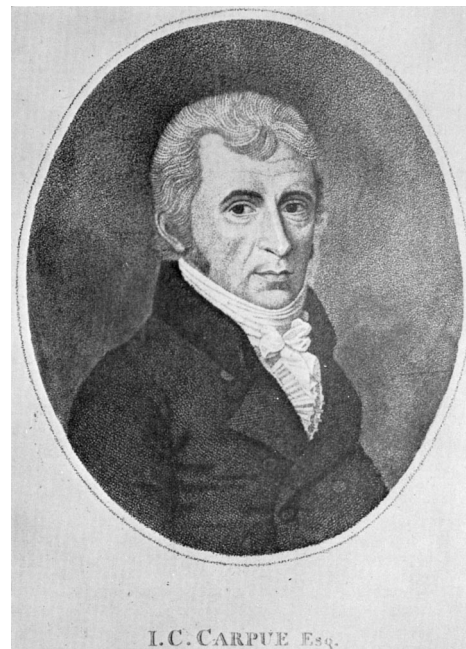


Fig. 4. Joseph Constantine Carpue, F.R.C.S., 1764 to 1846.

The most often-cited impetus to the new age of reconstructive surgery was a letter published in the *Gentleman's Magazine* of London in October of 1794¹⁹ (Fig. 3). In this account, a British surgeon named Lucas described an operative procedure for reconstructing the amputated nose of a British bullock driver named Cowasjee.

The reconstructive procedure was performed in India by a man of the brickmaker caste and involved the forehead flap. Lucas's account was read by Joseph Carpue (Fig. 4), a British surgeon at York Hospital in Chelsea, England. Carpue practiced the technique on cadavers for 20 years until he found the right patients. In 1814, he performed nasal reconstruction on two patients: a British military officer who had lost his nose to the toxic effects of mercury treatments, and another officer whose nose was mutilated by a sword. Reports at the time estimated that it took more than 90 minutes to perform the reconstructions in India, but Carpue indicated that he performed the entire procedure in 15 minutes (9 minutes for flap dissection and 6 minutes for suturing). The bandaging took a further 22 minutes. Carpue stated that "during this time the patient showed the greatest courage, not a single groan was heard."

He described his first two cases in an illustrated monograph entitled *An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead*²⁰ (Figs. 5 and 6). Subsequently, the forehead pedicled flap gained great acceptance throughout Europe.



Fig. 5. Plate I: "The loss of the septum, all the anterior part of the cartilage, and in truth, the whole front of the nose, a small portion of the alae, or sides of the nostril excepted. The nasal bones remained entire." (From Carpue, J. C. *An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead* Chelsea: York Hospital.)

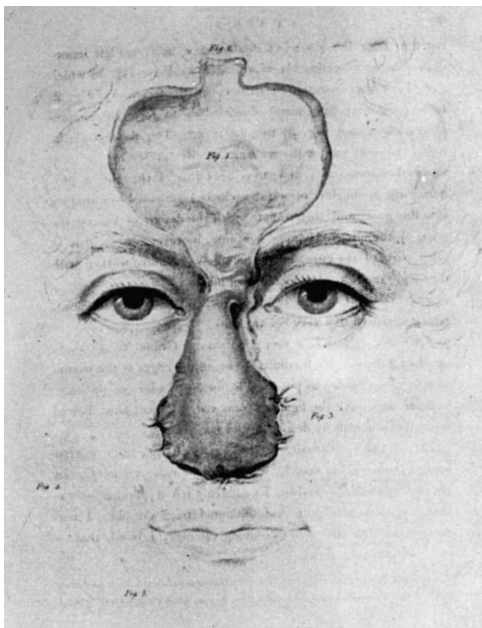


Fig. 6. Plate III: "The state of the nose, together with the wound of the forehead as it was left immediately after dissection." *Fig 1*, the dissection or cicatrix of the forehead; *Fig 2*, the portion of integument dissected off to form the septum of the nose; *Fig 3*, the flat nose. (From Carpue, J. C. *An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead*. Chelsea: York Hospital.)

In 1818, the German surgeon Carl von Graefe²¹ (Fig. 7), considered by many at the time to be the finest surgeon in Europe, published his major work entitled *Rhinoplastik*. The German method described by von Graefe modified the Italian method by using a free skin graft from the arm instead of the delayed pedicled flap. Nasal reconstruction was first performed in America by J. M. Warren in the late 1830s.²²

The folded forehead flap was being used in the 1840s by three different authors, an Italian, Natale Petrali, and two Germans, Ernst Blasius and Johann Friedrich Dieffenbach. There is evidence, however, that a Frenchman, Pierre August Labat, suggested the use of a trilobed flap folded inward, in Paris in 1834.²³ Dieffenbach²⁴ succeeded von Graefe in Berlin and wrote a comprehensive text on rhinoplasty in 1845 entitled *Operative Chirurgie*. He is credited for introducing the concept of reoperation to improve the cosmetic appearance of the reconstructed nose, and was one of the first surgeons to make reconstructive rhinoplasty more tolerable through anesthesia. As the foundation of the modern speciality of plastic surgery formed, important changes were taking place that affected the entire nature of the field. The overall risks of surgery decreased with the introduction of anesthesia in the 1840s and the development of antisepsis by Lister²⁵ in the 1860s. These developments allowed the concept of aesthetic surgery to exist.

The era of true modern rhinoplasty and total nasal reconstructive techniques began in the mid



Fig. 7. Carl Ferdinand von Graefe, 1787 to 1840.

to late nineteenth century, when the basic tenets of successful nasal reconstruction were established, as follows: (1) establishing the nasal framework, (2) fashioning a proper lining, and (3) applying a viable skin covering. It was readily apparent from the mid nineteenth century onward that the results of unlined forehead flaps were poor.

The external shape of the nose became distorted by the contracting scar on the underlying surface of the flap. Carpue, Dieffenbach, and several others had previously folded the distal end of the forehead flap to form the columella but left the alar portions unlined. The nostrils were simply stented with rubber tubing.

At the turn of the twentieth century, few reputable surgeons devoted their practices exclusively to reconstructive or aesthetic surgery. These procedures were not considered necessary by academic medicine at the time, and were performed only as adjuncts to normal surgical practices. John Roe (Fig. 8), an American otorhinolaryngologist, is credited as the first to develop an aesthetic approach to rhinoplasty.²⁶ In 1887, Roe presented his correction of a pug nose (dorsal nasal hump) for purely cosmetic indications²⁷ and, in 1891, Roe introduced the endonasal approach to rhinoplasty in his article “The Correction of Angular Deformities of the Nose by a Subcutaneous Operation.”²⁸ In 1892, Robert F. Weir published his techniques for correcting the saddle nose.²⁹ Jacques Joseph, the German orthopedic-trained

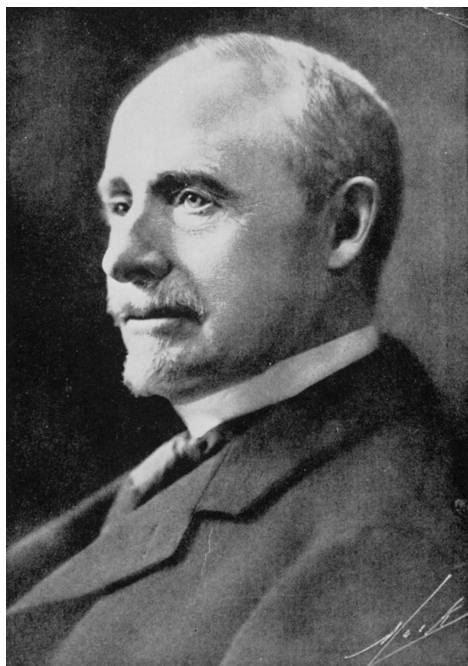


Fig. 8. John Orlando Roe, 1848 to 1915.

surgeon, published his first account of reduction rhinoplasty in 1898, “Operative Reduction of the Size of a Nose (Rhinomiosis).”³⁰

Although Roe preceded these efforts by several years, Joseph is regarded as the father of modern rhinoplasty. His analysis, classification, and repair techniques for the various types of nasal deformities make this difficult to refute. Joseph’s practice was undoubtedly influenced by anti-Semitic feeling at the time. The “Jewish nose” had been characterized by the prominent anthropologist Robert Knox as early as the 1850s,³¹ and was the subject of purportedly scientific studies of hereditary transmission in the 1900s. At the turn of the century, many physicians were arguing that surgical procedures to alter racial characteristics such as the Jewish nose could be a means of promoting patient well-being.³² Joseph saw himself as giving the gift of beauty or removing causes of individual ugliness³³ and, by 1905, had performed over 100 successful rhinoplasties. He was widely recognized for performing this procedure on wealthy Jewish patients.³⁴ Joseph developed several techniques such as using bone grafts (shaved pieces of tibia) to reconstruct the nasal dorsum,³⁵ and was probably the first surgeon to use cartilage suturing techniques, not unlike nondestructive techniques used today.³⁶ At the beginning of the twentieth century, Ombredanne clearly stated the main methods available for nasal reconstruction in his classic work *La Rhinoplastie* (1904):

There are three methods for nasal reconstruction: The Indian Method of taking a flap from the forehead, the French method of the sliding flaps taken from the neighbouring tissues of the face, and the Italian method of taking a flap from the arm or forearm. Next came the combined procedure using both flaps and some material for support, which could be metallic or organic as well as bone or cartilage.³⁷

The symbiotic relationship between plastic surgery and war throughout the ages was continued during World War I. The Great War produced the largest number of facial injuries and burns in the history of warfare. Trench warfare often left soldiers’ faces shattered or burnt beyond recognition. This period demonstrated the ability of plastic surgery to reconstruct the human form in a manner unlike anything seen before. Realizing the need for a facial reconstructive service, a young surgeon named Harold Delf Gillies, operating out of Aldershot Hospital, England, took to the job in hand. Gillies was inspired by Europe’s foremost surgeon of the time, Hippolyte Morestin.

After observing his work in Paris, Gillies threw himself into reconstructive surgery of the face. At this time, the forehead flap was still the preferred method of reconstruction:

The tint of the forehead skin so exactly matches that of the face and the nose that it must be first choice. Is not the forehead the crowning feature of the face and important in expression? Why then should we jeopardize its beauty to make a nose? First, because in many instances, the forehead makes far and away the best nose. Second, with some plastic juggling, the forehead defect can be camouflaged effectively.³⁸

In addition to using forehead flaps for nasal reconstruction, Gillies also used his most notable innovation, the tube pedicle.³⁹ The significant advances made throughout World War I were made apparent in the flurry of academic activity that began shortly after the war ended. Gillies documented his wartime experiences in his textbook *Plastic Surgery of the Face* in 1920. In 1919, John Staige Davis published the first American plastic surgery textbook, entitled *Plastic Surgery: Its Principles and Practice*.

This widely read and highly influential book became a classic text of the field. In 1928, Ferris Smith, an otorhinolaryngologist by training, explored the use of local facial flaps in his work *Reconstructive Surgery*. Joseph's seminal work, *Nasenplastik und Sonstige Gesichtplastik*, also published in 1928, was one of the most comprehensive and innovative texts ever written concerning rhinoplasty. In addition to his writings, Joseph taught popular international courses on rhinoplasty that were attended by many prominent plastic surgeons.

Several modifications of the forehead flap were described during the twentieth century, including those of Kazanjian, who popularized the vertical flap from the midline of the forehead and pioneered primary closure of the donor site.⁴⁰

In 1943, Gillies popularized the placement of composite chondrocutaneous grafts⁴¹ (previously described by König), and in 1956, Converse suggested the septomucoperichondral graft as an alternative.⁴² The more recent work of Millard⁴³⁻⁴⁵ and Burget and Menick⁴⁶⁻⁴⁸ has elevated nasal reconstruction to an art form. In 1988, Adamson described the expanded forehead flap to reconstruct nasal defects⁴⁹ (Figs. 9 through 11). Secondary cleft lip reconstruction has recently been nicely reviewed by Cutting,⁵⁰ who cites techniques described by individuals such as Potter, Tajima,

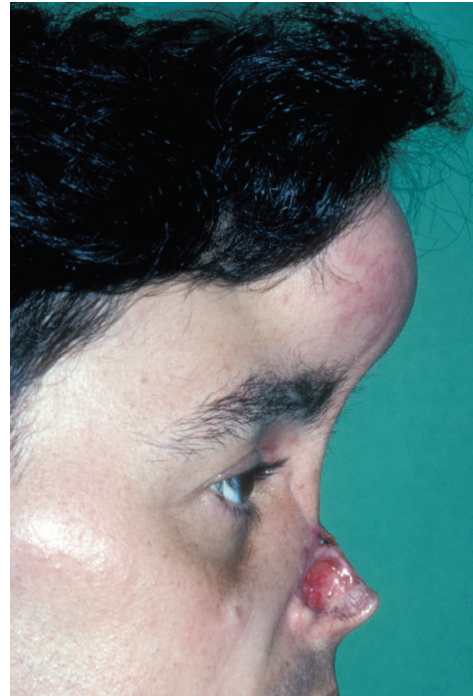


Fig. 9. The senior author prepared the expanded forehead flap that was used to reconstruct this defect.



Fig. 10. Lateral long-term follow-up view of the expanded forehead flap used to reconstruct the nose.

Dibbell, and Bardach. Contemporary aesthetic rhinoplasty techniques have been clearly reviewed in a recent article in this *Journal* by Sheen.⁵¹

Replantation of the nose using microsurgical techniques has been described in recent years with⁵² and without⁵³ venous anastomosis. A new era in plastic surgery has recently dawned.⁵⁴ Composite tissue allotransplantation of the nose is now a clinical reality. In November of 2005, in Amiens,



Fig. 11. Anteroposterior long-term follow-up view of the expanded forehead flap used to reconstruct the nose.

France, a surgical team led by Dr. Bernard Devauchelle and Jean-Michel Dubernard performed a partial face transplant on a 38-year-old woman whose face has been disfigured by a dog bite. The surgery involved transplanting a triangular graft of tissue extending from the nose to the chin, including the lips. Initial reports indicate that the recipient is doing well.^{55,56} In April of 2006 a team in Xi'an, the capital of Shaanxi Province, performed a face transplant on a 30-year-old man with facial disfigurement resulting from a bear bite. Initial reports indicate that the patient is doing well.⁵⁷⁻⁵⁹ It has taken many centuries for plastic surgery to achieve its modern identity and place within the realm of medicine, but the restoration of form and function always has remained its most humane and admirable goal.

We restore and make whole those parts which nature has given but which fortune has taken away, not so much that they might delight the eye, but that they may buoy up the spirit and help the mind of the afflicted—Gaspar Tagliacozzi, 1597

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