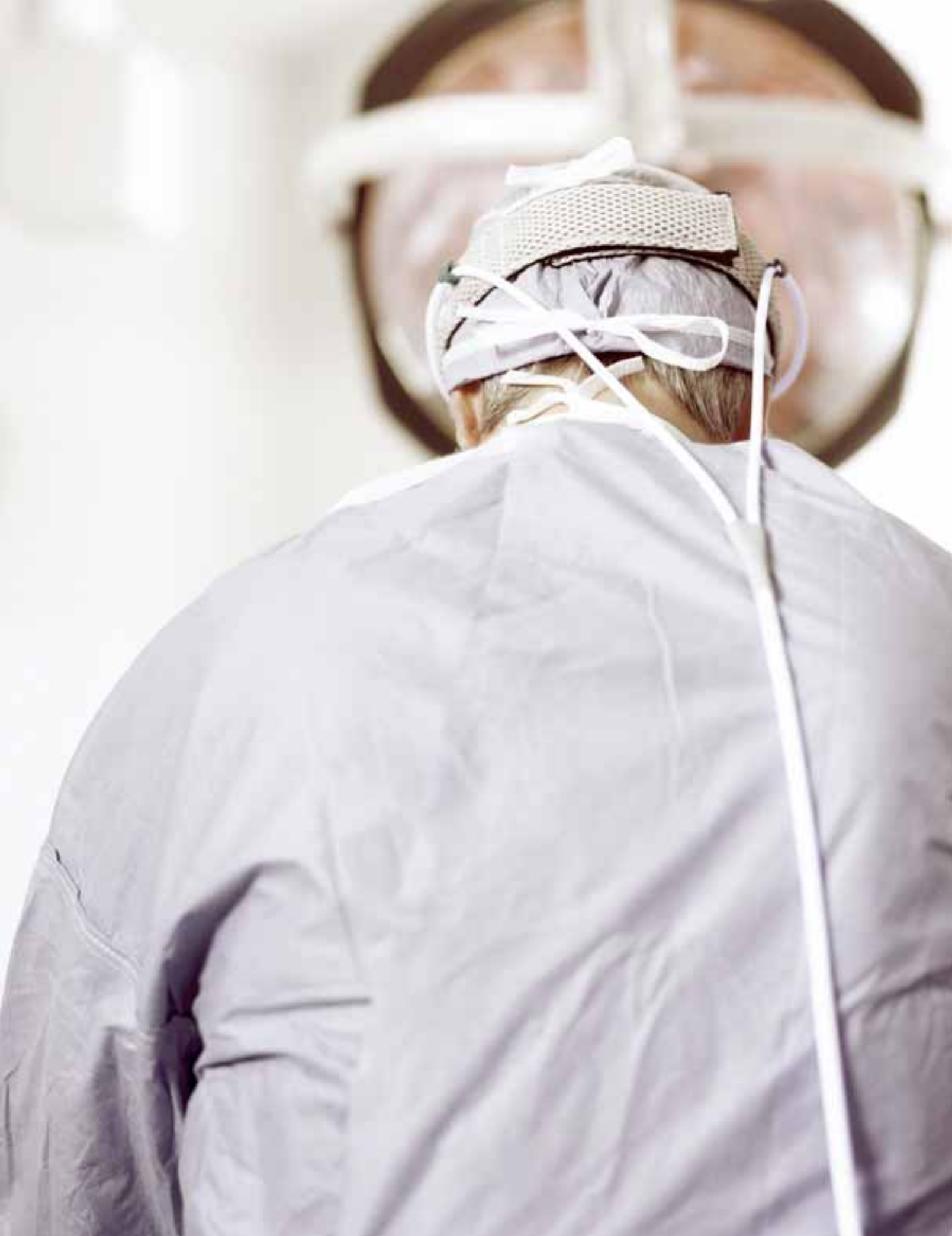
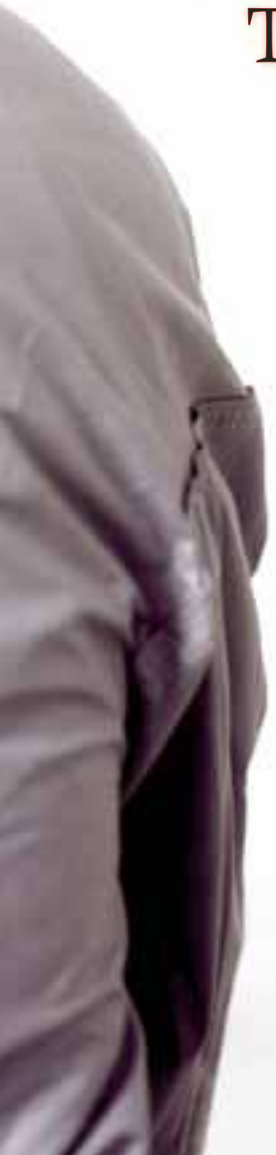


HISTORY AND DEVELOPMENT OF PLASTIC SURGERY

CRAIG R DUFRESNE, MD

THE ORIGINS OF PLASTIC SURGERY ARE ROOTED DEEP IN ANCIENT HISTORY AND FOLLOW THE PATH OF GENERAL SURGERY.

THE HISTORY OF SURGERY REPRESENTS THE HISTORY OF MAN'S STRUGGLE TO TREAT WOUNDS AND DEFECTS CAUSED BY BATTLE, INJURY AND TUMORS. FACIAL DEFORMITIES, WHETHER THEY ARE INFLICTED BY NATURE OR BY OTHER MEN, ESPECIALLY WITH AMPUTATION OF SUCH VITAL PARTS AS THE NOSE, HAVE RECEIVED THE MOST ATTENTION IN ANCIENT RECORDS.



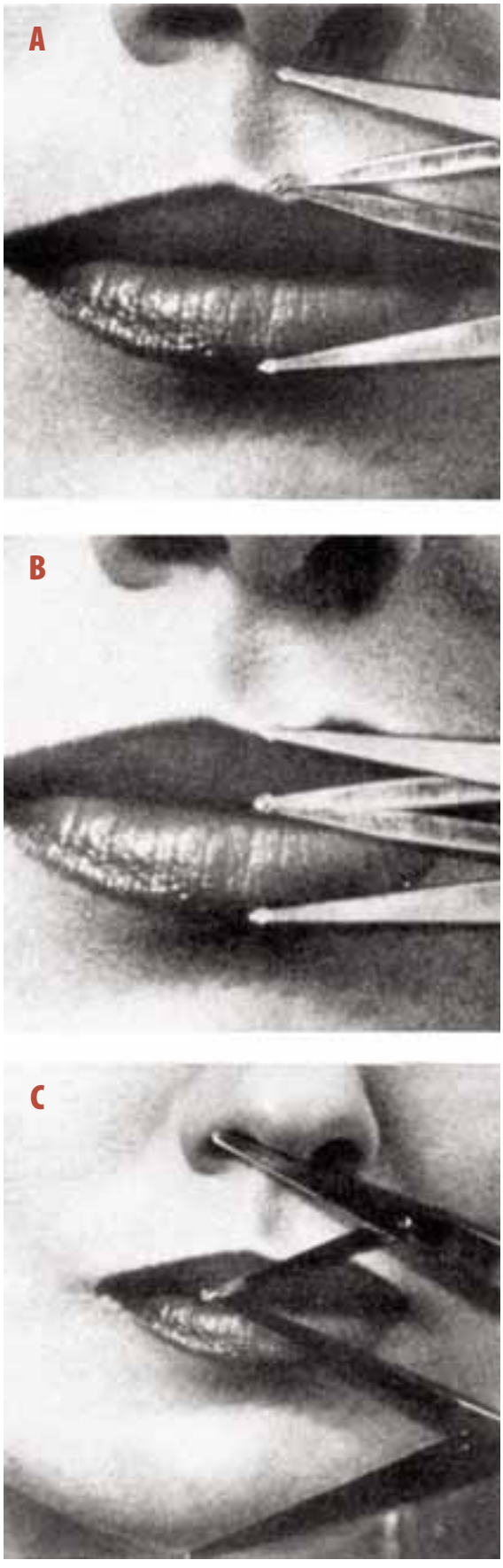


FIGURE 1

Measurements of the various landmarks of the face can be used to determine whether or not they fall within the ideal or normal range for a particular race or ethnic group. These are used to help delineate areas where the relationship may not be as ideal as possible.

Ancient man practiced trephining of the skull as early as 10,000 BCE. Specialized surgery, such as a cataract removal, was first developed and practiced by the Babylonians during the time of Hammurabi (approximately 2,000 BCE).

When the English invaded India, they were exposed to techniques and operations that were not readily know in Europe. As early as 1,600 BCE, the practitioner Sushruta, described operations for reconstruction of the nose and earlobes. In ancient India, the nose was considered the organ of respect and reputation. Amputation of the nose was a common form of punishment for criminals, as well as to identify the inhabitants of conquered cities. The operation for reconstruction was performed by members of a caste of potters known as Koomas. These individuals were able to take flaps of flesh from the forehead, maintaining its blood supply, and slowly migrate it down to reconstruct the nose. The English reported this phenomenon in their medical literature and hoped to further advance the use of flaps for such types of isolated problems.

Celsus (25 BCE to 50 CE) used advancement flaps to reconstruct different types of skin problems. He went on to develop island flaps with a subcutaneous pedicle.

After the period of the Roman Empire, Paulus Aegineta (625-698 CE) was believed to have had contact with the Hindu and Arab medical schools and philosophy. He described procedures varying from the treatment of nasal and jaw fractures to operations for hypospadias.

The period of the Renaissance, or Rebirth of Civilization, marked a transition from the fourth century to the Middle Age, reaching a zenith in the 15th and 16th centuries. Most of this happened in Italy. In 1543, *De Humani Corporis Fabrica* by Vesalius was published. This helped to lay the foundation of modern anatomical studies, where anatomy was changed from a Galenic to a Vesalian discipline.

By the 1800s, during the Napoleonic wars, great advances in plastic surgery were achieved because of the advent of modern warfare. This led to many types of facial injuries and burns. A greater understanding of wound treatment

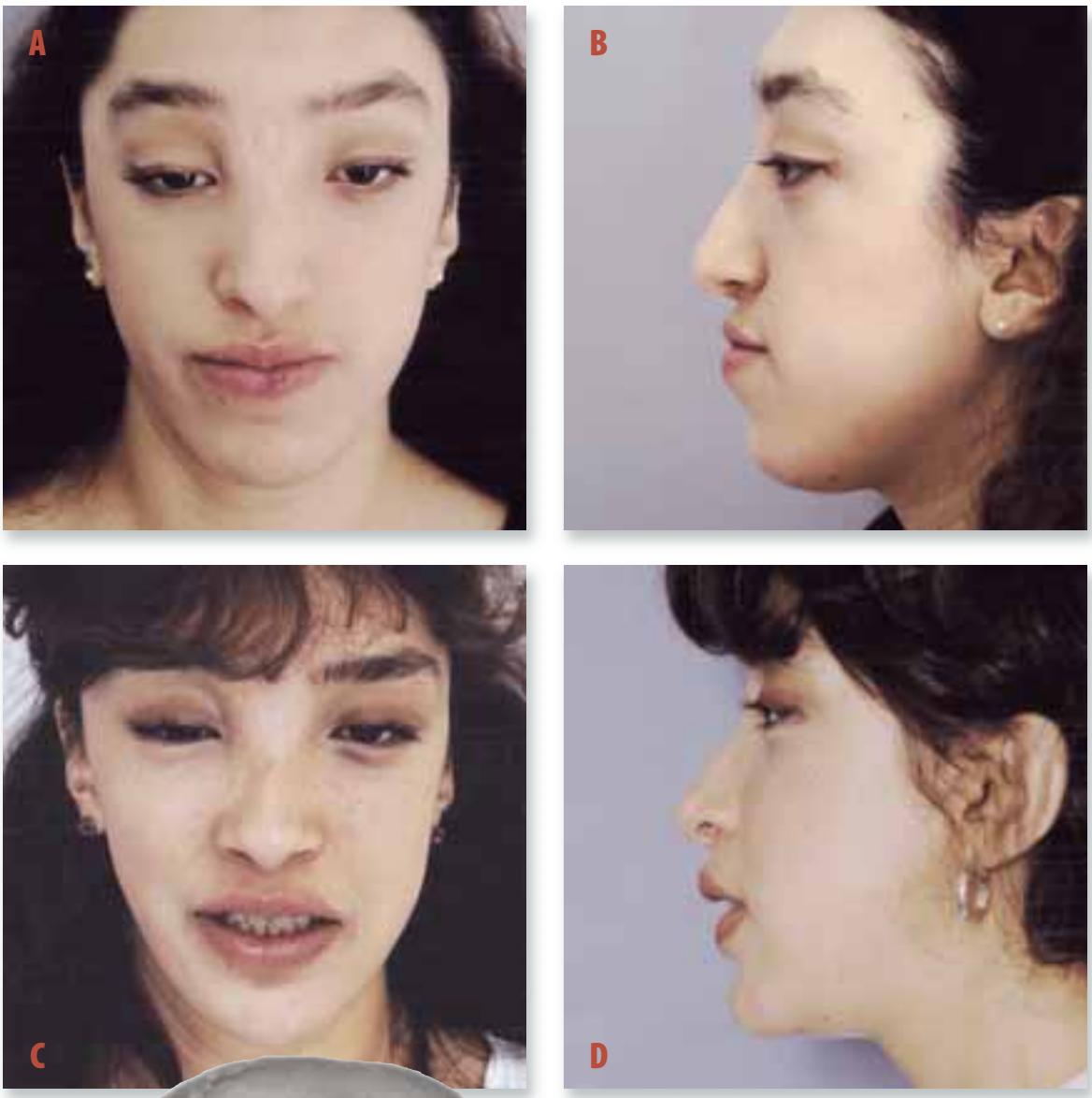


FIGURE 2 This young woman was born with a genetic condition that resulted in a wide separation of her eyes, elongation of the nose, flattening of the midface and alteration of her chin point in relationship to the rest of the face. Her skeleton reflected the early surgeries and the landmarks that needed to be altered when structurally changing the underlying nose, forehead and cheek areas. A better relationship and harmony were achieved, as seen in her postoperative pictures (C, D).

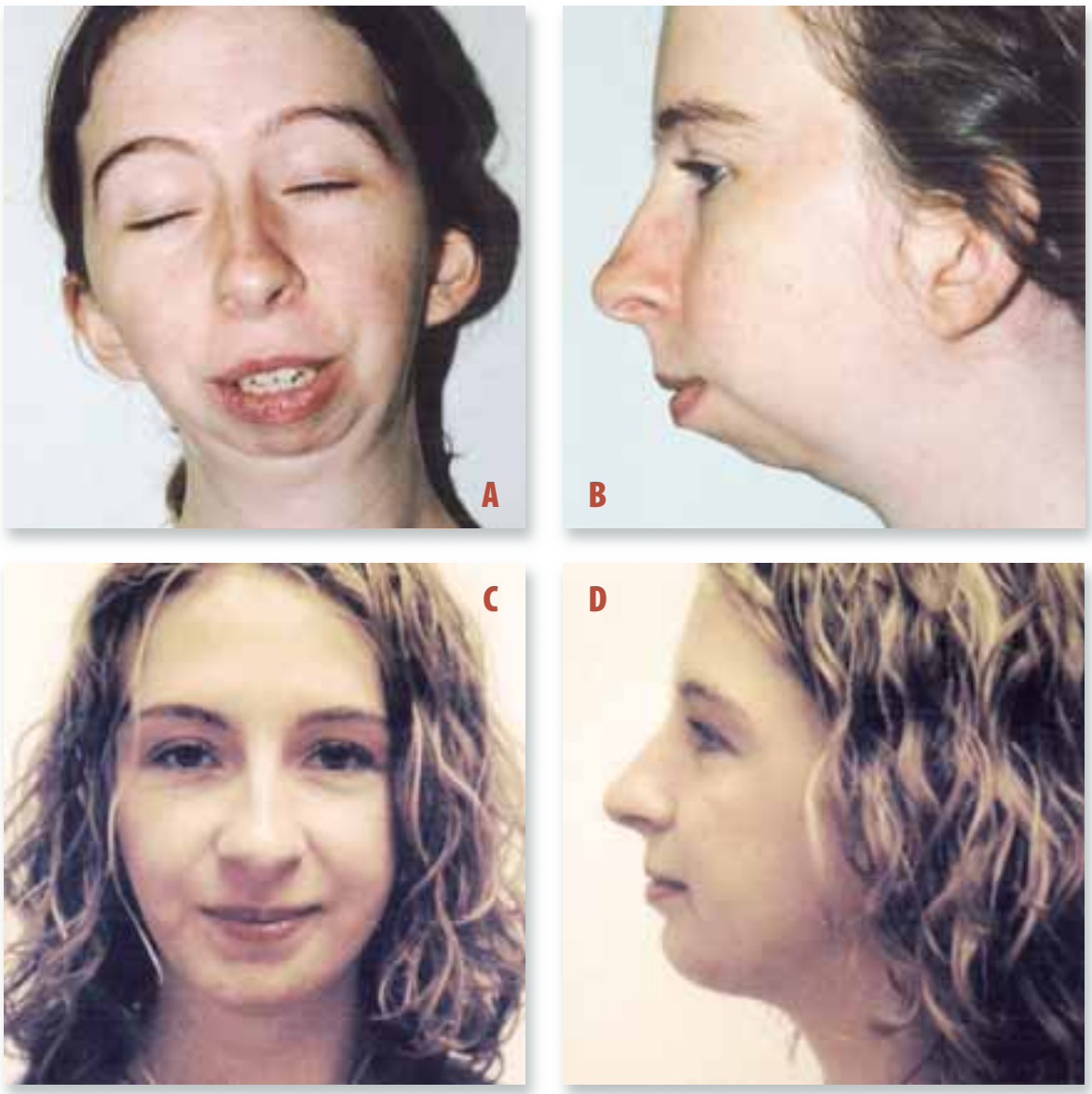


FIGURE 3 This shows a young girl with juvenile rheumatoid arthritis that had suffered severe underdevelopment of the lower jaw. Reestablishing the jaw into a more normal relationship greatly improves her aesthetics and overall appearance, keeping her face in balance and harmony.

and war-related injuries had developed. More advanced surgical techniques, dealing with facial reconstruction, were also evolving. In the early 1800s, the first attempts at skin grafting were performed to carry out coverage for amputated limbs.

In the early part of the 1900s, World War I trained a whole generation of doctors in treatment of injuries from trench warfare, such as gaping holes in skulls, shattered jaws or faces. World War II brought about continued improvement in medicine, including the use of antibiotics and more advanced management of war injuries. Also, a better understanding of anesthetic units and reconstruction brought about improved results in the correction of deformities, trauma and cancer, as well as aesthetic surgery.

By the second half of the 1900s, a greater interest in aesthetic plastic surgery arose with more advanced types of operations to deal with the bony skeleton, particularly of the face and neck area, involving the mandible, maxilla and cranium. This resulted in a better appreciation and expansion of the field of plastic surgery, causing it to continue to grow and develop.

The actual term, plastic surgery, is derived from the Greek, *plastikos,* meaning to shape, fold or mold. The term was first used in 1798 by Pierre-Joseph Desault, and then popularized by the Germans in 1838. Today, in most countries, the term plastic surgery designates the specialty within the realm of general surgery.

Present day plastic surgery deals primarily with the aesthetic appearance of the face, which is based not only on the harmonious proportions of the eyes, nose and mouth, but on their relationship to the underlying bony skeleton of the mandible, maxilla and cranium. Today's reconstructive and aesthetic surgeries run a common course and, in many ways, the two are indistinguishable. Reconstructive techniques are used not only to correct the deformity of abnormality, but also can improve the aesthetic proportion. The expectations of patients with severe deformities are similar to those requesting aesthetic procedures. Despite the limitations of surgery, patients often desire not merely to have a normal appearance, but also to be more beautiful.

Ideal results in aesthetic plastic surgery are based partly on scientific and partly on artistic solutions. Scientifically, the plastic surgeon relies on numerous standards, cephalometric tracings and measurements to achieve normal and aesthetic results. The scientific numbers, which have filled volumes of work over the years, cannot always realize a beautiful result. They serve only as guidelines. The aesthetic success of a procedure depends upon highlighting the unique proportions and characteristics of the face to reflect its individual character and beauty.

Since Greco-Roman times, artists have used rules of simple proportions or canons to describe the ideal human figure. One of the most frequently sited in medical literature is derived from the Pythagorean mathematical description of a ration of 1:1.618, often called the "golden section." This relationship constant, called Phi, which was derived by means of a ruler and a

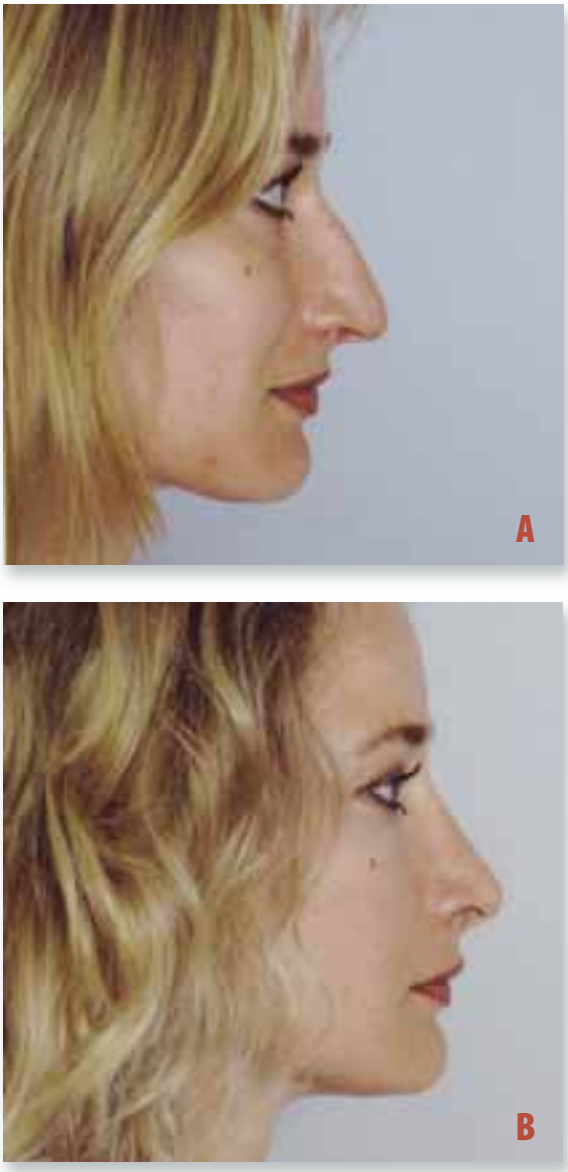


FIGURE 4 Reduction in the nose and in altering the nasal profile greatly improved the aesthetic appearance of this young woman without altering any other structures.

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AN EARLIER VIEW OF PLASTIC SURGERY

WEEKLY, MILLIONS OF PEOPLE SIT DOWN AND, FOR 60 minutes, watch their peers become physically transfigured by the talents of surgeons, dentists, trainers and stylists. America is redefining the parameters of plastic surgery and, in many instances, these procedures are becoming merely lifestyle choices.

The roots of this specialty reach back thousands of years and thousands of miles to the Asian subcontinent and Indian tradition. Ayurveda, the oldest system of medical science, was practiced in India more than 5,000 years ago and translated means "life knowledge." It is based on the tenet that all physical diseases are derived from imbalances in the body. The goal of Ayurveda was the preservation of health in the healthy and the restoration of health to the sick. Four ancient Vedas (texts) show frequent references to medicine, drugs, methods of treatment and explanations of different parts of the human anatomy. In the text, *Atharva Veda* (800 BCE), eight divisions of medicine were listed: surgery of the head and neck, ophthalmology and otorhinolaryngology, surgery, toxicology, psychiatry, pediatrics, geriatrics and gynecology.

From India, the spread of medical knowledge retreats into myth and oral tradition. Approximately 2,500 years ago, in 500 BCE, a physician named Sushruta developed the operative techniques for rhinoplasty and authored the *Sushruta Samhita,* which describes sophisticated surgical procedures.

In another text *(Charaka-Samhita),* when civilization was overwhelmed by diseases, a group of scholars gathered at the base of the Himalayas Mountains and selected one representative to study Ayurveda and return to teach others. In turn, six other pupils learned the science and each wrote a separate treatise on the knowledge. Of the original six texts, three remain; only references to the missing three prove their former existence. In 100 CE, a physician named Charaka revised and supplemented the Atreya Samhita and that version, *Charaka-Samhita,* is a major work on internal medicine.

Otoplasty and rhinoplasty are actually described in the *Sushruta Samhita.* Initially, methods that explain how to pierce an infant's ear lobe are included. After years of wearing heavy ornaments, the ear lobe will expand and ultimately split apart. Sushruta actually detailed 15 procedures for reconnecting the separate ear lobes. One procedure calls for removing a piece of

skin from the cheek, turning it back and stitching the lobules. Follow-up care included periodic dressing of the wound and healing salves.

For rhinoplasty, Sushruta recommended that the portion of the nose to be covered should be first measured with a leaf. Then a piece of skin from the cheek, appropriately sized, would be excised and turned back to cover the nose, keeping a small pedicle attached to the cheek. The nasal stump is cut with a knife; the physician places the skin on the nose and sutures the two parts. During the procedure, two tubes of eranda (caster oil plant) are inserted into the nostrils to ensure the nose's shape. Postoperatively, the skin is sprinkled with a powder made from licorice, red sandalwood and barberry. The nose is bandaged with cotton and clean sesame oil is applied frequently. Healing occurs over time, and the grafting is successful.

Besides otoplasty and rhinoplasty, Sushruta also mentions the reconstruction of the broken lip and harelip.

Although it is difficult to pinpoint exactly when plastic surgery was first performed, the surgery would have been necessitated because the loss of body parts, such as the nose, was a common injury. At one time, removal of the nose was a frequent punishment, and it was a essential to find a substitute for an absent nose.

More important than the exact method of grafting is the incontrovertible evidence that surgery, even plastic surgery, was practiced in India long before it became a science in Western civilization. However, the Greeks, during the time of Philip of Macedonia and Alexander the Great explored and conquered Asian lands, and Indian medical practices would have spread to the West, possibly back from Arab countries.

By 400 CE, Ayurvedic works were translated into Chinese. Three hundred years later Chinese scholars were studying medicine in India. Indian culture influenced not only Chinese spirituality and philosophy but greatly affected Chinese medicine and herbology through Ayurveda. In 800 CE, the works from the Ayurveda were translated into Arabic. In the next century, under the influences of physicians such as Avicenna, Islamic medicine became very influential in Europe and served as a major contributor to European medicine.

Roman legends contain some vague references to plastic surgery. Genuine records of plastic surgery are not found in Europe until the middle of the 15th century. In 1442, Branca, an Italian surgeon of Catania in Sicily, performed plastic surgeries on the nose, using the flap from the face, similar to the Indian procedure. Branca's son, Antonio, continued his work and was the first surgeon to utilize a flap from the arm for reconstructing the nose. Other Italians, the Boinia brothers, continued and their work is described in a book published by Fioravanti, a doctor in Bologna, in 1568.

Following up in Bologna, Gasparo Tagliacozzi, another scientist and professor of surgery and anatomy at the university, published *De Curtoroum Chirurgia per Insitionem (The surgery of defects by implantation)* in 1597. It was the first scientific publication on plastic surgery and described methods of reconstruction of the nose using a graft from the arm and of replacement of the ears and lips. He included numerous illustrations.

Not much happened for the next 200 years until Voltaire satirized Tagliacozzi's operation on the nose, taking the graft from the buttocks. During the Middle Ages, duels resulted in many men losing their noses and substitutes were made of gold, silver or ivory.

In India from 1769 to 1799 CE, the British waged four wars. As a result of these wars, the British learned two very important techniques from the Indians—rocketry and plastic surgery. During the wars, some Indians working for the British Army were punished by the dismemberment of their noses and right arms.

After the wars, an English commanding officer noticed a peculiar nose and scar on an Indian merchant. He learned that the merchant's nose had been cut off as a punishment for adultery, and a potter made a substitute nose. The British commanding officer sent for the potter and asked him to reconstruct the noses of his Indian employees. The operations were performed, and an illustrated account was published in the *Madras Gazzette* and later reprinted in the *Gentleman's Magazine of London* in October 1794.

This description energized a young English surgeon, Joseph Constantine Carpue, who researched more information on the Indian operation. He later successfully performed two similar operations in 1814. His results were published and a German surgeon, Carl von Graefe, performed a similar procedure on the nose using skin from the arm. Subsequently, plastic surgery was commonly performed in Europe.

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compass, is named in honor of the Greek sculptor, Phidias (493-430 BCE). (Figure 1).

When plotted, the orderly mathematical progression of these numbers forms triangles, spirals and arcs: the proportions of which are found in the natural world in seashells, flower shapes and other forms, even the spiral pattern of the human mandible. This unique progression of numbers results in a pattern of "beautiful relationships" that can be applied to the analysis and reconstruction of the human face. The height and width of the face, canthi of the eyes, alar rim of the nose, width of the mouth, height of the lips and angle of the chin are among the elements whose individual proportions and relationships contribute to aesthetic appearance (Figure 2 A-E).

Leonardo da Vinci, both artist and scientist, carefully delineated the degree of variation in "the ideal human morphological form." His work, and that of other artists, helped refine proportional canons. Although these canons were developed and used by artists, scientific need for this information exists; therefore, the study of anthropometry, the measurement of living things evolved. Anthropometry came into general use in the past century and provided a quantitative tool for describing the human body and, in particular, the human face. Indices were created to metrically describe the shape and contour and proportions of the human face in a less subjective manner (Figure 3 A-D). This allowed anatomists and anthropologists to determine average or ideals for various population races and ethnic groups (Figure 4 A-D).

Conclusion

In the 21st century, the approach to plastic surgery is actually more global—evaluating a patient's lifestyle, habits and nutrition. Techniques of anti-aging are now employed to treat the aesthetic concerns in American society. As scientists become better at identifying factors that increase aging and those that can slow down aging, greater strides will be made in actually altering the aging process. As other research groups continue to develop ways of culturing the patient's own stem cells, a greater range of possibilities will arise for replacing body parts with the same exact tissues. Exciting times are ahead for medical professionals in plastic surgery, particularly as it becomes more mainstream and available to everyone.

About the author

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