



AUTOLOGOUS FAT GRAFTING

by Nydia Morales, CST

Plastic surgery for pure cosmetic enhancement is becoming more commonplace. As the practice spreads, procedures have become more affordable, and opened the door for middle-income individuals to receive treatments that were previously reserved for the wealthy. In the process, these procedures have also become more refined.

What is it that compels people to pursue an elective surgery, such as plastic surgery? In order to answer this, one can reference Maslow's Hierarchy of Needs. Maslow's pyramid breaks down into five distinct categories: physiological needs, which are basic biological needs, including food, water and warmth; safety needs, which are environmental needs, including safe and secure surroundings; love and belonging needs, including the basic social requirements of friends and intimate relationships; prestige and esteem needs, including respect, which give people a sense of accomplishment and self-worth; and self-actualization, which is the point at which one finally recognizes and accepts his or her ultimate potential. **Please see Editor's Note.*

Self-dissatisfaction is a confrontation with one's self. It can also influence the way a person perceives that he or she is viewed by others. When a person is insecure about physical aspects of his or her body, prestige and esteem needs are negatively affected. These perceived short-comings can have a negative effect on a person's evaluation of self-worth. In some instances, surgery offers a legitimate remedy. The ultimate goal of a cosmetic surgi-

LEARNING OBJECTIVES

- ▲ Evaluate the success of autologous fat grafting
- ▲ Compare and contrast the methods of facial augmentation
- ▲ Review the preparation and procedure for autologous fat grafting
- ▲ Examine the history of plastic surgery
- ▲ Gauge the wide-spread use of plastic surgery in the United States

cal procedure is to help the patient achieve a positive evaluation of himself or herself.

The challenges vary from patient to patient. In some cases, it may take years before the patient is fully satisfied and is able to accept himself or herself. Personal appearance is affected by aging, trauma, disease and heredity. One of the most common phrases in a plastic surgeon's office is, "I don't like my..." Walking through the doors of a cosmetic surgery facility can be a hard step, but it is the first step in resolving the unhappiness that has manifested.

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There are many options with plastic surgery. Procedures can range from buttocks and breast augmentation to rhinoplasty or a facelift. The central focus of this article is autologous fat grafting, a technique that can be utilized in a variety of procedures. The method is minimally traumatic, and the fat is harvested from the patient's own abdomen or thigh. It is then injected into the area that is in need of enhancement or remodeling. For facial procedures, the most common areas include cheeks, nasolabial folds, the tip of the nose, chin and lips. The ultimate goal of the procedure is to create a natural appearance.²

While autologous fat grafting has proven to be highly successful, it is not the only option for facial augmentation. Other methods include injectable fillers, such as hyaluronic acid, collagen-based structural fillers and calcium-based microspheres, suspended in a water-based gel. These artificial fillers are used to conceal deep wrinkles, nasolabial folds, the nasojugal groove and provide enhancement for the lips. Chemical peels, including trichloroacetic acid, salicylic acid, alpha hydroxyl acid and phenol are used to resurface the skin. Finally, intradermal injections of botulinum toxin type A may be used to improve deep wrinkles, crow's feet and frown lines between the forehead and eye brows. It can also be used as a treatment to improve oily skin. All patients are strongly advised to consult their plastic surgeon regarding specific goals and needs.

Fat is a natural choice for grafting material. An early pioneer in the use of autologous fat grafting for facial remodeling in the 1970s, Tolbert Wilkinson, MD, found that the health and safety benefits of using the patient's own fat for the injection are significant. Since the donor is the patient, the immune system accepts the transplanted fat. The transplanted fat can also be removed, making the procedure reversible. The cells are fragile in the first month following the transfer, so the physician can crush and remove the graft if necessary.⁶ This option is utilized if the result of the procedure is too bulky. The lips are an example of where this result may occur.

In addition, Wilkinson was impressed by the durability of the grafts, noting that some of his patients' grafts were still working after 15 to 20 years.⁶

Fat, or adipose tissue, is a naturally-occurring substance in the human body. Fat storage results from the conversion of nutrients from dietary fats, proteins and carbohydrates acting together to create a stockpile of reserve energy. Fatty acids and glycerol are broken down in the stomach and small intestine before the lymphatic system transforms them into triglycerides, which are then stored as adipose tissue.³ Sugars from carbohydrates, such as glucose, are also converted into fatty acids and stored.⁴

Fat is typically stored on the abdomen, hips and thighs. Since it lays dormant on the body, it is an accessible entry point for easy collection. This fat is used for grafting.⁵

Some of the most common facial locations that are treated with fat grafting include the nasolabial folds, marionette grooves, lips, chin, jaw line, neck and cheeks. Patients receiving procedures in these areas are often seeking a rejuvenating effect. There are many factors that can cause the dermis and epidermis to atrophy, creating indentations in the skin. One of the more common causes is the after-effects of cortisone injections that were used to treat cystic acne lesions.¹⁰ Other causes include aging, sun exposure and smoking. Fat grafting provides the augmentation needed to fill these areas.

Proportionate distribution of the grafted fat is the key to maintaining the balance of the face. The surgeon will begin by filling in the cheeks and lower eyelids before moving on to other parts of the face. The purpose is to give the fat a chance to settle and take its placement on the face. In the neck area, subcutaneous fat is injected to fill in the creases,

or the cartilage to provide a smooth appearance. If there is a depression from the eyebrow to the supratarsal fold, the surgeon injects the fat superficial to the orbicularis oculi muscle. In this way, autologous fat grafting can be used as an alternative option to an overall face-lift procedure, or as a supplement to the face lift.⁷

How successful is the autologous fat grafting procedure? A first-of-its-kind study was recently documented on the longevity of the procedure's results. In the 2009 survey, titled, "Autologous Fat Grafting: Long-term Evidence of Its Efficacy on Midfacial Rejuvenation," 33 patients were injected with 10 ml of autologous fat to the midface region. Pre-

and postoperative three-dimensional colorimetric analysis (photographs) was used to assess volume change. Magnetic resonance imaging (MRI) was also used to record volume retention. Of the 33 participants, only eight patients needed 3 ml of touch-ups (secondary procedures).

An additional aspect of the study used ultrasonography to record the results of the fat transfer. The patients were scheduled for quarterly follow-up visits for one year following the procedure. The results of the study revealed a high rate of successful fat retention: 51 percent at three months, and 45 percent at six, nine, and 12 months. The eight patients with touch-ups had a lower percentage (29.6) of volume retention.⁸

Patients who have undergone abdominal surgery are not good candidates for autologous fat grafting due to the possibility of developing a ventral hernia.

PREOPERATIVE PROCEDURE

The surgeon reviews the procedure preoperatively, and also obtains and reviews the patient's consent form and medical history. He or she then takes preoperative photographs of the patient, which will be used to illustrate the postoperative difference. The surgical technologist remains in the O.R. at all times, and the patient's vital signs are constantly monitored. For this type of outpatient procedure, there is no circulating nurse or anesthesiologist present. Before the procedure begins, the surgical technologist confirms that the consent form has been signed and countersigns it, reviews the medical entry and takes and records vitals, including blood pressure and pulse oximeter readings. Close attention is given to any irregularities, such as cardiac dysrhythmia, or anything that could indicate a potential medical risk.

ANESTHESIA

The choice of anesthetic varies depending on numerous factors, including the patient's overall health, current medications, consideration of the surgeon and patient preference, and the number and length of time of the procedures that are being performed. Based on these variables, a facial procedure can be performed under general anesthesia, an IV with sedation, or local anesthesia. Most cases are treated with a local anesthetic.



This patient did not like how her nasolabial folds (cheek wrinkles) made her look older and tired. She was also concerned that her skin wasn't "smooth" and had lots of oil. Autologous fat injections were performed to help improve the deep wrinkles and a salicylic acid peel was done to effectively smoothen her skin and reduce the oil. Fillers would not have been as effective given her anatomy.

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The local anesthetic of choice is a tumescent solution, consisting of 400 ml of normal saline, 90 ml of one percent lidocaine without epinephrine, 10 ml of 8.4 percent sodium bicarbonate and 1 ml of epinephrine (1:1000).

If the patient is nervous prior to the procedure, the surgeon may choose to administer 5-10 mg of diazepam, sublingual, to treat the anxiety. Post-operatively, acetaminophen is often sufficient to manage the pain. In some instances, however, a narcotic pain reliever is prescribed.

In addition, the patient will be prescribed a postoperative antibiotic to prevent bacterial infection. Three of the primary medications are azithromycin; cephalexin, which is used for patients who have certain heart problems in order to prevent coronary infection, such as bacterial endocarditis; and clindamycin, which is used for patients who have an allergic reaction to penicillin.

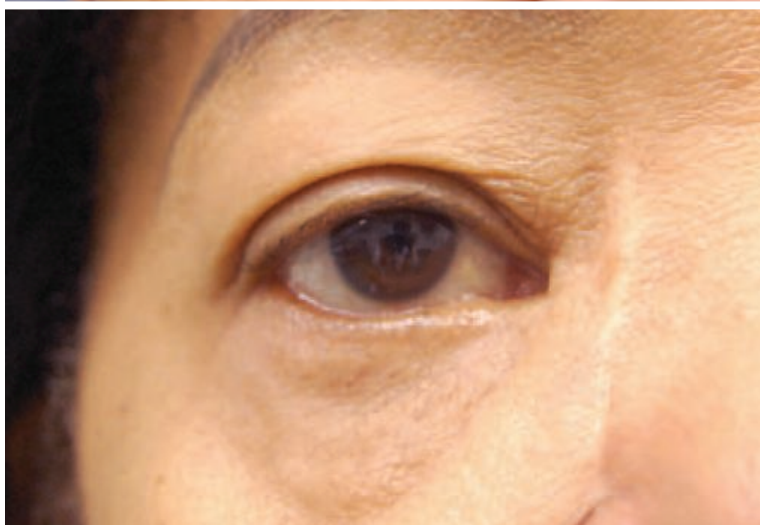
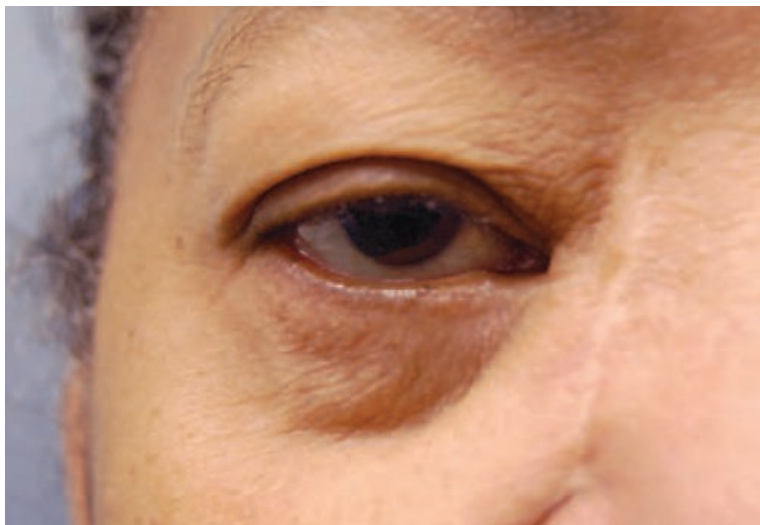
INSTRUMENTATION AND SUPPLIES

Supplies for Fat Grafting Procedure
Small, medium and large blunt cannulas (3 mm)
10-15 syringes (10 ml)
30-gauge needles
4 x 4
Sterile gloves
Bouffant / cap
Wash basin
Long, cotton-tipped applicator
Drapes: suitable for operative sites
Suture and dressing – surgeon's preference
Marking Pen
Electrosurgical pencil with needle-tip electrode (kept on the side, should it be needed)

FAT GRAFT DONOR SITES

The lower umbilical region is an easy-access donor site, and is widely used. Other donor sites include:

- ▲ Inner thigh: In the frog-leg position with the knee flexed and externally rotated (flat on table). The puncture is made on the skin fold along the inguinal line.
- ▲ Anterior thigh: With the patient in the supine position and both legs straight, a puncture is made along the inguinal line.



This patient had undergone extensive surgery for removal of a cranio-facial tumor. Once she had successfully been treated for her tumor, autologous fat injections were used to fill in the deep groove under her eye that was due to tissue and bone removal during her cranio-facial surgery. The fat injections provided her with a natural and long lasting improvement in the cosmetic appearance and functional support of her lower eyelid. This same technique can be easily used for aesthetic purposes in patients with deep grooves under their eyes.

- ▲ Outer thigh and buttock: The patient is placed in the lateral decubitus position, and a puncture is made on the fold of the buttock.
- ▲ Waist roll: Also using the lateral decubitus position, a puncture is made on the inferiolateral extend of the fat pad.
- ▲ Hip: Similar to the waist, the patient is placed in the lateral decubitus position, but the puncture is made in the posterior of the fat pad.
- ▲ Triceps: The patient is placed in the lateral decubitus position, and a puncture is made at the postlateral extend of the axillary fold.⁹

Some of the most common facial locations that are treated with fat grafting include the nasolabial folds, marionette grooves, lips, chin, jaw line, neck and cheeks.

OPERATIVE PROCEDURE

The patient is seated in the reverse Trendelenburg position. The patient's face, as well as the puncture area of the donor site, are cleansed with alcohol wipes. The face is also cleansed with surgi-scrub. Sterile drapes are placed on the thoracic and epigastrium region, as well as on the lower portion of the hypogastrum region.

Once the area has been prepped, the surgeon outlines the planned surgical paths with a sterile marking pen (on both the abdomen and face). He or she then administers the local anesthetic. When the anesthetic has taken effect, the first step in the procedure is to harvest the fat that will be transplanted in the graft. A 30-gauge needle is used to make the entry point for the blunt cannula that is attached to a syringe. In a thrusting, lateral-to-lateral movement, the fat is aspirated from the donor site, while the surgical technologist applies fingertip pressure to the site.

Once the physical harvesting of the fat is complete, the syringes are placed in a centrifuge (to be operated by the surgeon) to remove excess water and impurities. The process takes a few minutes, and at its completion, approximately $\frac{3}{4}$ of the contents of each syringe is useable fat. The fat ranges in color from hues of orange to yellow. The closer the color is to orange, the greater the actual fat content. The surgeon applies a 5-0 nylon suture to the donor site, while the surgical technologist applies an antibiotic ointment to a long, cotton-tipped applicator. The surgical technologist then applies the antibiotic ointment to the wound, which is covered with a 4x4 dressing, followed by a cold compress.

The surgeon then injects the fat graft in the specified areas that have been clearly marked. He or she makes approximately three subcutaneous tunnels in each graft site, injecting the fat as the needle is slowly withdrawn. The surgical technologist then cleanses the area and applies 4x4

dressings. A cold compress is applied in 20-second intervals, alternating sides on the affected region of the face, if the procedure is symmetrical. The chair is then raised to a seated position, and vitals are taken again and recorded. Prescriptions for antibiotics (mandatory) and prescription pain relievers (if needed), or over-the-counter extra strength acetaminophen are noted by the surgeon. Written postoperative instructions are given to the patient, and a follow-up appointment is scheduled for one week.



This patient did not like how her deep smile lines (nasolabial folds) made her face look older and tired. She wanted long lasting results and was not keen on using any artificial materials in her face. Therefore, autologous fat injections were easily done to provide her with a natural and refreshing look to her face. In addition, a slight and subtle elevation was accomplished to her cheek area resulting in a more youthful contour to her face.

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POSTOPERATIVE CARE

The patient is instructed to maintain ice packs on the recipient area for 48-72 hours post surgery. For a facial procedure, the head must be elevated while sleeping to minimize edema. Sleeping with two pillows is generally sufficient. Strenuous exercise is not allowed, although short walks are acceptable. The patient is also placed on a diet that restricts salt intake in order to reduce facial swelling. In some cases, swelling in the recipient area can last up to six months.

POSTOPERATIVE COMPLICATIONS AND FOLLOW-UP

Postoperative complications for plastic surgery, including autologous fat grafting procedures, include infection, bleeding and hematoma. Bruising, swelling, and mild discomfort are also common, although not normally considered serious.

After the procedure, follow-up visits are scheduled for one week, two weeks, and one month. At that time, postoperative photos are taken. The surgeon retains extra vials of the patient's fat, and refrigerates them should touch-ups be needed in the future.

**Editor's Note: An in-depth look at Maslow's Hierarchy of Needs is available in the August 2009 issue of The Surgical Technologist.*

ABOUT THE AUTHOR

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From the Author

The patients I have encountered are very representative of Maslow's definition of prestige and self-esteem needs. What I have come to understand is that a personal dissatisfaction with a particular element of one's body does not necessarily indicate a sense of vanity. Being unhappy affects the total body and mind, which can be concealed to a certain degree. The serious-minded patient usually takes a year before finally confronting themselves to actually start to change that personal perception. Once the process gets started, and especially after seeing the finished result, the happiness sets in. I

have heard numerous patients acknowledge, "I should have done this a year ago!"

One of the best parts of my job occurs when the surgeon hands the mirror to the patient after a procedure. The expression of relief is evident, and the dissatisfaction that entered the office dissolves as the patient walks out the door. Being a part of helping a person boost his or her self-esteem is both fulfilling and gratifying.

This article is dedicated to my mom, Maria C Morales. Through life's difficulties she gave me the strength to focus and finalize this writing. May she rest in peace. June 14, 2009.

Plastic Surgery: A Timeline

by Tom Borak

The practice of plastic surgery is much older than one might expect. It is believed that nose reconstructions were performed in ancient India as early as 2,000 BCE, when amputation of the nose was an accepted form of punishment.¹ Surgical procedures are noted in Sanskrit texts, including *Sushruta-samhita*, which was written in approximately 600 BCE. It describes the reconstruction of the mutilated nose, using tissue from the cheek.⁴ However, most of the modern procedures that are used today date back to the 1880s and 1890s.²

Aesthetic, or cosmetic surgery became very popular in the 16th century, during the Renaissance. This resurgence in interest paralleled the syphilis epidemic of the time. Syphilis is a sexually-transmitted disease caused by the bacterium *Treponema pallidum*.³ Advanced cases of syphilis can cause disfigurement and even death. The primary role of aesthetic surgery at the time was to rebuild the noses of syphilitics, so they could become less visible in society.²

It was during this time that Italian surgeon Gasparo Tagliacozzi and French surgeon Ambroise Paré

began experimenting with the early Indian ideas, sparking a renewed interest in the use of local and distant tissue to reconstruct complex wounds, giving rise to the modern concept of plastic surgery.⁴

Pierre Joseph Desault, a French anatomist and surgeon, coined the



JOHANN FRIEDRICH DIEFFENBACH

term “plastic surgery” in 1798.² Derived from the Greek word *plastikos*, which means “fit for molding,” plastic surgery eventually became the dominant label for all featural and reconstructive surgery in the early 19th century.² The catalyst that sparked the widespread use of the term was the 1818 publication of *Rhinoplastik*, a monograph on the recon-

struction of the nose by Karl Ferdinand von Gräefe. A superintendent of German military hospitals during the Napoleonic Wars (1800–15), and professor of surgery and director of the surgical clinic at the University of Berlin (1810–40),⁵ Gräefe’s work revived Tagliacozzi’s “Italian Method,” which used a graft from the upper arm, rather than the forehead.

Prior to this publication, and in the immediate aftermath, plastic surgery was generally understood to be surgery on the nose. However, after publication, there was a surge in the number of “plasties,” as new procedures were all tagged with the suffix. In an attempt to curtail the number of uniquely-named procedures, Eduard Zeis, who is credited with

authoring the first textbook on plastic surgery, disavowed the continuous labeling of specific procedures after the model of “rhinoplasty” He adopted Desault’s term, plastic surgery, to encompass *all* reconstructive procedures to the face and body.²

Despite the surgical innovations and writings of these pioneers in plastic surgery, Johann Friedrich Dieffenbach (1792–1847) is widely

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cited as the “father of plastic surgery.”² It was Dieffenbach who used the term “beauty surgery” (today referred to as cosmetic surgery) to differentiate purely aesthetic procedures from “real” reconstructive surgery, which led the movement toward a definitive distinction between the two.²

Significant growth and innovation in the field took place during and following the first World War, as the need for reconstructions ballooned. Burn and blast victims, along with those who suffered other disfiguring injuries in the line of battle, presented new challenges to surgeons in the emerging field of reconstructive surgery.

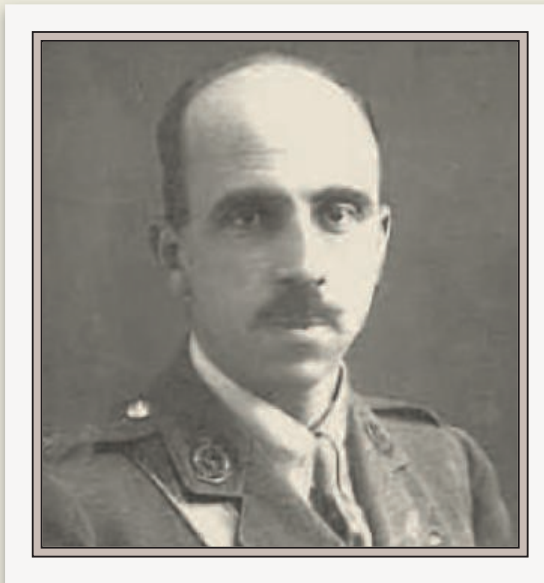
One of the premier surgeons during this time was Sir Harold Delf Gillies, a New Zealander who is famous for his innovative work in the practice of skin grafting and facial reconstructions from gunshot, blast and burn wounds during World War I.⁶ Nearly 100 years after Dieffenbach’s contributions revolutionized the field, Gillies is credited as being the “father of modern plastic surgery” for his innovative methods. In a groundbreaking procedure, Gillies reconstructed the

face of Walter Yeo, a British sailor, who sustained massive facial burns, as well as the loss of his upper and lower eye lids during the Battle of Jutland in 1916. The relative success of this surgery, and the growing need for similar operations prompted the opening of a new hospital devoted exclusively

qualified and very-well advertised surgeons, who adopted the term, plastic surgery, without any true training in surgery and without any other surgical ability than to remove a few folds of skin or a small hump of the nose.”² Because of this, “beauty” surgeons were often deemed quacks by their peers.

While the term quack may not be as prevalent today as it once was, the practice of plastic surgery continues to exist in shades of gray. For example, any physician, whether acknowledged as a specialist by his peers or not, can undertake aesthetic surgery.² More and more non-board certified physicians perform aesthetic procedures every day, including dentists performing hair transplants.²

As physicians’ ability to eliminate pain and reduce the risk of infection grew, the practice of plastic surgery blossomed. The oldest association for aesthetic surgery in the United States is the American Association of Oral Surgeons, which was founded in 1921. It became the American Association of Plastic Surgeons in 1942, and today is known as the American Society of Plastic and Reconstructive



SIR HAROLD DELF GILLIES

to facial repairs. (Gillies is also credited with pioneering sex reassignment surgery in the mid-1940s.)⁶

As the practice expanded, a rift grew between reconstructive surgeons, who saw aesthetic surgery as an incidental part of their practice,² and cosmetic surgeons, who were accused by the establishment, including Gillies himself, of being, “poorly

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WALTER YEO

Surgeons, comprising 97 percent of all plastic surgeons certified by the American Board of Plastic Surgery. The board itself was organized in 1937, and admitted to the American Board of Surgery in 1938.

Plastic surgery is a rapidly-growing practice in the United States. In 1981, there were 296,000 reported procedures performed. By 1984, that number had grown to 477,700.² In 1996, the American Academy of Facial Plastic and Reconstructive Surgery developed a survey, which revealed that 825,000 plastic and reconstructive procedures had been performed on the face alone in 1995, a nine percent increase from 1993. According to the survey, 65 percent of the procedures performed in 1994 were done on people with a family income of less

than \$50,000 per year, indicating that financial factors are not a significant deterrent in the decision to aesthetically change one's body.

In 1997, the total number of all surgical and nonsurgical cosmetic procedures performed in the United States totaled 2,099,173. By 2007, that number had morphed to 11,701,031. These numbers represent a 162 percent increase in the total number of cosmetic procedures. Surgical procedures increased by nearly 80 percent, while nonsurgical procedures increased by more than 233 percent. Nearly 92 percent of all procedures were performed on women. In total, Americans spent nearly \$12 billion dollars on cosmetic procedures in 2008.⁷

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