

Facial Paralysis and Reanimation
“Smile Surgery”
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Introduction:

Facial paralysis can result from a variety of causes, and it can affect people at nearly any age. Some are born without facial movement (on one side or both). Some may lose the ability, either spontaneously (as in Bell’s Palsy), or as a result of surgery or injury. Regardless of the cause, patients share in common a lack of function of a particular nerve, the facial nerve.

The facial nerve provides several functions. It influences taste and hearing, but its most noteworthy function is its control over the muscles of facial expression. We have a facial nerve on each side of the face. They are separate, and in most cases, paralysis only effects one side. In some cases, it may effect both sides. On right and left sides, the facial nerve comes out in front of the ear, deep to the surface. Each facial nerve has five main branches. These branches fan out to the regions of the face. Each one controls specific movements, and patients with facial paralysis can experience loss of movement in some or all of the branch areas. The upper branches control the movement of the eyebrow and the muscles of the eyelids. The eyelid muscles are particularly important because they allow us to blink and to close our eyes fully. The loss of this function can lead to dryness and the possibility of injury to the cornea. The lower branches provide movement to the lips and the corner of the mouth. These are the branches that allow us to smile. Loss of function impairs our ability to smile, and can cause problems with drooling.

The ability to smile is underappreciated until it is taken away. So many of our social interactions depend on our ability to express our emotions through facial gestures. Even the simple return of a pleasant smile to someone passing us by creates a brief social connection. When we cannot return a gesture or express ourselves effectively, it can lead to others misinterpreting our mood, intelligence, or intentions. For those with unilateral (one side) facial paralysis, expressions are asymmetric. Many studies have discussed the importance of symmetry in the perception of beauty. No one is perfectly symmetric – that much is true. But when the amount of asymmetry reaches a certain point where others perceive it strongly, the problem can have devastating effects on self-esteem and our social interactions. The goal of surgery is not necessarily to make someone perfectly symmetric; it technically may not be possible. But, if our expressions can be controlled to a point which more closely approaches what is considered normal, the effects can be life-changing.

Surgery for facial reanimation is one of the most challenging technical procedures to perform. Few centers in the country offer programs designed to treat this problem. The positive impact that these procedures can have on quality of life are as profound as the satisfaction that it gives those who can provide it.

The Duke Facial Paralysis Program

In 2002, the Duke Facial Paralysis Program was initiated by Dr. Jeffrey R. Marcus and Dr. Michael Zenn, of the Division of Plastic Surgery at Duke University. Dr. Marcus, trained in Pediatric Plastic Surgery and Craniofacial Surgery at the Hospital for Sick Children in Toronto Ontario, brought the teaching and organization of the renowned Toronto "Smile Surgery" program to North Carolina. Dr. Zenn, a nationally recognized Duke plastic surgeon with extensive experience in microsurgery also spent time at the Toronto program learning the technical aspects of this challenging field. Together, they began seeing patients with facial paralysis of all ages to help restore (or create anew) the ability to smile. They quickly recognized the importance of proper rehabilitation and therapy to delivering the best results, and enlisted the help of Lisa Massa, a specialist in physical therapy with experience helping patients affected by Bell's Palsy and other forms of facial paralysis. Ms Massa continued her own training by visiting other centers involved in the treatment of facial paralysis as the team structured an organized program for patients at Duke.

Today, the Duke Facial Paralysis program sees patients from throughout the State of North Carolina, from regional and distant states, from other countries. The program has been designed to accommodate the needs of patients travelling from near and far. Not all patients have the same needs, and not all patients are candidates for the same procedures. "Smile Surgery" refers to a particular type of facial reanimation which is best suited to patients with total or near-total loss of the ability to smile. Patients who are interested in finding out whether they may be candidates for this procedure may find more information by following the "Smile Surgery" link.

“Smile Surgery”

Surgeons have attempted to help patients with facial paralysis for more than 50 years. Over this time many techniques have been developed, some which are still in routine use today. The most important advances, however, have been made in the last 10-15 years, with continuing improvement still ongoing. “Smile Surgery” is a form of surgery that aims to improve one particular aspect of facial paralysis – the ability to smile. It does not address problems with eye closure or the ability to move the eyebrows. For these movements, there are other procedures with long track records for benefit.

“Smile Surgery” most often consists of two separate surgical procedures, generally separated by a period of 6-12 months. To understand how these procedures help, it is useful to consider first the patient with one-sided facial paralysis. In this situation the facial nerve on one side does not function. For those born with the condition, the muscles of expression do not develop. The facial nerve conducts electrical currents from the brain. The nerve is attached to a muscle, which performs the action. If we think of the situation simplistically, there are then two problems – an lack of electrical “wiring”, and an lack of a muscle that is able to perform. For patients who at one time had a working facial nerve, but who have lost it, the situation is similar. In this situation, the muscles were once present. However, if enough time has elapsed, the muscles lose their ability to respond even if they are provided with a stimulus. In either case, we need to restore two things: the nerve supply and the muscle to act. These are the two stages in “smile surgery”.

In the first stage, we bring nerve supply to the paralyzed side of the face. It is not possible to reconnect to the brain, so another source is needed. We recognize that the facial nerve on the opposite side of the face functions normally. Knowing the intricate anatomy of the facial nerve, we can select the specific branches of the facial nerve on the normal side which are providing a smile. Fortunately, there is not just one branch, but several, so that we can connect a length of nerve graft from a branch and extend it across the face (beneath the skin) to the paralyzed side. A graft of nerve can be taken from the back of the calf through a series of three small incisions which generally leave minimal scars. The nerve (called the “sural nerve”) provides a small area of sensation to the side of the foot, which is the only major loss of its removal. The surgery is done in the first stage on the normal side, through an incision that is very similar to what is commonly used in facelifts. Therefore, the scars are generally very well concealed and tolerated. A small tunnel beneath the skin is created to place the far end of the nerve on the paralyzed side after the near end is attached to the working facial nerve on the normal side.

The graft of nerve is like an empty tube once it has been removed from the calf. The new nerve fibers from the normal side must grow through the graft to reach the far end. This has to happen before the second stage where a muscle is transferred to the paralyzed side. If the muscle is transferred before the nerve has grown through the graft, then it will mean a longer time before the muscle can receive stimulation. This would potentially harm the muscles ability to move properly. This explains why the two procedures are separated by at least 6 months. By the time of the second procedure, the far end of the nerve is a “live wire” ready to be connected to the new muscle

In the second stage, a muscle of moved to the paralyzed side of the face, using a similar incision as in the first stage. In the human body, muscles are fed by an artery that

pumps in blood and by a vein that allows the blood to flow back out. The muscle that is chosen is removed with its artery and its vein, as well as its nerve that will be connected to our nerve graft. The artery and vein are connected to vessels in the face so that blood flow continues to supply the muscle. The muscle used is called the “gracilis muscle”. It is a muscle on the inner part of the thigh, that can be removed through a single incision of about 12cm in length. The gracilis is only one of several muscles that all act to bring together (“adduct”) the legs, so that there is little to no loss with its use.

The most technically sophisticated parts of “smile surgery” involve the selection of the nerve on the normal side in the first stage and the connection of the blood vessels and nerve at the second stage. All of these parts of the procedure are done under a microscope. In the Duke program, Dr Zenn and Dr Marcus work together during these procedures to keep the time in the operating room as short as possible. Still, although the procedures are done just beneath the skin, they require between 5 – 7 hours. After surgery, it is very important to monitor the status of the muscle. The Duke team uses a tiny implantable monitor wire that allows them to listen to the flow of blood going into and out of the muscle. The monitor wire is easily removed after the first 48-72 hours, when it is evident that all is well. In the rare event that the monitor suggests a problem at any time, the team can return to the operating room to have a second look and correct any problems.

Mobius Syndrome and Bilateral Facial Paralysis

When both sides of the face are paralyzed, the surgical procedure is altered. Each side must be corrected, and the surgical procedure for each side may be done in one stage per side. Therefore, there are still two procedures total. The procedure for each side is similar to the second stage as noted above. However, because there is no normal facial nerve to use on either side, a different nerve must be selected. One of the most exciting developments in facial reanimation in the past several years has been the use of the Masseter nerve for bilateral cases. The masseter nerve is present on both sides and is generally not affected by paralysis. It is located at just the right position for attachment of the gracilis muscle nerve, therefore, it may be done in only one stage. The masseter nerve is normally used to help chew, so it requires some additional training for patients to learn to smile naturally after the surgery. If not for this fact, it would be the first choice for all patients having “Smile Surgery”. In our program, this single stage approach is sometimes the preferred approach for adult patients with one-sided facial paralysis.

Frequently asked questions

How soon do you see function?

On average, we begin to see some movement after 5-6 months from the second stage. This varies from patient to patient and has some relationship to age. Full maximized movement may be seen by one year from the surgery.

Is there anything we can do to help the process?

Therapy and exercise are very helpful, but only once we begin to see some initial movement. At this time, guidance by the facial rehabilitation specialist, Lisa Massa, will give you the information to train movement at home. Biofeedback techniques are most commonly used. Frequent visits are not necessary, but a periodic check will allow our team and you to monitor the progress. Progress is based on the amount of change that is seen from an initial baseline evaluation.

How long is each procedure? How long is each hospital stay?

The first procedure takes about 4-5 hours and requires an overnight stay in the hospital. The second procedure takes about 5-7 hours and requires 3-4 nights stay.

We live outside of North Carolina. How do we arrange these visits?

We are able to coordinate surgeries for out of state patients through our RN coordinator Susan Anderson. Please follow the "out of town patient" link.

How do I know if I am a candidate for "smile surgery"?

Patients who are candidates generally have little to no smile movement. Patients who have incomplete paralysis may still be candidates for other types of treatment. Although we cannot give medical consultation or advice over the internet, we can provide an initial screening to help you determine if you would benefit from a visit for consultation. We would require a brief statement of the problem and a summary of the medical history including:

1. Cause of the paralysis
2. Duration of the condition (ie when did the condition begin)
3. Prior surgical procedures and their dates
4. Any prior non-surgical therapy
5. Results of any past testing, such as EMG

Additionally, a series of photographs and if possible, a brief digital or VHS video demonstrating the following movements:

1. Rest
2. Eyebrow elevation
3. Eye closure
4. Tight eye closure
5. Natural smile (no teeth showing)
6. Big smile (with teeth showing)
7. Pucker