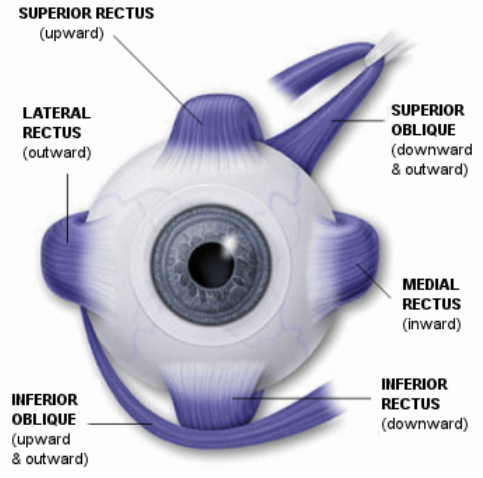
EYE MUSCLE SURGERY
(Strabismus Surgery)

It is often necessary to undergo an operation to correct a misalignment of the eyes. The goals of surgery are twofold. The first is to change the present ocular alignment in such a way to enable the brain to use both eyes together, hopefully reestablishing binocular function. The second is to improve the appearance so that the eyes look straight and move together. The chances for achieving these goals are influenced by the degree and severity of the strabismus, the age of onset, types of previous treatment, quality of binocular function (depth perception), and the compliance with pre and post-operative therapy.

The results of strabismus surgery are not always perfect because human tissue varies from individual to individual. Therefore, **it may take more than one operation to achieve the goals of straight eyes**. The success rate varies anywhere from 50 to 90%, depending on the type of operation and condition of the eyes. In complicated eye muscle abnormalities, the surgery may be performed in steps or stages, with the first operation designed to only correct part of the problem. A second or even third operation may be necessary to deal with any residual misalignment or to correct another aspect of the problem. In some instances, the correction of one problem will uncover a second problem that was not apparent before the surgery.

The purpose of this discussion is to acquaint you with the facts about **strabismus surgery** so that expectations of what can be achieved are realistic. With vigorous and complete treatment, the results are usually extremely gratifying.

ANATOMY



Eye muscle surgery involves either weakening or strengthening the muscles that control eye movement. There are 6 eye muscles that control the movement of each eyes. Four of these muscles are called **rectus muscles** and their functions are straightforward. The superior rectus muscle attaches to the top of the eye and pulls the eye up. The inferior rectus muscle attaches to the bottom of the eye and pulls the eye down. The medial rectus muscle attaches to the side of the eye, closest to the nose and pulls the eye in. The lateral rectus muscle attaches to the outside of the eye closest to the ear and pulls the eye out.

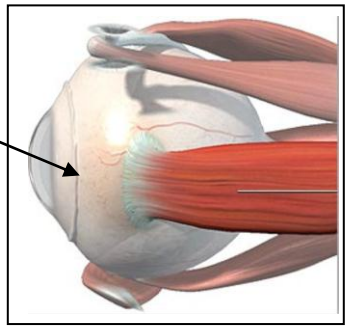
Two additional muscles have very complicated eye movement functions and these are called the **oblique muscles**. The superior oblique muscle attaches to the top back part of the eye and runs through a pulley at the top part of the nose. This muscle pulls the eye downward when the eye is looking toward the nose. The inferior oblique muscle attaches to the bottom back part of the eye and pulls the eye up when looking toward the nose. These muscles are called the oblique muscles because they attach "obliquely" to the eye when the eye is looking in the straight-ahead position.

The two eyes are coordinated by a central area in the brain and move together in a way that is analogous to the front wheels of an automobile. You normally can't move the left front wheel independently of the right, and likewise, you can't move your left eye independently of the right eye. If one of your car wheels is bent inward, you can make it straight by turning the steering wheel. However, the previously straight wheel will now be inturned. The same concept of movement applies to the eyes. Thus, while it may appear that it's the right or left eye that's misaligned, it is really a problem between the 2 eyes. Therefore, you can correct eye muscle and alignment problems by operating on either eye or, more commonly, on both eyes.

SURGICAL PROCEDURES

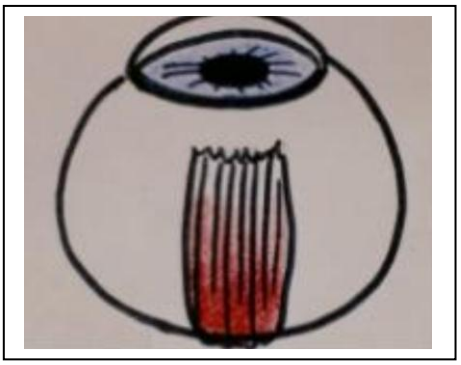
Strabismus surgery consists of 2 general types of operations. One is a weakening procedure of the muscle which is called a **recession**, and the other is a strengthening procedure which is called a **resection**. The technique for doing these operations is as follows:

To expose the eye muscle, an incision is made in the conjunctiva, which is a thin, whitish skin over the surface of the eyeball. The conjunctiva is that tissue which becomes red and blood shot when the eyes get irritated. The eye muscles are located underneath this conjunctival tissue. Therefore, incisions through the skin of the face or the eyelids are not necessary to reach the eye muscles.

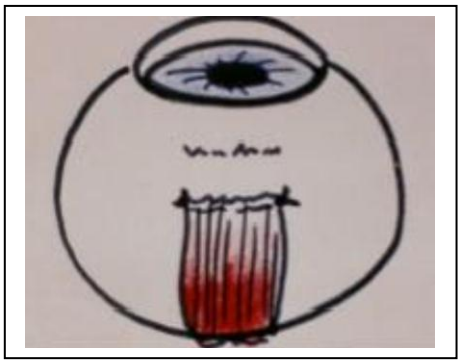


A common misconception is that the eye is removed from its bony cradle called the orbit and placed on the face during the operation. This is completely untrue. There are far too many attachments and tissue holding the eye in place to remove it from the socket, and there is no need to do this to access the eye muscles. The muscles are located approximately ¼ of an inch from where the clear dome of the eye (called the cornea), meets the white tissue of the eye (called the conjunctiva). Therefore, it is not difficult to get to the eye muscles.

If a recession is planned for a particular muscle, a suture is placed in the tendinous portion of the muscle and the muscle is removed from its attachment to the eye. It is then recessed or moved backward ¼ to ½ an inch and reattached to the eye. This movement from its original position to a position further back on the eye effectively relaxes the pull of the muscle and allows the eye to come into a straighter position.



BEFORE SURGERY

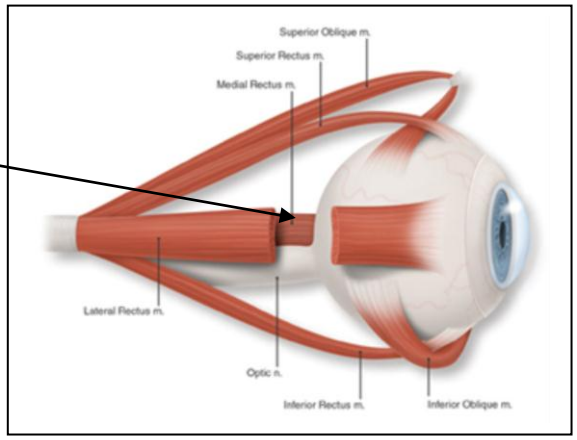


AFTER SURGERY (muscle recession)

After the muscle is sewn back to the eye, the conjunctiva is repositioned to its original place with stitches that are later absorbed. There are no stitches that have to be removed at a later date.

In a resection or strengthening procedure, a ¼ to ½ inch piece of muscle is removed and the muscle is reattached at its original location.

muscle resection



The amount that the muscles are moved is determined prior to the surgery. The technique takes a great deal of skill to move the muscles correctly and is best performed by someone with extensive experience. The time estimate for the surgery varies but usually runs around 20 minutes per muscle. This is actual

operating time; it does not include the time necessary to put the patient to sleep or wake him/her up.

The following are examples of patients who required eye muscle surgery.

Patient 1: Mary is a 3 year old girl who was noted to have an inward turning of the left eye at age one year. It is now apparent to everybody that she has an esotropia (an inward deviation of the eyes). It was decided that Mary needs an operation to correct her eye muscle problem.

BEFORE SURGERY

The operation can be done in one of several ways. Remember, while it appears that the left eye is the problem, it is really a misalignment of the two eyes together. The fact that we see the left eye turn inward means that Mary is looking at us with her right eye most of the time.

If we cover up her right eye, she will bring her left eye from its inturned position to a straight ahead position, to look at us. Now, under the cover, the right eye will be inturned. We can operate on the left eye, or the right eye, or both eyes. One of three operations will be recommended. The first would be an operation solely on the left eye. This would involve weakening the left medial rectus (the inside muscle which is pulling the eye in) and strengthening the left lateral rectus (the outside muscle which is not pulling hard enough) to keep the eye in a straight-ahead position.

Secondly, a similar operation could be performed on the right eye. That procedure would involve weakening the right medial rectus and strengthening the right lateral rectus muscle to rebalance the alignment between the two eyes. A third operation, the one most commonly used for this particular problem, is to weaken the medial rectus muscle on each eye.

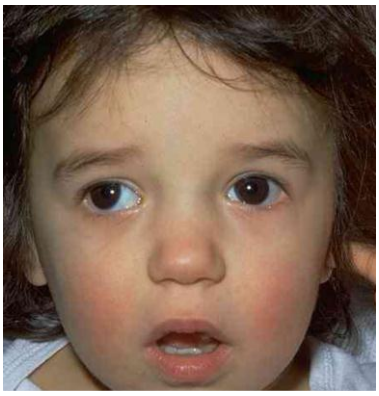
AFTER SURGERY

Patient 2: Sarah is a 3 year old girl noted to have the right eye drifting out. This initially began only occasionally, but now the eye is spending more and more time in the outward position. Because of this, it has been decided that a surgical procedure is necessary to help control this situation.

Because Sarah has an exotropia (eyes which deviate outward), she will need an operation to pull the eyes inward. This could be accomplished by one of three operations.

The first would be a recession or weakening of the right lateral rectus muscle (this is the outside muscle of the right eye which pulls the eye out), combined with a resection of the right medial rectus (to strengthen the inside muscle to help pull the eye in). The same operation could be done on the left eye. A third operation, and the most common, is a weakening or recession of both lateral rectus muscles.

BEFORE SURGERY



AFTER SURGERY

There are many additional types of eye muscle surgeries. All of them are quite complicated and a discussion of them here would be unnecessarily confusing. The principles, however, are the same. We basically weaken or strengthen muscles, depending on the particular problem, in order to get the eyes into the ideal position.

ANESTHESIA

One of the risks of strabismus surgery is undergoing anesthesia. Luckily, with today's techniques and equipment, this risk is extremely small. It has been said that it is safer in the operating room having a strabismus operation than it is riding in a car on a four-lane highway. To minimize problems, every effort is made to ensure that the patient is in the best physical condition before she/he undergoes anesthesia.

Prior to surgery, you may be asked to obtain certain blood work, tests and x-rays, as deemed necessary. The anesthetic concerns for strabismus surgery are different than most other types of surgery. Most of the patients are healthy, the operation is usually very short, and major organ systems are not involved. This

keeps the anesthetic problems encountered to a minimum. Because of this, the surgery will most likely be done as an outpatient (meaning the patient goes home the same day). This reflects the relative safety and ease of recovery from general anesthesia used for eye surgery. Patients who have more complicated medical problems and need to undergo strabismus surgery may require that the surgery is done in a hospital and they are kept overnight.

Since eye surgery is “elective”, any condition that would increase the risk of complications from anesthesia must be eliminated prior to surgery.

This is especially important in children. Conditions such as ear ache, pneumonia, flu-like symptoms, gastrointestinal problems, etc., will result in postponement of the surgery until they have been treated. It is far safer to postpone the surgery than to operate on a child or an adult who is sick from an illness.

The anesthesiologist will talk to you prior to the surgery and it is important that you discuss with him/her any questions that you may have regarding the anesthesia.

COMPLICATIONS

During surgery, every effort is made to reduce the likelihood of problems. However, during the course of any surgical procedure, problems can arise. It is the surgeon’s responsilbility to minimize these problems in the operating room.

After the surgery, it becomes the patient’s responsibility to carefully follow instructions and treatment prescribed. The most frequently encountered complications are as followed:

1. Overcorrection / Undercorrection

   This is not really a complication but we will restate it here so that there is no misunderstanding. We might overcorrect or under correct a misalignment of the eyes that we are trying to repair. An overcorrection would be to make an eye that was originally turning inward, turn outward. An undercorrection would be an improvement in the alignment of the eyes but the eyes are still turned inward. This failure to achieve optimal alignment occurs anywhere from 20 to 40% of the time and may result in the need for the use of glasses, special eye drops, prisms, or an additional surgical procedure.

2. Infection

   Infection can occur in the immediate postoperative period, but fortunately, this is extremely rare. The ocular tissues are highly vascular and this usually aids in the prevention of this problem. You

will be given instructions with regard to the use of antibiotics and in the care and use of the eyes in the immediate postoperative period. A postoperative visit will be scheduled to detect any early signs of an infection. Severe infection inside the eyes can result in loss of vision. Fortunately, this is very unusual after strabismus surgery.

3. Scleral perforation

   During the operation, the eye muscle is often removed from the eye and then has to be reattached. The outer coating of the eye is approximately 1/12 of an inch thick. Rarely, the needle used to sew the eye muscle onto the eye can actually enter into the eye itself. This usually is of little consequence and rarely necessitates any concern. Occasionally, a small hemorrhage may occur which normally resolves without intervention. Very rarely, (1 out of 100,000), a retinal detachment can result which will require further surgery to repair. In some cases, a freezing treatment called cryotherapy will be used to ensure that the puncture site is sealed. Fortunately, with today's modern needles and careful technique, this is an extremely rare occurrence.

4. Slipped muscle

   The suture used to attach the eye muscle to the eye is extremely strong. However, in rare situations, the suture may break, which can cause the muscle to slip or become detached from the globe. This requires prompt reoperation to reattach the muscle. Fortunately, this also rarely happens.

5. Loss of vision

   Permanent loss of vision from eye muscle surgery occurs approximately in one out of 10,000 eye muscle operations. The cause is usually internal eye infection (endophthalmitis), internal eye hemorrhage, or retinal detachment. Early detection and treatment can save vision. Changes in eyeglass prescriptions can occur after eye muscle surgery due to slight alterations in the shape of the eye or cornea. This may not be permanent and new glasses will usually correct any refractive changes.

6. Double vision

   In the immediate postoperative period, it is not unusual for the patient to see double (called diplopia). The eye muscles are sore and are not working correctly, or occasionally the eye position has been changed enough so that the brain processes two images instead of one. The double vision normally resolves within days to weeks, and in some cases, it is desirable immediately after the surgery. Persistent double

vision, however, may require additional intervention if it does not resolve in an appropriate period of time. Every effort is made to try to anticipate whether or not this will occur so that the patient can be prepared for this in the immediate postoperative period.

POSTOPERATIVE PERIOD

Instructions will be given to you at the time of surgery with regard to how to take care of the eyes in the postoperative period. Eyes vary in appearance and comfort depending on the type of operation and the previous condition of the eyes prior to surgery. You can expect the eyes to be somewhat sore and irritated for at least several weeks after the operation. The conjunctiva will be red and swollen, and it may feel like you have sand or other foreign objects in the eye.

Sometimes, the upper and/or lower eyelids will also accumulate fluid and swell. This usually resolves within several days. If both eyes are operated on, neither eye will be patched. If however, just one eye is operated on or if the surgery is done with adjustable sutures, a patch may be used to increase comfort.

It is recommended that most people refrain from employment or school for up to one week following the surgery. While you may be able to resume your normal activities within a day or two, it is better to anticipate a longer recovery period in case it is needed. Specific details for how to take care of the eyes are given on the postoperative eye care information sheet.

ACTIVITIES

The 2 basic principles that should guide activities for the first week after surgery are:

1. **Nothing gets in the eye(s)**
2. **Avoid any possible injury to the eye(s)**

If you apply these 2 rules to the planned activities and neither is an issue, then the activity is OK. Otherwise, **DON'T DO IT !**

Questions about additional issues not covered in this handout may arise. Please feel free to contact your surgeon prior to surgery in order to get all your questions and concerns answered.