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Pediatric Ophthalmology • Pediatric and Adult Strabismus
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12 Eye Muscle Surgery

Erin, not yet two years old, had been through a lot since her right eye started to cross. First, her left eye was patched. That did not help the crossing, and in fact it made the left eye start to turn in. Then she was given glasses. They seemed to help some, but the crossing was still pretty obvious. So the doctor recommended surgery on her eye muscles.

Erin's parents were concerned about the surgery and had many questions. Her mom had heard that the eyes had to be taken out for this kind of operation, and that made both parents particularly nervous.

The surgery recommended for Erin is typical of most eye muscle operations. It is designed to straighten the eyes by changing the way the muscles pull. The effect is often dramatic *(see photos on page 108)*. Erin's transformation took only about an hour, and she went home from the hospital two hours later.

It's very rare for strabismus to be so severe that surgery cannot correct it. And there's no truth to the claim that it can be "too late" for surgery. One charming lady we know finally had her operation at age 86.

The benefits of surgery

Normal appearance and self-esteem "But isn't the surgery just cosmetic?" parents often ask. This question brings to mind the movie star who doesn't like the shape of his nose or the size of her breasts—people who want to improve parts of their bodies that are already normal. But it's simply not normal to have one's eyes looking in different directions. It's been that way since ancient times, when cross-eyed figures were used to represent evil spirits.

People who have strabismus are seldom allowed to forget about it, especially if the deviation is severe. School-age children may be teased mercilessly. Adolescents suffer self-image problems as they

begin to be interested in the opposite sex. Adults may find that their careers are adversely affected, especially if their work involves contact with the public.

Cross-eyed people are reminded of their disfigurement every time they make eye contact with someone who doesn't know which eye to look at. The 86-year-old lady mentioned above is a good example. She had had a successful operation as a child, but over time, as often happens, her eye had again drifted out of alignment. She became so self-conscious that she was embarrassed to go to the grocery store.

Improved function Eye muscle surgery can improve the visual function of some patients. Older children (or adults) with recently acquired strabismus may have double vision and lose depth perception. These symptoms can be troublesome. For example, if Tommy is playing baseball, he won't know which ball to hit.

For children whose strabismus is incomitant *(see Chapter 10)*, turning or tilting their head is the only way they can use their eyes together. (In rare cases, the eye muscles are so tightly pulled out of position that one eye cannot be centered and its vision is impaired.) Similarly, many children with nystagmus (involuntary eye movements) can control their problem and achieve better vision only by holding their head to one side. Their head positions become nearly constant, and make them look and feel different from their peers. Eye muscle surgery may permit all of these children to resume normal posture.

Surgery like Erin's helps the two eyes work together to make one image. Exactly how well depends on the individual.

What surgery can and cannot do

Vision: One thing Erin's surgery will not do is to make her see more clearly. That has already been accomplished by patching and glasses. In rare cases, a child whose glasses have failed to control the eye crossing will need weaker glasses, or none at all, after surgery. But that is the exception. It's best to assume that straightening a crooked eye will not improve its vision or change its need for glasses.

Stereopsis: Even the most accurate surgery can't restore perfect stereoscopic vision unless the visual areas of the brain have the potential to develop this kind of visual coordination. The best results are expected in patients whose strabismus begins after the first few years of life, remains intermittent, and is accurately repaired soon after it begins.

Will Erin's eyes work together perfectly to make a stereoscopic image after surgery? Probably not. But this actually isn't such a terrible problem. After all, most children with strabismus seem to function normally in most visual tasks.

Most specialists believe that if the two eyes work together, even

partially, they are more likely to remain straight or nearly straight after surgery. For a constant deviation in infants, the best chance for the eyes to work together is with early surgery, within the first 2 years of life. For intermittent deviations and those acquired after infancy, the timing of surgery should be individualized, depending on their severity and symptoms.

Alignment: It would be nice if the surgeon could tell Erin's parents that her surgery will work perfectly, that her eyes will be perfectly aligned when she wakes up and will remain so for the rest of her life. In fact, however, it is usually not that way. In time, there will probably be at least a small amount of crossing or drifting in some direction. But this crossing is often hard to see. And if one has to look critically to detect it, it probably doesn't require more surgery.

Perhaps it's best, since strabismus seems so hard to "cure" completely, to consider Erin's problem as a condition to be "controlled." In about 80% of all cases, surgery can control strabismus so well that it's hard to see two months later. If not, or if it slips out of control later, it can almost always be improved with another operation.

The risks of surgery

In addition to its being reasonably effective, Erin's surgery is relatively safe. It's rare for the eyes to end up out of alignment in some way that can't be put right later. Complications affecting the vision could occur—for example, the retina could be damaged or a serious infection could set in—but these problems are extremely rare. Double vision occasionally happens after surgery, especially in patients age 7 or older, so that's one more reason it's better to operate early. However,double vision is rarely a serious problem (even in adults), and it can almost always be fixed. Other minor complications, such as wound irregularities or changes in eyelid position,sometimes occur but they are unusual.

Anesthesia problems, potentially disastrous, are exceptional in modern operating rooms. Erin's parents can help avoid problems by letting the surgeon know if she becomes ill just before surgery. Eye muscle surgery is elective; nothing terrible would happen if it had to be delayed several days or weeks. Some doctors worry that even a cold or earache may increase the chance of a complication from the anesthesia. For safety's sake it is better to reschedule surgery if the child is not in the best possible health.

What to expect

The actual experience of surgery is much less frightening today than it once was. Children hardly ever stay overnight in the hospital. They're more comfortable at home, they get more attentive care from their parents than from hospital personnel, and they're not surrounded by children who are sick and may even be infectious.

Before surgery Several days before surgery, a nurse may show parents and older children the operating room and recovery room and explain what will happen step-by-step. As a precaution, a routine physical examination is usually performed (blood and urine tests may not be required). The risks of anesthesia increase if there is anything in the stomach when the child is put to sleep, so it's important to avoid solid food after midnight the night before surgery. Depending on the child's age, clear liquids may be permitted up to several hours before anesthesia is begun.

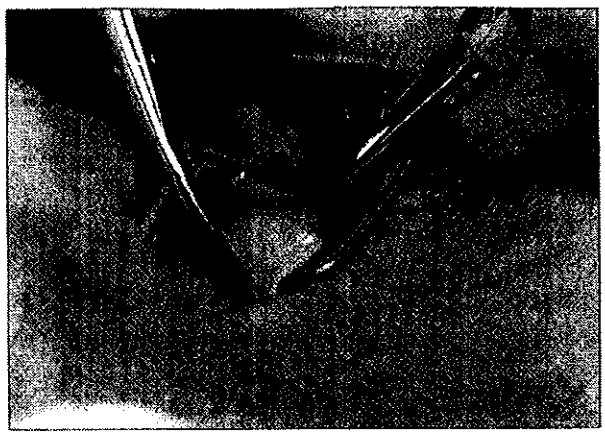
The surgery itself On the day of surgery, Erin will be separated from her parents as little as possible. In many hospitals, her parents may be permitted to accompany her into the operating room, sitting with her as the anesthesia is breathed through a mask. Then the parent will be escorted to a waiting area. No needles are used until she is asleep, when the intravenous can be started painlessly.

It is not necessary to cut the skin. Incisions are made in the conjunctiva with scissors, not a scalpel or a laser. A small spring-loaded speculum holds the eyelids open, and a surgical assistant moves the eye from side to side as needed with forceps. Special hooks are used to hold the muscle that needs surgery.

Individual eye muscles will be weakened or strengthened during surgery, depending on the judgment of the surgeon and on whether the eye turns in, out, up or down. The most commonly performed procedure weakens the muscle by *recessing* it: moving the muscle's attachment to the sclera backward several millimeters.

In Erin's case, the medial rectus muscle pulls her eye too strongly toward her nose, so her surgeon will recess that muscle by cutting away connective tissue from the front and the sides of the muscle, putting a suture through it close to where it attaches to the eye, and

INDUCTION OF ANESTHESIA. The early phases of anesthesia are usually not unpleasant for the child. In this case, the mother's presence serves to calm his fears.



CONJUNCTIVAL INCISION IN MUSCLE SURGERY. (left). The eye is pulled up so that the scissors can be used to cut the conjunctiva in the inferonasal quadrant, so the medial rectus muscle can then be approached.

CLOSING THE CONJUNCTIVA (right). The conjunctival incision is closed with absorbable sutures at the completion of the surgery.

cutting the muscle just in front of the suture. The surgeon will then place sutures in the sclera at a carefully measured point. When the sutures are tied in position, the operated muscle will still pull the eye, but not so hard that the eye is crossed.

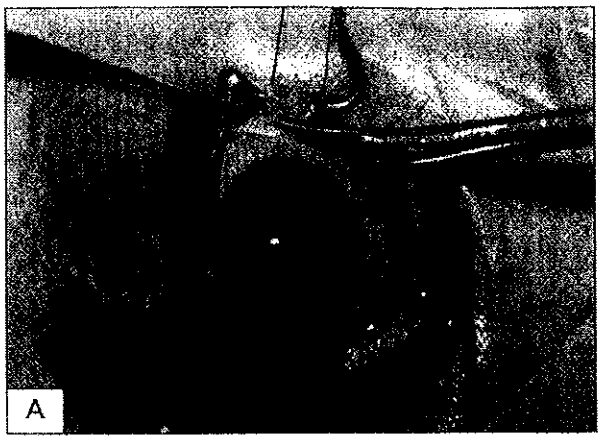
Strengthening operations, called *resections*, usually involve removing a measured length of muscle, then tightening the muscle much as a belt is tightened by moving its position in the buckle. In some cases a resection of one muscle (e.g., the left lateral rectus), is performed in conjunction with a recession of the opposite muscle (e.g., the left medial rectus).

For teenagers (and adults) an adjustable suture may be used with recessions or resections. This technique can be especially helpful in situations that involve more unpredictability—for example, in reoperations. The suture that attaches the muscle to the sclera has a slip knot that holds the muscle. When the patient wakes up or the local anesthesia has worn off, the knot is untied and the muscle is repositioned with minimal discomfort. This technique can't be used for children who are too young to cooperate for the adjustment.

Parents often ask, "How do you know how much to weaken or strengthen the muscle?" Surgeons refer to a table of specific amounts for different angles of deviation. Then they individualize this number based on their own experience, on the patient's measurements, and on other clinical data. The planning of eye muscle surgery demands as much skill as the surgery itself.

Sometimes a surgeon elects to operate on the non-deviating eye. When one eye is higher than the other, for example, the eyes can be made level either by raising the lower one or by lowering the higher one. The same logic applies when one eye turns in or out. It is especially important to include surgery on the "straight" eye if the angle is large or if there is an abnormal head posture.

At the end of the procedure, the incision is sewn together with tiny sutures that are hard to feel or see. These are absorbed after several days.



MUSCLE SURGERY—RECESSION. (A) In this surgery for esotropia, the medial rectus muscle is being detached from its original insertion. Absorbable sutures have been preplaced posterior to the scissors so the muscle cannot retract into the orbit. (B) The medial rectus has now been detached and the forceps grasp its original insertion. (C) The preplaced sutures have been sewn into the sclera so that the new insertion (small arrow) is several millimeters posterior to the old one (large arrow). The medial rectus will now adduct the eye less forcibly, decreasing the esotropia.

No blood products are transfused during the operation. *Some parents need to be reassured that the eye is never removed from the head.*

Recovery Erin's surgery will take an hour or so. (Some types of eye muscle surgery are completed more quickly; complicated reoperations and procedures involving many muscles may take even longer.) Much of the time will be spent getting Erin safely to sleep and, after surgery, waking her up again. Erin will probably begin to stir in the operating room once the anesthesiologist stops administering the anesthesia. She will then be taken to the recovery room, where nurses will monitor her as the anesthesia wears off. Her parents will be at her bedside before she is fully awake.

At first Erin will be fretful, in and out of sleep and crying when she is awake. Her eyes will be sore, and the conjunctiva will be very red. The eyes will not be covered after surgery. Therefore, the parents will probably see a scant amount of blood in the tears. This is normal and is nothing for them to be frightened of. They will be instructed simply to wipe the blood away with a clean tissue or washcloth.

Erin will be ready to go home several hours after her surgery. Because the digestive system is affected by the anesthesia, it may take

MUSCLE SURGERY — POST OPERATIVE. Generally children sleep for an hour or two after surgery. In this case, the parents comfort their son in the recovery room.

time before she can tolerate solid food. Water, chipped ice, and apple juice tend to be well tolerated. Her discomfort can be eased by any children's strength painkiller and a compress of cool or warm water. Hugs from Mom or Dad in a rocking chair will probably be even better.

By the next day the oozing and tearing will stop and Erin will probably be ready for a light breakfast. Her parents should discourage her from rubbing her eyes, but this is rarely a problem. Erin's activities will be restricted very little. It will be okay for her hair to be washed since she'll instinctively close her eyes, and she can even be given a shower. Her surgeon is likely to tell the parents that she should not go swimming or splash in the tub for a week or two.

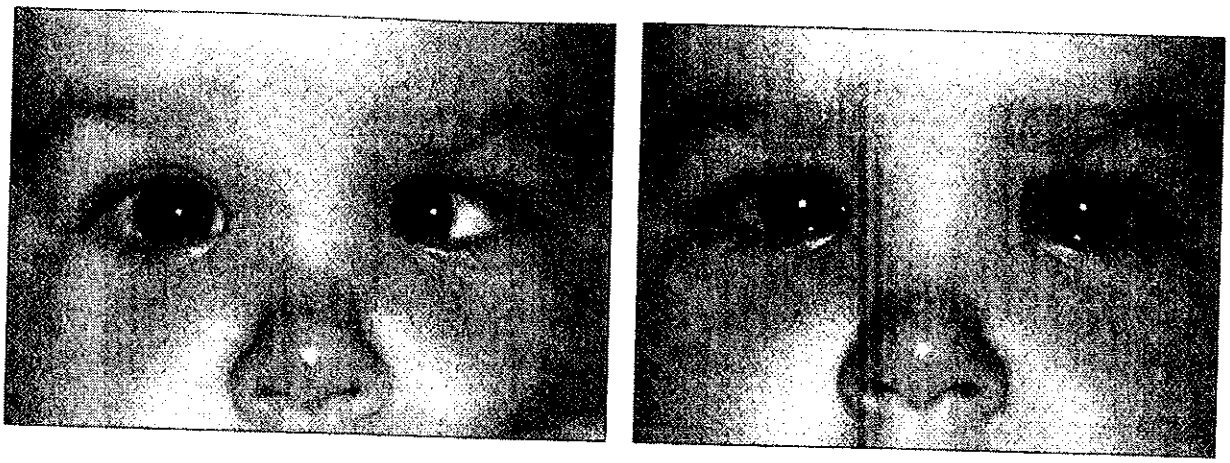
Infections are quite rare. When one does occur, it's typically within the first week after surgery. The parents would notice the eye becoming more and more red, swollen, and uncomfortable.

Afterward The effects of Erin's surgery will be seen as soon as she first opens her eyes. The alignment of her eyes is likely to change over time, though, especially during the healing period. After two weeks it should be hard to tell that surgery was done. (A slight irregularity of the conjunctiva may persist, though it is more likely after a complicated reoperation.) In about six weeks, her ophthalmologist will be able to tell how successful the surgery has been.

Routine checkups will be made at least every 6 to 12 months by her surgeon, who will have several goals in mind:

1. *Best possible vision in each eye.* Erin's glasses may need to be changed, or patching may be indicated. (If Erin hadn't had glasses, it might be necessary to prescribe them later.)

2. *Close-to-perfect alignment of the eyes.* Again, an adjusted (or



THE EFFECT OF MUSCLE SURGERY. Left: Preoperative photograph shows 20 degree left esotropia. Right: The same child two days after both medial recti were recessed.

new) prescription may be given. Sometimes further surgery is needed.

3. *The fewest possible operations.* Usually when a second or third operation is needed, it is not because the first time was unsuccessful, but because the eyes have become misaligned after surgery. Even adults with a childhood history of strabismus may develop a deviation years later (this was the case with the 86-year-old lady mentioned at the beginning of this chapter).

The longer a child's eyes remain aligned after surgery, the better the chances of never needing another eye operation.

Injections as an alternative to surgery

During the past decade or so, some surgeons have developed an alternative treatment for strabismus that involves the injection of a drug into the eye muscles that need weakening. A minute dose of the drug, which has the brand name Botox, is injected directly into the eye muscle. Though this is the same compound that causes botulism, the injection causes no side effects like the dreaded disease, and can have very helpful weakening effects on the eye muscles.

The usefulness of Botox injections for strabismus is limited, though. The effect of the drug may be temporary, so about half of all patients need to be reinjected, and it is not particularly effective for large angles of misalignment.

Most surgeons prefer not to use this drug for young children, since injection may be difficult without anesthesia. But it may be helpful for older children (and adults) who have eye muscle palsies, such as after head trauma. (It is also used in treating other medical conditions—blepharospasm, for example— that have nothing to do with the eye muscles.)