

Surgery for Adult Strabismus

If you're seeing an uptick in the number of adult patients with strabismus, you're not alone.

Three key factors are propelling this trend: First, demographic changes mean that "there are increases in the sheer number of older adults who have the risk factors for strabismus," said Stacy L. Pineles, MD, at Stein Eye Institute in Los Angeles. "Second, there is increased awareness [among clinicians and patients] that there are treatments for adult strabismus, and the results are not just cosmetic but also can improve function. Third, we have newer techniques that are less invasive and can be done under topical anesthesia, making the surgery less daunting for many patients."

Driving Factors

According to the Academy's recently published *Adult Strabismus Preferred Practice Pattern*, strabismus is common among adults, with an estimated incidence of 4%.¹

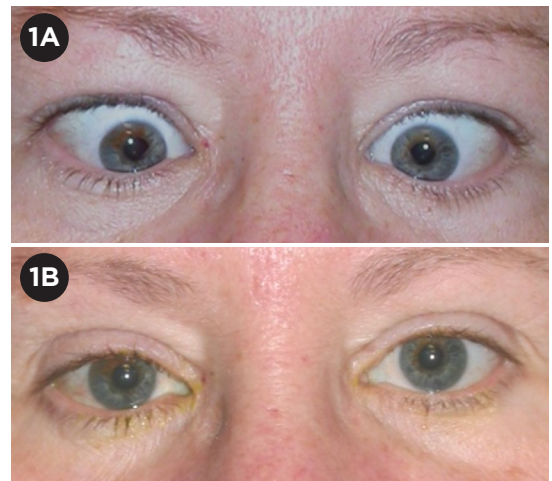
A matter of age. Some cases—particularly divergence insufficiency, sagging-eye syndrome, and strabismus fixus—are associated with aging. And as the population has aged, these conditions "have generated an increase in referrals for patients who would like definitive surgical repair of their new-onset diplopia," said Linda R. Dagi, MD, at Harvard and Boston Children's Hospital in Boston.

Other causes that may play a role include "sleep apnea, changes in diet, and lifestyle comorbidities associated with the use of electronics," said Federico G. Velez, MD, at Duke University in Durham, North Carolina. However, he cautioned, the full impact of these lifestyle factors is not yet known.

Previous surgeries. Dr. Dagi also noted that she is seeing "increasing numbers of adults with lifelong strabismus for whom prior surgery failed over time." Many of these patients were told, incorrectly, that if the surgery did not work before, it would not work now—or that they would develop diplopia if they underwent surgery as adults.

Awareness of benefits. Many new adult strabismus patients are being referred from other medical providers, who now recognize that successful repair can improve a patient's quality of life.

As Dr. Velez pointed out, "Adults with strabismus have more than just misalignment—they have diplopia, visual confusion, abnormal binocular visual fields, and binocular inhibition." He emphasized that the condition "affects patients' relationships, work, pro-



GRAVES DISEASE. (1A) Before surgery, this patient had esotropia, hypotropia, and fixation duress. (1B) Surgery resolved these issues—except for diplopia in extreme up-gaze—and obviated the need for any additional surgery for her "thyroid stare."

motions, and self-esteem. Adults want to be independent and able to drive, travel, and read, and to get involved in relationships."

Improvement in surgical techniques. "New surgical techniques are being offered to patients who were told previously that nothing was available," said Dr. Velez. These include the use of adjustable sutures, which Dr. Dagi cited as significantly improving the rate of success. "The odds of developing persistent diplopia in primary position where none existed before is less than 1%,"¹ she added.

Advent of minimally invasive surgery. "Like everything else, strabismus surgery has moved to small, more selective incisions," Dr. Velez said. "Studies based on magnetic resonance imaging

BY ARTHUR STONE, CONTRIBUTING WRITER, INTERVIEWING LINDA R. DAGI, MD, STACY L. PINELES, MD, AND FEDERICO G. VELEZ, MD.

of the extraocular muscles have given us important information on the anatomy of the muscles and how we can make surgery more effective.” (See “A Look at MISS.”)

Complexities Inherent in Treating Adults

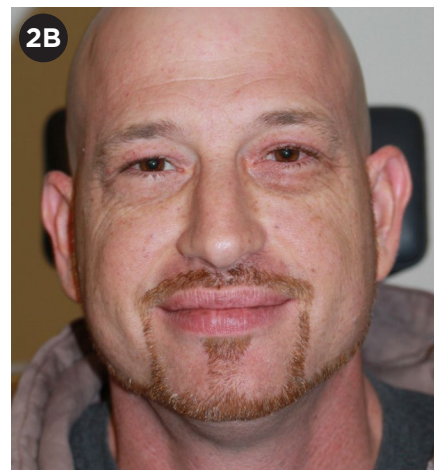
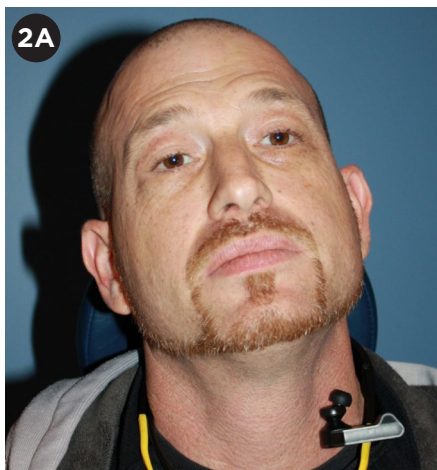
What nuances should be taken into account when operating on patients with adult-onset strabismus?

Technical challenges. Adult strabismus patients are more complex than their younger counterparts, Dr. Velez emphasized. “They may have recurrent or persistent childhood deviations, previous surgery, scar tissue formation, or lack of surgical reports from previous procedures.” He added, “acquired deviations are very complex and usually change with a variation in direction of the gaze. Associated ocular disease and previous ocular surgeries can make the procedure more complex.”

“The conjunctiva needs to be handled delicately, as it is more friable or may have regions of scarring from prior surgery,” Dr. Dagi said. In addition, she pointed out that “patients who have strabismus from thyroid eye disease are at risk of developing a very rare complication called pulled-in-two syndrome.” This is a spontaneous horizontal transection of an extraocular muscle about 10 mm back from the anatomical insertion—and while successful repair is nearly always possible, the surgeon should be experienced in operating with the abnormally stiff muscles associated with thyroid eye disease, Dr. Dagi said.

A note on diplopia. “It is important to consider diplopia, which is not frequently seen in patients who have strabismus from early childhood,” said Dr. Pineles. With diplopia, she added, “One needs to consider it in straight-ahead gaze as well as with other directions of gaze, such as right-, left-, and down-gaze, which are important for mobility, reading, and driving.”

A note on comorbidities. “Many of our adult strabismus patients have other medical comorbidities, and some take anticoagulants, so close consultation with other treating physicians is important at all points during their care,” Dr. Dagi said.



TRAUMA. (2A) The shadow behind this patient helps illustrate the extent of his pre-operative torticollis. (2B) Following surgery, his torticollis resolved and he regained a wide field of binocular vision.

Five Sample Cases

Drs. Dagi, Pineles, and Velez provided the following case synopses to illustrate the challenges and rewards of the types of cases they treat.

1. Graves disease. This patient developed Graves disease as an adult. “She presented with significant esotropia and hypotropia with diplopia in all fields of gaze,” Dr. Dagi said (Fig. 1A). The patient wore a patch for more than 1.5 years to prevent double vision while waiting for her disease to become quiescent. She also had upper eyelid retraction from her thyroid eye disease.

“We performed bilateral medial rectus and inferior rectus recessions with adjustable sutures. She enjoyed restoration of 70 arc seconds of stereopsis and resolution of diplopia in all fields except for extreme up-gaze,” Dr. Dagi said. Resolution of fixation duress eliminated the “thyroid stare” and resolved the need for additional surgery to treat eyelid retraction (Fig. 1B).

2. Trauma. A 44-year-old man was hit by a baseball. He suffered a right orbital wall and floor fracture without entrapment of the rectus muscles; however, he had preoperative diplopia. “The fracture was repaired by an orbital surgeon, who used a titanium mesh implant placed to reduce enophthalmos; the extraocular muscles remained free,” Dr. Dagi said. “He developed more significant diplopia—vertical, horizontal, and torsional—after surgery and was able to maintain single

vision only when adopting a significant compensatory head posture. His field of single vision was looking down to the left” (Fig. 2A).

Excision of scarring between the extraocular muscles and the implant, and adjustable suture surgery on the patient’s superior oblique, lateral rectus, and inferior rectus muscles restored a wide field of binocular single vision, (Fig. 2B), allowing him to return to work as a telecom installer, Dr. Dagi said.

3. Progressive diplopia. A 61-year-old woman presented to Dr. Velez and his fellow, Megan Law, MD, with a history of progressive, constant horizontal distance diplopia. “She had stopped driving and playing tennis,” Dr. Velez said.

The patient’s medical history included pseudophakia and ptosis repair, and she only wore reading glasses. On examination, she measured 20 PD of comitant esotropia at distance and small-angle well-controlled esophoria at near. She had excellent stereopsis. “The patient was diagnosed with distance esotropia divergence insufficiency, consistent with sagging-eye syndrome,” Dr. Velez said.

The patient underwent bilateral strabismus surgery consisting of bilateral left rectus muscle resection using adjustable sutures. Surgery was performed under topical anesthesia using proparacaine and tetracaine eyedrops and ophthalmic 3.5% lidocaine gel.

Intraoperative and immediate one-hour post-op evaluation and adjustments were performed.

One year after surgery, Dr. Velez said, “her alignment and resolution of diplopia remained stable. She started driving and playing tennis again.”

4. Complicated glaucoma. A 61-year-old man with a history of complicated glaucoma was referred to Dr. Velez for diplopia. “His past surgical history included right eye superior trabeculectomy with mitomycin C, multiple needling, and implantation of a superotemporal drainage device. He noticed diplopia one to two months following implantation,” he said.

On examination, the patient’s visual acuity was 20/60 in his right eye and 20/20 in his left. His motility examination revealed a 14 PD right hypertropia and a 7-degree incyclotropia. “The patient had severe balance and depth perception problems, with diplopia in all gazes, including down-gaze,” Dr. Velez said. “He was unable to read unless his right eye was closed. Because his deviation was incomitant, prism glasses did not help.”

The patient consented to have

surgery for his right eye only. This was performed in conjunction with glaucoma and anterior segment specialists and consisted of right eye angle surgery using the Trabectome (NeoMedix) and explantation of the glaucoma plate and tube. Significant scar tissue formation was removed superiorly, and the capsule surrounding the glaucoma valve was excised. The superior oblique tendon was repositioned, and the superior rectus muscle was recessed. An amniotic membrane graft was placed superiorly.

The patient’s diplopia and hypertropia resolved postoperatively, Dr. Velez said. (See images with this article online.) “At his last post-op follow-up, he was diplopia free, the motility examination revealed orthotropia in primary and secondary gaze positions, and his intraocular pressure remained stable with no medications.”

5. A large exotropia. “A 32-year-old woman came to see me with a very large exotropia,” said Dr. Pineles. “She had an eye injury during childhood and was blind in one eye. Over time, that eye had deviated significantly.” The patient had been told that, as she was blind in that eye, surgery was not

indicated. “She was extremely shy, did not make eye contact, and wore her hair over her face so that it covered her eye,” Dr. Pineles said. Moreover, she was unemployed at the time.

Dr. Pineles told the patient that surgery was “certainly indicated to restore the normal alignment of her eyes.” She added, “We did the surgery, and her eyes were straight afterward.” And when she came in six months later, “She had her hair tied back, had an extremely friendly and bubbly personality, made eye contact with me, and had gotten a job as a cashier at a grocery store. The surgery literally changed her personality and her life.”

Technically, the patient had 70 PD of exotropia, Dr. Pineles said. “I used an adjustable suture (bowtie) on the lateral rectus and a fixed suture on the medial rectus muscles. Since the patient was monocular, I had to operate only on one eye—despite the fact that I would typically do both eyes for this large of an angle. I performed 6.5-mm MR resection and 10-mm LR recession. She had mild postoperative foreign body sensation, but otherwise no issues.”

1 Dagi LR et al. *Ophthalmology*. 2020;127(1):P182-P298. Also available at aao.org/ppp.

A Look at MISS

The phrase minimally invasive strabismus surgery (MISS) was originally coined by Swiss ophthalmologist Daniel Mojon, MD.¹ Dr. Dagi describes MISS as “a specific technique Dr. Mojon introduced that accesses the extraocular muscles through exceptionally small conjunctival incisions.”

There is some variation in how other strabismus surgeons interpret “minimally invasive,” Dr. Dagi observed. “The surgical planning for each case is unique, with every effort made to be as minimally invasive as possible while still achieving the desired goal.”

“It depends on what is considered minimally invasive surgery—e.g., small incision, less disruption of tissue, and selective weakening or strengthening,” said Dr. Velez. “All of these can be done in any patient.”

What about more complex cases? “When addressing more complex cases in which there has been prior extraocular or orbital surgery and scarring, this approach may limit what can be accomplished,” Dr. Dagi said.

Dr. Velez added, “I agree with Dr. Dagi about dissection in cases of previous surgery with severe scarring or implantation of devices, but the incision and what is done to the muscle may be different. Although the incision is bigger, it may still be less invasive. Dr. Mojon’s [concept of] MISS refers to small incisions. My concept refers to more selective, less invasive muscle procedures,” which may vary in size.

1 Mojon DS. *Br J Ophthalmol*. 2007;91(1):76-82.

Dr. Dagi is associate professor of ophthalmology at Harvard and director of the Adult Strabismus Program at Boston Children’s Hospital in Boston. She served as chair of the Pediatric Ophthalmology/Adult Strabismus PPP Panel. *Relevant financial disclosures: None.*

Dr. Pineles is associate professor of ophthalmology and director of the Residency Program at Stein Eye Institute, David Geffen School of Medicine at the University of California, Los Angeles. She served on the Pediatric Ophthalmology/Adult Strabismus PPP Panel. *Relevant financial disclosures: None.*

Dr. Velez is associate professor of ophthalmology at Duke Eye Center, Duke University in Durham, N.C. He served as vice chair of the Pediatric Ophthalmology/Adult Strabismus PPP Panel. *Relevant financial disclosures: Luminopia: C; Nevakar: C.* See the disclosure key, page 10. For full disclosures, view this article at aao.org/eyenet.



MORE ONLINE. For additional images, see this article at aao.org/eyenet.