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Medial transposition of a split lateral rectus muscle in synergistic divergence

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Synergistic divergence is a rare congenital ocular motility disorder characterized by paradoxical abduction during attempted horizontal gaze to the contralateral side. It is generally unilateral and associated with limited adduction of the affected eye and large-angle exotropia in primary position. Various surgical techniques have been used to manage this condition, with limited success. We describe our experience using splitting and medial transposition of the lateral rectus muscle on the affected side to treat an 18-month-old girl with synergistic divergence. Postoperative improved motor alignment remained stable through 6 months' follow-up.

Case Report

An 18-month-old girl presented at the Strabismus Service of Cairo University Hospital with an outward deviation of the left eye since birth. Her perinatal and developmental history were unremarkable. On examination, she had a central, steady, and maintained fixation in her right eye and poor fixation in her left eye. Cycloplegic refraction was +2.00 DS in both her eyes. Anterior segment and fundus examination were unremarkable for both eyes.

Motor evaluation revealed a left exotropia of 100$^{\Delta}$ (Krimsky test). Ductions and versions were full in the right eye. The left eye was fixed in the exotropic position, with complete limitation of adduction and inability to reach the midline in both versions and ductions. On attempted right gaze, the left eye showed paradoxical abduction together with downward movement and an increase in the exotropia suggestive of synergistic divergence (Figure 1). In addition, the vertical movements of the left eye were limited. There was no significant narrowing of the palpebral fissures of either eye on horizontal gaze.

Magnetic resonance imaging of the brain and orbits revealed mild subvolemia of the brain tissue, thinning out of the corpus callosum, and areas of incomplete myelination of white matter consistent with age. No abnormalities were seen in the extraocular muscles or in the orbits.

Intraoperatively, forced duction showed moderate tightness of the left lateral rectus, which was explored through a limbal incision. The muscle insertion was 7 mm from the limbus, and the width of the insertion was 7 mm. The muscle was originally hooked and secured with 6-0 polyester sutures, as a preliminary step for lateral rectus orbital wall fixation. After hooking the muscle, the length and tightness of the muscle were assessed for the possibility of splitting and transposition to the medial rectus insertion. This was tested by sliding the muscle above and below the globe and confirming that the distal end of the muscle could reach both the upper and lower borders of medial rectus insertion. The muscle was split along its horizontal axis for approximately 15 mm. The 5-0 polyester sutures were removed, and each half was secured with 6-0 polyglactin 910. The sutures were passed under the superior and inferior rectus muscles and then secured to the sclera 1 mm posterior to the upper and lower poles of the medial rectus insertion.[1] Forced duction testing was performed again at the close of surgery and showed minimal restriction to abduction.

The patient was examined 1 day, 1 week, 3 months, and 6 months after surgery. There was marked improved of the ocular alignment postoperatively, with a residual left exotropia of about 8$^{\Delta}$ (Figure 1). The synergistic divergence disappeared completely, with complete limitation of abduction of the left eye. There was minimal improvement of left eye adduction, but the eye was able to reach the midline. Fundus examination showed no changes in the color of the optic disk. Pupillary reactions remained intact. The motor alignment remained stable through the last follow-up, at 6 months. The patient was advised to continue to do part-time occlusion.

Discussion

Synergistic divergence is a rare ocular motility disorder, with simultaneous abduction of both eyes on attempted gaze to the normal side.[2] Several surgical techniques have been suggested for the management of synergistic divergence, including unilateral or bilateral lateral rectus muscle recession, total tenotomy of the lateral rectus muscle, lateral rectus muscle extirpation and denervation, lateral rectus muscle orbital wall fixation, large resection of the medial rectus muscle, oblique muscles weakening, and transposition of the vertical rectus muscles.[2-6] In general, there is a high rate of undercorrection.[4,5] In addition, synergistic divergence usually persists after surgery, and it is difficult to achieve any adduction with these surgical procedures.[4] Although most lateral-rectus-weakening procedures have been shown to reduce the exotropia, only lateral rectus extirpation and orbital wall fixation have been shown to eliminate the synergistic divergence postoperatively. No

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FIG 1. A, Preoperative clinical photographs of the patient showing large left exotropia in the primary position and synergistic divergence of both eyes on attempted right gaze, with an increase of the left exotropia associated with some downward movement of the left eye. B, The same patient 3 months after left lateral rectus muscle splitting and medial transposition showing improvement of alignment in primary position and disappearance of synergistic divergence.

published technique, including medial rectus resection,[6] vertical muscle transposition,[3] and oblique muscle transposition,[5] has achieved adduction beyond the midline.

Splitting of the lateral rectus muscle and medial transposition is a surgical technique that has been suggested for the management of complete oculomotor nerve palsy.[7,8] The technique has the theoretical advantage of being potentially reversible. It can also be augmented by combining it with medial rectus resection. The main drawback of the technique is the possibility of posterior slippage of the split halves of the lateral rectus. Such slippage might cause compression of either the optic nerve or the vortex veins.[9] In our patient, there were no complications. The pupillary reaction and the optic nerve remained intact during the entire follow-up period. Another limitation to this technique is that in many cases of synergistic divergence, the lateral rectus muscle is too tight and/or short to reach the upper or lower poles of medial rectus muscle insertion. In our patient, the tightness of the muscle was only minimally heightened, possibly of her young age.

Although this technique was previously reported in cases of complete oculomotor nerve palsy, this is, to our knowledge, the first time it has been used to treat synergistic divergence. In addition to correcting the exotropia and eliminating the synergistic divergence, we thought that by performing a medial transposition of the aberrantly innervated lateral rectus muscle, we might achieve some adduction, which is not attainable in cases of oculomotor nerve palsy. Although patients with synergistic divergence usually have their eyes fixed in abduction, true abduction movement on gaze toward the affected eye is usually either absent or reduced.[2-6] The anomalous abduction movement appears mainly on at attempted adduction, which is gaze toward the normal eye. After transposition of the lateral rectus medially, it was not expected to contract on attempted abduction but rather on attempted adduction, which may result in some adduction movement. Although we hoped this would be true, the improvement of adduction was minimal and did not further improve over the course of follow-up. We are not sure whether or not this can be explained by the anomalous course of the transposed lateral rectus muscle. Finally, although the alignment of the patient remained stable for 6 months after surgery, the long-term stability of the results is uncertain.

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