

Anomalous separation of the medial rectus muscle, abnormal separation into superior and inferior compartment, and surgical management

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Abstract:

We describe a case of an anomalous separation of the medial rectus muscle in an 18-month-old female undergoing strabismus eye muscle surgery for partially accommodative esotropia. During surgery and after hooking the medial rectus muscle, it was noted that the width of the muscle tendon was shorter than usual and that the muscle insertion was displaced inferiorly, this prompt further exploration. It was found that the medial rectus muscle had an anomaly where it was separated into two (superior and inferior) compartments which were 5 mm apart. This finding may further suggest the compartmentalization theory of the horizontal rectus muscles where the muscle is separated into two nonoverlapping superior and inferior zones, each working independently of the other. In this report, we present the case and suggest surgical technique that can be utilized to address this abnormality, along with the postoperative results.

Keywords:

congenital anomaly, pediatric ophthalmology, rectus muscle, strabismus

INTRODUCTION

The anatomy of the extraocular muscles consists of four rectus muscles that control primarily horizontal and vertical eye movement, in addition to two oblique muscles and the levator eyelid muscle. All rectus muscles originate from the annulus of Zinn in the orbital apex. Normally, the medial rectus inserts with the other rectus muscles along an imaginary line known as the spiral of Tillaux, with the medial rectus being the closest to the limbus at about 5.5 mm, and the superior rectus is the furthest at about 7.7 mm from the limbus. The width of the medial rectus tendon insertion is about 10 mm, with the lower edge being slightly closer to the limbus than the upper edge. Embryologically, it is thought that the horizontal rectus muscles are formed from a contribution of both superior and inferior mesodermal complexes in the orbit.^[1] There are few case reports of congenital anomalies of the rectus muscles, including

complete absence of the rectus muscle,^[2,3] bifid insertion,^[4] and insertion into abnormal position.^[5]

We report a case of an anomalous medial rectus muscle insertion. We present our intraoperative findings, surgical approach, and the postoperative outcome.

CASE REPORT

An otherwise healthy 18-month-old Caucasian female presented to the ophthalmology clinic at Boston Children's Hospital for the evaluation of esotropia of the left eye that was first noticed 8 months before presentation. She had a history of nasolacrimal duct obstruction that was treated conservatively and resolved spontaneously. There is no family history of strabismus or amblyopia. On her first ophthalmic examination, we were unable to measure the visual acuity using preferential looking test (PLT) due to poor cooperation; however, she had a clear fixation preference to the right eye. She had full ocular motility in both eyes and no nystagmus. In

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primary gaze, she had a left esotropia of 30 prism Diopters (PD) using Krimsky test; we were unable to measure her alignment in different directions of gaze or evaluate her stereopsis due to her level of cooperation on that first examination. Cycloplegic refraction was +1.25 in the right eye and +2.50 in the left eye. The remaining examinations including pupils and anterior and posterior segments were unremarkable. Patching of the right eye was prescribed for 2 h daily to treat the strabismic/anisometropic amblyopia of the left eye, along with full cycloplegic spectacle correction to correct any accommodative component of the esotropia. On further follow-up, she was noted to have decreased vision in the left eye seeing 20/130 compared to 20/63 in the right eye using PLT. She continued to have a left esotropia of 30 PD with correction and 40 PD without correction. The family was counseled about the likely need for strabismus surgery to treat this partially accommodative esotropia. She was later booked for a left medial rectus recession and a left lateral rectus resection to correct 30 PD of esotropia. During surgery, after isolating the medial rectus on a muscle hook, the muscle tendon width was noted to be shorter than expected and inferiorly displaced. Anterior pole test was performed and was negative confirming that the muscle was not transected, the muscle was secured on a 6-0 polyglactin 910 suture, and before detaching the muscle from the globe, further exploration was made which revealed another piece of muscle with similar short tendon width and more superiorly displaced medial rectus insertion. The position of the vertical rectus muscles was confirmed by hooking the two muscles to insure that the two medially inserted muscles are not the superior or inferior rectus muscle. It was concluded that these were two separate compartments of the medial rectus muscle, each tendon measured 5 mm in width, and the two heads were separated by 5 mm [Figure 1]. The two muscle compartments were separated at least all the way back to the sleeve where the muscle penetrates Tenon's capsule; further exploration beyond Tenon's was not performed to avoid complications and fat adhesion. Each insertion of the two heads of the medial rectus was imprecanted with a 6-0 double-armed polyglactin suture as if it is a separate muscle the muscles were detached from the sclera. A decision was made to join the two compartments together as one muscle to allow for better control during adjustment and decrease the chance of inducing any vertical deviation. The inferior suture of the superior compartment of the medial rectus was tied to the superior suture of the inferior compartment [Figure 2], it was noted that the muscle belly was significantly separated, and so, an augmentation suture was placed 4 mm from the distal ends of the two compartments [Figure 3]. The superior border of the now joint muscle compartments was attached to the sclera halfway along the original superior compartment insertion and the same for the lower suture, yielding a width of about 10 mm for the two joint compartments. Hang back technique was used and the muscle was recessed 4.5 mm; an adjustable suture using the short tag noose technique^[6] was used given the unpredictability of the response to the surgery in this scenario. The lateral rectus muscle of the same eye was then resected 6 mm, which was uneventful.

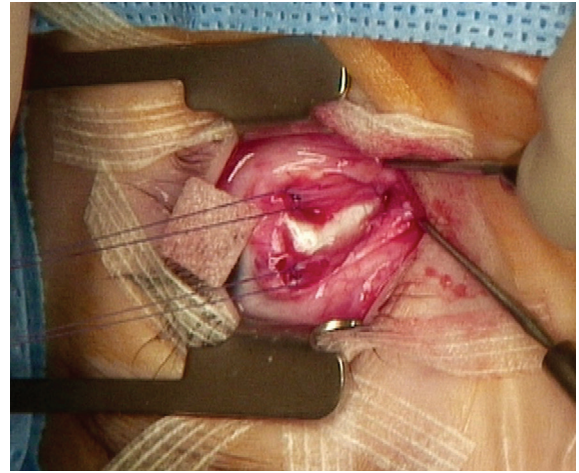


Figure 1: Intraoperative photograph showing two separate compartments of the medial rectus muscle, the insertions are separated by 5 mm of bare sclera, and each insertion is 5 mm in width

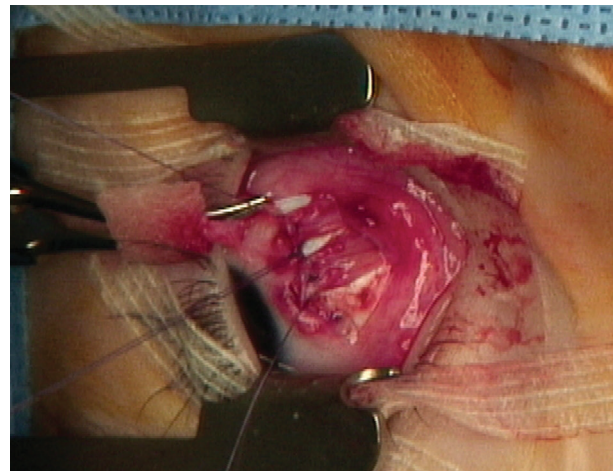


Figure 2: Surgical repair of the separated medial rectus muscle. The inferior suture of the superior compartment of the medial rectus was tied to the superior suture of the inferior compartment joining it into a single muscle complex

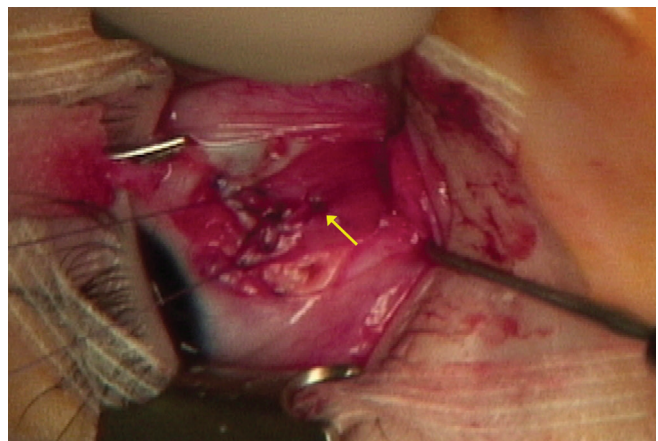


Figure 3: Augmentation suture placed 4 mm from the insertion to join the separated muscles bellies of the two compartments

About 1 h after the surgery, orthoptic examination showed orthotropia at distance and near using Krimsky test, no

adjustment was needed, and the patient was discharged home. She maintained good alignment, and at the 1-month postoperative follow-up, her vision was 20/30 in the right eye and 20/40 in the left, she had 400 s arc of stereopsis, alternate prism cover test showed orthotropia at distance and near with correction and esotropia of 10 PD at near without correction. She continued to maintain good alignment over time (the latest follow-up was 10 months after surgery).

DISCUSSION

This case illustrates a rare anatomical variation where the medial rectus is separated into two compartments, each inserted independently from the other. Recent evidence has suggested that the horizontal rectus muscles are compartmentalized where the innervation is separated into two nonoverlapping superior and inferior zones, each working independently of the other.^[7-9] Embryologically, it is thought that the horizontal rectus muscles are formed from a contribution of both superior and inferior mesodermal complexes in the orbit.^[1] This further suggests the possibility that the horizontal rectus muscles are formed by joint but distinct superior and inferior compartments. Here, we present a case where these compartments are abnormally separated and a suggested surgical technique of repairing it.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published

and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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