Inferior Oblique Belly Transposition for Small Angle Hypertropia With Inferior Oblique Overaction: A Pilot Study

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ABSTRACT

Purpose: To evaluate the efficacy of transposition of the belly of the inferior oblique muscle in treating inferior oblique overaction with small angle hypertropia.

Methods: The medical records of 10 patients who underwent inferior oblique belly transposition from March 2014 to July 2016 were reviewed. Transposition of the inferior oblique muscle belly consisted of suturing the entire body of the muscle to the sclera 5 mm posterior to the temporal insertion of the inferior rectus muscle. All patients had small hypertropias (< 5 prism diopters) in the primary gaze position with associated inferior oblique overaction. Deviations in both primary and lateral gazes, compensatory face turns or head tilts, and the degree of inferior oblique overaction were evaluated preoperatively and postoperatively.

Results: Nine of the 10 patients had a complete resolution of inferior oblique overaction. In the remaining patient, the inferior oblique overaction improved from +3 to +1. None of the patients had any residual vertical deviation. There was elimination of compensatory head tilting in 5 patients and correction of compensatory face turns in 4 patients. One patient with mild up drifting of the involved eye also improved after the procedure. All patients expressed subjective satisfaction with the surgical outcome.

Conclusions: Transposition of the inferior oblique muscle belly effectively weakened mild to moderate inferior oblique overaction and corrected small primary position hypertropias. This procedure may be a useful addition to surgical treatment options in patients with small hypertropias associated with inferior oblique overaction.

INTRODUCTION

Inferior oblique myectomy and recession are the most commonly performed procedures to weaken inferior oblique overaction. In patients with small hypertropias in the primary gaze position (< 5 prism diopters [PD]), both procedures carry the risk of overcorrecting small vertical deviations. Z-myotomy has been reported as an alternative surgical option for mildly overacting inferior oblique muscles associated with small hypertropias; however, it is still not widely used since it was originally described more than 60 years ago. We tested transposition of the inferior oblique muscle belly to correct mild to moderate inferior oblique overaction with small primary position hypertropias.

PATIENTS AND METHODS

Ten patients between the ages of 6 and 35 years (mean age: 18.6 years) with inferior oblique overaction and small incomitant hypertropias were selected to undergo the procedure. The vertical deviation and inferior oblique overaction was caused by mild unilat-
eral superior oblique palsies in 8 patients, whereas 2 patients had monocular primary inferior oblique overaction. Unilateral transposition of the inferior oblique muscle belly was the only procedure performed in 8 patients, whereas horizontal rectus muscle surgery was also performed for 2 patients because of coexisting exotropia or esotropia. Exclusion criteria were previous strabismus surgery or combined surgery on another cyclovertical muscle at the same operation.

All patients underwent inferior oblique belly transposition consisting of suturing of the entire body of the muscle to the sclera 5 mm posterior to the temporal insertion of the inferior rectus muscle (Figure 1). An inferior temporal incision was made and the inferior oblique muscle was isolated. The muscle was then secured with a double-armed 6-0 polyglactin 910 absorbable suture. The entire inferior oblique muscle was secured approximately 10 to 11 mm from the insertion. We then measured 5 mm behind the temporal insertion of the inferior rectus muscle and marked the sclera with the calipers. The inferior oblique muscle was then sutured to the sclera at this position with partial thickness scleral bites. The tight sutures strangled the muscle belly.

All of the procedures were performed by the three authors (SY, XG, DRT) between March 2014 and July 2016. Of the 10 patients, 5 adult patients had surgery under local anesthesia and 5 pediatric patients had surgery under general anesthesia.

Age, etiology, and visual acuity were recorded. Ocular alignment was assessed using the alternate prism and cover test at distance and near in the nine diagnostic gaze positions. The degree of inferior oblique overaction was assessed from +1 to +4 preoperatively and postoperatively. Anomalous head postures and torsional deviations (assessed by fundus photography) were also evaluated preoperatively and postoperatively.

**RESULTS**

The follow-up period ranged between 6 and 12 months. Changes in preoperative and postoperative hypertropia in the primary and lateral gazes were from 3.30 ± 0.48 and 8.60 ± 2.63 to 0.10 ± 0.32
and 0.60 ± 1.35 PD, respectively. The mean degrees of preoperative and postoperative inferior oblique overaction were 1.5 ± 0.71 and 0.1 ± 0.32, respectively (Figure 2). Five patients with head tilts and 4 patients with compensatory face turn improved to normal position (Figure 3). One patient with mild up drift of the involved eye also improved after the procedure. No patient showed overcorrection or anti-elevation syndrome postoperatively.

**DISCUSSION**

A small incomitant hypertropia due to inferior oblique overaction may cause diplopia and anomalous head postures, the latter of which is often concerning for parents. Patients may complain of double vision that worsens in side gaze and/or asthenopia. Because of the incomitancy of the heterotropia, prisms are often unsatisfactory. Standard inferior oblique weakening procedures carry the risk of overcorrection. Our pilot study showed that inferior oblique belly transposition effectively decreased the inferior oblique overaction and corrected the small associated vertical deviation. Therefore, inferior oblique belly transposition may be an excellent surgical option for select patients.

Lee et al. and Cruz et al. reported the results of a Z-myotomy of the inferior oblique muscle to correct small incomitant hypertropias due to mild inferior oblique overaction. In Lee et al.’s study, Z-myotomy corrected hypertropia of 6.55 PD in primary gaze. Compared with their results, the inferior oblique belly transposition procedure resulted in a smaller correction of hypertropia in the primary gaze position, with similar improvements in inferior oblique overaction. Therefore, the current procedure may be more suitable for small hypertropia (<
5 PD) associated with inferior oblique overaction. Inferior oblique belly transposition may be safer in treating patients with small angle hypertropia associated with inferior oblique overaction.

The inferior oblique muscle’s 15-mm arc of contact with the globe is the longest of the extraocular muscles. Magnetic resonance imaging studies show that the inferior oblique muscle’s path from its origin to the lateral border of the inferior rectus muscle is straight. Lateral to the inferior rectus muscle, the inferior oblique muscle curves to follow the globe. The gaze-related inflection in the inferior oblique muscle’s path corresponds to its pulley and functional origin near the temporal border of the inferior rectus muscle. This pulley anatomy may explain why transposition of the inferior oblique muscle belly works as it does for the posterior fixation of a rectus muscle.

In the current procedure, the location of the suture in the belly of the inferior oblique muscle is approximately 11 mm from its insertion, whereas the location of the fixation suture in the sclera 5 mm posterior to the inferior rectus muscle insertion is approximately 12 to 14 mm from the inferior oblique muscle insertion. This increases the distance between the inferior oblique muscle insertion and where the inferior oblique muscle naturally passes the temporal border of the inferior rectus muscle by approximately 3 mm and moves it closer to the inferior oblique muscle origin. The location of the fixation suture is similar to the position of the inferior oblique muscle insertion after a standard recession, with perhaps a small amount of anteriorization. This most likely results in a mild loosening effect and may explain why the primary position hypertropia improves in these patients.

Suturing the entire inferior oblique muscle body with tendon sparing to a point on the sclera at the equator of the globe has been recently introduced as a new inferior oblique weakening procedure. Tomarchio et al. sutured the entire body of the inferior oblique muscle to the sclera at Gobin’s point, which is 5 mm below the inferior insertion of the lateral rectus muscle. They found that this fixation procedure provided an effect similar to standard inferior oblique anterior transposition.

We previously reported a similar procedure in which we sutured the entire inferior oblique muscle to the sclera at a point corresponding to the original temporal insertion of the inferior rectus muscle. We use this entire inferior oblique belly anterior transposition procedure to treat hypertropias in patients with an absence of the inferior rectus muscle. The entire inferior oblique belly anterior transposition procedure works well and provides an effect similar to inferior oblique anterior transposition combined with resection.

Transposition of the inferior oblique muscle belly effectively weakens mild to moderate inferior oblique overaction and corrects small primary position hypertropias. This procedure appears to be a useful addition to our inferior oblique surgical armamentarium.

REFERENCES