In contrast, the use of ophthalmic low-temperature electrocautery close to but not in direct contact with the suture did not lead to weakening. Nor was weakening observed with the use of bipolar cautery applied directly to the suture for as long as 2 seconds. The lack of damage to the thread by the bipolar current was unexpected. One possible explanation is that the polyglactin 910 threads, which are coated with calcium stearate and polyglactin 370 to improve performance and reduce the rate of in vivo absorption, may not conduct electrical current well. The chemical composition of polyglactin 910 suture (a copolymer comprised of 90% glycolide and 10% L-lactide), coupled with its intrinsic lack of water and ion content compared to biological tissue, may render it relatively invulnerable to the coagulative effects of standard bipolar electrocautery. It is important to note, however, that inordinately high bipolar levels were not tested in the current study, nor was the effect of blood or adjacent biological tissue, all of which might alter the physical properties of the suture in vivo with respect to bipolar cautery.

The data from this study suggest that cautery may be safely used in strabismus surgery, but the use of thermal electrocautery requires extreme care to avoid direct contact with the suture. On the other hand, bipolar cautery used at typical ophthalmic surgical settings does not appear to substantially weaken coated 910 polyglactin suture. Taken together, these data suggest that bipolar cautery may be preferable to thermal electrocautery in strabismus surgery.

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A new application of modified Nishida muscle transposition procedure for medial rectus muscle transection following endoscopic sinus surgery without tenotomy or splitting muscles

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The modified Nishida muscle transposition procedure, in which the one-third of the vertical rectus muscle bellies are sutured onto the sclera in the infero- and superotemporal quadrants without either tenotomy of the vertical rectus muscles or splitting of the vertical rectus muscle is an effective treatment for abducens nerve palsy. We report 2 cases of large-angle exotropia caused by medial rectus transection following the endoscopic sinus surgery treated using the modified Nishida procedure to transpose both vertical rectus muscles nasally, combined with lateral rectus muscle recession.

Patients with medial rectus transection, a severe but relatively rare complication of endoscopic sinus surgery (ESS), often present with large-angle exotropia and adduction deficits. Surgical management of the condition is challenging and often requires two or more procedures, especially in cases where the residual muscle stump cannot be recovered.[1] Full- or half-tendon vertical rectus transposition (VRT), such as the Hummelsheim procedure, is a viable treatment option in these cases; however, these procedures are technically complex and risk potential anterior segment ischemia, because they require operating on more than two rectus muscles. Additionally, the transposed muscles are split, and the anterior ciliary arteries in the transposed muscles may be compromised during the surgery. Vertical deviation is also a possible complication.

Muraki and colleauges[2] previously reported a case series that used a modified Nishida muscle transposition

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procedure for the treatment of abducens nerve palsy: the one-third of the vertical rectus muscle bellies in the infero- and superotemporal quadrants were sutured onto the sclera without either tenotomy of the vertical rectus muscles or splitting of the vertical rectus muscle. We report 2 patients in whom the modified Nishida muscle transposition procedure was combined with lateral rectus recession for the management of large-angle exotropia caused by medial rectus transection following ESS.

Case Reports

This study was approved by the Shanxi Province Eye Hospital Ethics Committee. Two adult patients with a medial rectus transection after ESS were treated using the modified Nishida procedure combined with lateral rectus muscle recession. Full ocular examinations were performed, including pre- and postoperative slit-lamp examination for signs of anterior segment ischemia. Ocular motility examination also included tests for ocular deviation in primary gaze, ductions, versions, and cyclotorsion. Both patients were followed up for more than 10 months.

All procedures were performed by the same surgeon (JHL). Upper and lower nasal fornix conjunctival incisions were made to locate the vertical rectus muscles, then 5-0 nonabsorbable sutures were passed through the nasal margin of each vertical rectus muscle at approximately one-third of its width and tied 10 mm behind the muscle insertion, thus avoiding placement of the suture around the anterior ciliary vessels (Figure 1A). The same sutures were then anchored through the scleral wall 12 mm from the superonasal and inferonasal limbus; thus, the nasal margins of the superior rectus and inferior rectus were transposed superonasally, or inferonasally, respectively (Figure 1B). Concurrent adjustable suture lateral rectus recession was performed in both cases. Meanwhile, interrupted 8-0 polyglactin 910 sutures were used for conjunctival closure.

Case 1

A 67-year-old woman presented with a marked exotropia and diplopia following ESS for nasal polyps 14 months previously (Figure 2A). She had normal visual acuity (20/20) in each eye. Prism cover testing revealed an exotropia of 80^{Δ} in the primary position. Her left eye could not adduct to midline; forced duction testing was negative. Orbital computed tomography (CT) revealed a bony defect in the medial orbital wall and a complete transection of the midportion of the medial rectus muscle in the left eye (Figure 2B). The rest of the anterior and posterior segment examination was normal. She underwent nasal vertical rectus muscle transposition using the modified Nishida procedure combined with an adjustable suture lateral rectus recession of 9 mm. Postoperatively she was orthotropic, with improved adduction to the midline and no diplopia in primary gaze (Figure 2C). The patient had

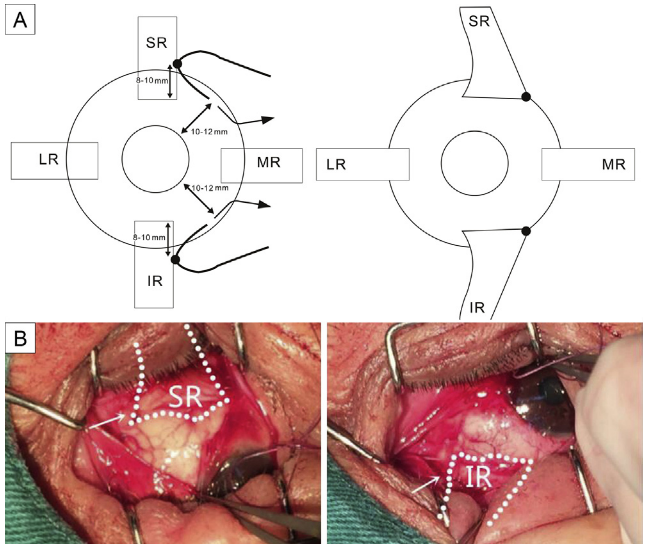

FIG 1. A, Illustration of the surgical method (right eye). One-third of each vertical rectus is transposed and anchored supero- or inferonasally. *IR*, inferior rectus muscle; *LR*, lateral rectus muscle; *MR*, medial rectus muscle; *SR*, superior rectus muscle. B, Transposed vertical rectus muscle (left eye).

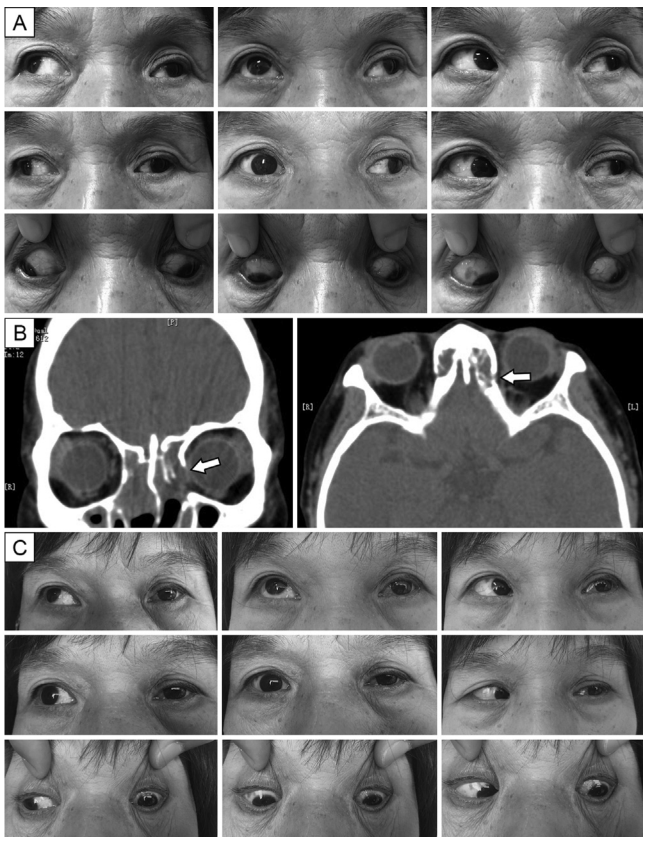

FIG 2. A, Preoperative eye position with right eye fixation. B, Orbital computerized tomography. In the coronal view, the arrow indicates the transection of the left medial rectus muscle; in the axial view, the defect in the medial wall of the left orbit. C, Postoperative eye position with right eye fixation.

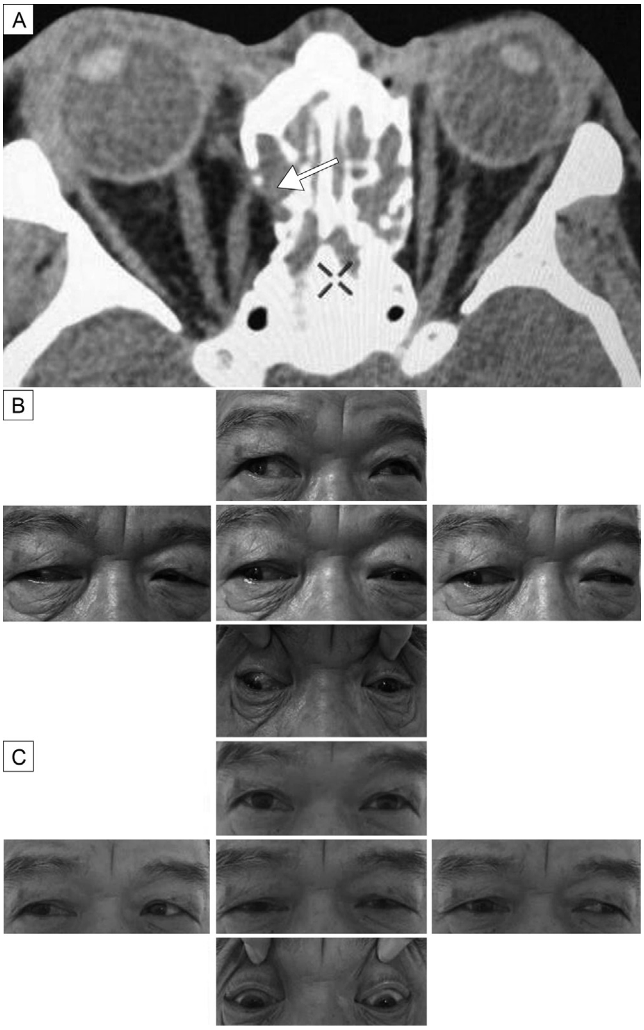

FIG 3. A, Orbital computerized tomography (axial view) showing the transection of the left medial rectus muscle (arrow). B, Preoperative eye position with left eye fixation. C, Postoperative eye position with left eye fixation.

a postoperative follow-up of more than 10 months, with no evidence of complications, vertical deviation, or cyclodeviation.

Case 2

A 63-year-old man suffered a medial rectus transection in the right eye after ESS. His condition was confirmed 16 months earlier by orbital CT. He had an exotropia of 90^{Δ} in the primary position, and his right eye could not adduct to the midline (Figure 3B). Forced duction testing was negative. The rest of the anterior and posterior segments examination was normal. Orbital CT scan also revealed a bony defect in the medial wall and a complete transection of the midportion of the right medial rectus muscle (Figure 3A). Nasal vertical rectus muscle transposition using the modified Nishida technique was performed in combination with an adjustable suture lateral rectus recession of 12 mm. Postoperatively the patient was orthotropic, and his right eye was able to adduct up to the midline (Figure 3C). He showed no signs of anterior segment ischemia, vertical deviation, or cyclodeviation up to 10 months after the surgical procedure.

Discussion

Tanaka and colleagues[3] reported success using the modified Nishida procedure to treat a patient with type 1 Duane syndrome. Sharma[4] has also reported success using the modified Nishida procedure in a case with an absence of medial rectus, although no details were provided on the etiology or the long-term outcome. Murthy and Pappuru[5] have also reported a good outcome in cases where the modified Nishida procedure was used to treat patients with monocular elevation deficiency. Based on these reports, we sought to manage exotropia caused by medial rectus transection using the same technique; in our cases, the transposition procedure was combined with a large ipsilateral lateral rectus recession and yielded a good result, with both patients achieving orthotropia in primary gaze position and resolution of diplopia.

In the case of medial rectus transection, full-tendon VRT with tenotomy and muscle splitting carry the risk of anterior segment ischemia because circulation is compromised when 3 rectus muscles are operated on. Anterior segment ischemia was not observed in either of our cases despite the involvement of 3 rectus muscles. Vertical deviation is another possible complication of VRT. According to Fitzsimons and colleagues,[6] the incidence of vertical deviation after standard VRT in adults with abducens nerve palsy is 13%-30%.[6] Vertical deviation did not occur in either of our cases, and we note the technical simplicity of our method, which does not employ additional procedures such as tenotomy, muscle splitting, and reattachment to new insertions, as required in the Hummelsheim procedure.

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