

Anterior Transposition of Inferior Oblique Muscle for Treatment of Unilateral Superior Oblique Muscle Palsy with Inferior Oblique Muscle Overaction

Yoon-Hee Chang¹, Kyoung Tak Ma², Jong Bok Lee², and Sueng-Han Han²

¹Department of Ophthalmology, Ajou University School of Medicine, Suwon, Korea;

²The Institute of Vision Research, Department of Ophthalmology, Yonsei University College of Medicine, Seoul, Korea.

Although many weakening procedures for the inferior oblique muscle have been advocated, there is some controversy as to the most beneficial procedure for weakening overacting inferior oblique muscles. This study was undertaken to determine if unilateral anterior transposition of the inferior oblique muscle alone could be a safe and effective procedure for treating unilateral superior oblique palsy from the perspective of hypertropia, inferior oblique overaction, and abnormal head posture. The records of 33 patients, who underwent anterior transposition of the inferior oblique muscle for unilateral superior oblique palsy at our institution between Jan 1995 and Dec 2002, were retrospectively reviewed. The average preoperative inferior oblique overaction was 2.3 ± 0.64 , and the hypertropia in the primary position was 12.3 ± 7.69 prism diopter (PD). Twenty-six patients showed head tilt to the opposite direction preoperatively. After the anterior transposition of the inferior oblique, inferior oblique overaction was diminished in 32 patients (97%). Twenty-six out of 33 patients (79%) had no hypertropia in the primary position at last postoperative assessment. Of the 26 patients with head tilt before surgery, 21 patients (81%) achieved full correction after surgery. Satisfactory results were obtained in most of the patients in our study with the exception of three patients who required additional surgery. No patient demonstrated postoperative hypotropia in the primary position. None of the patients noticed elevation deficiency or lower lid elevation. The anterior transposition of the inferior oblique was found to be safe and effective for treating superior oblique palsy with

secondary overaction of the inferior oblique muscle.

Key Words: Abnormal head posture, anterior transposition of inferior oblique muscle, hypertropia, inferior oblique overaction, superior oblique palsy

INTRODUCTION

Superior oblique palsy is the most common form of isolated vertical muscle palsy. A diagnosis is made by the criteria of the Parks three-step test, i.e. the vertical deviation is increased in adduction, and there is a head tilt to the opposite side.¹ Weakening the antagonist inferior oblique muscle is commonly used to treat superior oblique palsy when there is an overaction of the inferior oblique muscle. This can be accomplished by an inferior oblique myectomy, recession, disinsertion or extirpation, or recession with anterior transposition. Among these methods, the anterior transposition of the inferior oblique is performed by reattaching the insertion site of the inferior oblique muscle slightly anterior to the temporal border of the inferior rectus muscle. Elliott and Nankin reported that this slight modification of the standard recession is more effective than with other methods.² Anterior transposition is also known to be effective in inferior oblique muscle overaction especially when associated with dissociated vertical deviation (DVD).³⁻⁵ However, there are some reports showing ambiguous results from using anterior transposition of the inferior oblique muscle for the treatment of superior oblique palsy. In order to avoid postoperative hypotropia, it was

Received April 1, 2004

Accepted June 7, 2004

This paper was presented at the 89th meeting of the Korean Ophthalmological Society in Apr 2003.

Reprint address: requests to Dr. Sueng-Han Han, Department of Ophthalmology, Yonsei University College of Medicine, Yongdong Severance Hospital, 146-92 Dogok-dong, Kangnam-gu, Seoul 135-720, Korea. Tel: 82-2-3497-3440, Fax: 82-2-3463-1049, E-mail: shhan222@yumc.yonsei.ac.kr

suggested that anterior transposition should be performed in both eyes for bilateral inferior oblique muscle overaction and not unilaterally.⁶

For unilateral superior oblique palsy with moderate to severe hypertropia, recession of the ipsilateral superior rectus muscle or contralateral inferior rectus muscle in addition to unilateral inferior oblique muscle weakening procedure was usually performed simultaneously. This study was undertaken to determine whether unilateral anterior transposition of the inferior oblique muscle alone could be a safe and effective procedure for treating unilateral superior oblique palsy from the perspective of hypertropia, inferior oblique overaction, and abnormal head posture.

MATERIALS AND METHODS

The records of patients, who underwent anterior transposition of the inferior oblique muscle for unilateral superior oblique palsy at our institution between Jan 1995 and Dec 2002, were retrospectively reviewed. All the procedures were performed by one author. Patients with other ocular diseases or a previous history of ocular muscle surgery were excluded. Among 42 patients, 33 patients fulfilled the criteria. There were 16 males and 17 females with an average age of 8 (range 1-40) years. The average follow-up period was 19 (range 1-81) months.

For each patient, a full ocular examination including the visual acuity, versions and ductions in the diagnostic positions of gaze, the primary position deviation at distance and at near and with head tilt, abnormal head posture (head tilt), cycloplegic refraction and fundus examination was performed. Inferior oblique overaction was measured in adduction position by comparing the difference in the height of the eyes at the 6 o'clock limbus and graded according to the amount of over elevation of the eye (in comparison with the position of the other eye): 1+ represented 1 mm, 2+ represented 2 mm, 3+ represented 3 mm, 4+ represented 4 mm of over elevation.⁶ Hypertropia was measured in the primary position at distance using prism and cover test.

The same surgical method was used in all patients.⁷ Locking forceps were placed at the

conjunctiva near the limbus at 12 o'clock position and the eyeball was retracted superiorly. The conjunctiva and Tenon's capsule were incised using Wescott scissors 8 mm from the limbus at the inferotemporal direction. Bleeding was controlled by cautery. The inferior oblique muscle was isolated with a muscle hook and the muscle was clipped with two mosquitos and severed with the Wescott scissors. One 7-0 vicryl double-armed suture was placed through the insertion site of the muscle and reattached to the sclera adjacent to the temporal side of the inferior rectus muscle insertion site. The conjunctival flap was placed and closed with 7-0 vicryl interruptedly. Five patients underwent concurrent horizontal rectus muscle surgery.

All preoperative and postoperative examinations and measurements were made by the same observer, thereby insuring there were no observer variations in the study. The postoperative results at last follow-up visit were evaluated in terms of hypertropia, inferior oblique overaction, and abnormal head posture.

RESULTS

The average preoperative inferior oblique overaction in the 33 patients was average 2.3 ± 0.64 , and the average hypertropia in the primary position was 12.3 ± 7.69 prism diopter (PD). Twenty-six patients exhibited head tilt to the opposite direction preoperatively. The average postoperative follow-up period was 19 months ranging from 1 to 81 months. Table 1 shows the clinical characteristics of the patients.

As shown in Fig. 1, inferior oblique muscle overaction was diminished in 32 patients (97%) and reduced in 1 patient. Twenty-six out of 33 patients (79%) had no hypertropia in the primary position at last postoperative assessment, and 6 patients had some residual but smaller hypertropia. One patient showed a 1 PD-increase in hypertropia after surgery. The mean reduction in hypertropia was 10 PD (Fig. 2). Out of the 26 patients with head tilt prior to surgery, 21 patients (81%) achieved full correction, and 5 patients displayed residual head tilt. No patient demonstrated postoperative hypotropia in the primary position.

Table 1. Clinical Characteristics of the Patients

No.	Sex	Age	IOOA	Hypertropia (prism diopter)	Head tilt	Postop. IOOA	Postop. hypertropia	Postop. head tilt	Follow-up (months)	
1	m	4	2	6	right tilt	-	0	none	2	
2	m	13	2	16	right tilt	-	0	none	6	
3	m	6	2	15	-	-	0		2	
4	m	39	3	30	right tilt	-	5	none	1	
5	f	3	4	20	left tilt	-	0	none	5	LIOOA 3+
6	f	2	2	10	right tilt	-	10	none	11	
7	m	3	2	15	left tilt	-	0	none	9	LIOOA 2+
8	f	10	3	30	-	-	0	none	8	
9	f	6	2	8	left tilt	-	0	none	1	
10	f	5	1	10	left tilt	-	0	none	10	Concurrent XT
11	f	3	2	10	right tilt	-	0	left tilt	27	RIOOA(2+)
12	f	3	2	5	left tilt	-	0	none	16	
13	f	4	2	14	right tilt	-	0	none	10	
14	m	40	2	20	-	-	12		1	
15	m	4	3	16	right tilt	-	0	slight right tilt	3	
16	f	1	3	20	right tilt	-	16	none	31	
17	m	5	2	3	right tilt	-	0	none	28	
18	f	9	2	7	left tilt	-	0	none	29	
19	m	14	2	10	left tilt	-	0	none	3	RIOUA(1-)
20	f	7	3	26	-	-	0	none	21	
21	m	5	2	9	right tilt	-	0	none	19	RIOOA(1+), Rt. Hypertropia 10
22	m	2	2	20	right tilt	-	14	right tilt	14	Concurrent XT
23	m	3	2	0	right tilt	-	0	none	27	
24	f	4	2	15	right tilt	-	0	slight right tilt	28	
25	f	3	2	16	right tilt	-	0	none	67	Concurrent XT
26	f	2	2	5	right tilt	-	6	none	64	
27	f	1	3	0	-	1	0	right tilt	63	Concurrent ET, LIOOA(3+)
28	f	2	3	6	right tilt	-	0	none	81	Concurrent XT
29	m	15	3	14	left tilt	-	14	none	1	
30	m	2	1	4	left tilt	-	0	none	9	
31	m	34	2	6	-	-	0		1	
32	m	5	3	18	left tilt	-	0	none	4	Concurrent XT
33	f	4	3	10	-	-	0	none	21	

IOOA, Inferior oblique overaction; XT, Exotropia; IOUA, Inferior oblique underaction; ET, Esotropia.

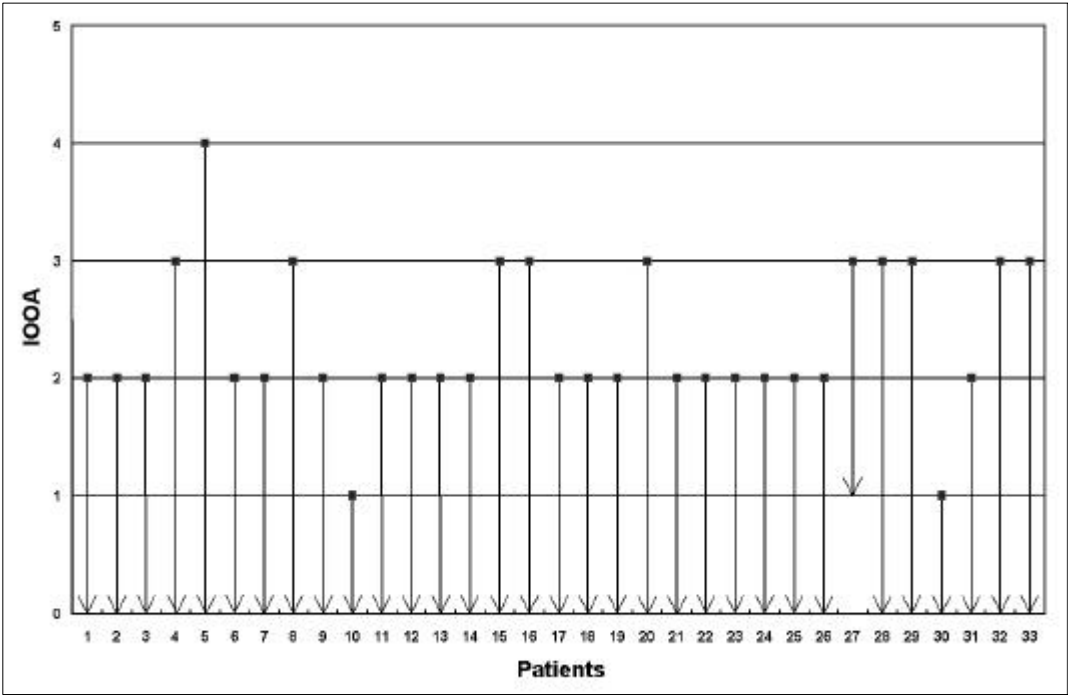


Fig. 1. Preoperative and postoperative inferior oblique overaction (IOOA). The inferior oblique muscle overaction was diminished in 32 patients (97%) and reduced in 1 patient.

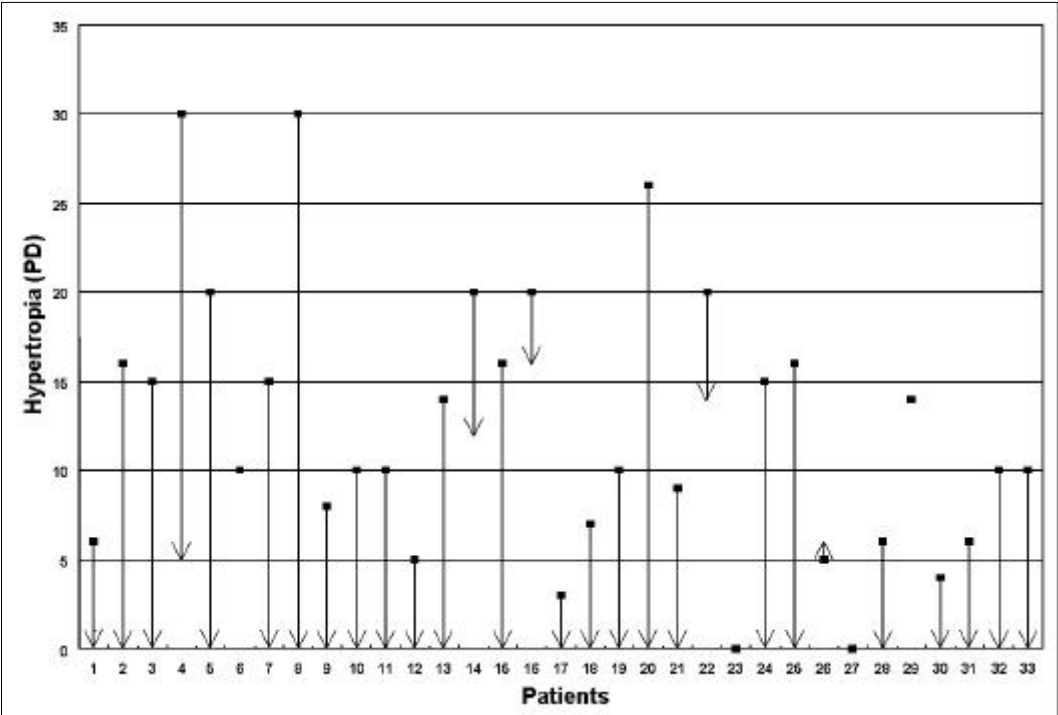


Fig. 2. Preoperative and postoperative hypertropia. Twenty-six out of 33 patients (79%) had no hypertropia in the primary position at last postoperative assessment, and 6 patients had a residual hypertropia. One patient showed a 1 PD-increase of hypertropia after surgery.

In addition, none of the patients noticed elevation deficiency or lower lid elevation. Five patients subsequently developed a contralateral inferior oblique overaction. One patient developed an underaction (1-) of the inferior oblique muscle. Three patient required additional surgery during the follow-up period.

DISCUSSION

Since Duane first described a transcutaneous tenotomy at the origin of the inferior oblique muscle in 1906, there has been some controversy as to the most beneficial procedure for weakening overacting inferior oblique muscles.^{8,9} There have been many weakening procedures on the inferior oblique muscle advocated for both primary and secondary overaction. Recently, the notion that anterior displacement of an inferior oblique muscle enhances its weakening effect has attracted increasing tension.¹⁰ The mechanics of the inferior oblique action dictate its anatomy: the insertion is temporal to the globe's center of rotation and is oriented in the anterior to posterior line, the anterior fibers being the effective extorters, the posterior fibers being the effective elevators. Therefore, anterior transposition of the inferior oblique muscle markedly weakens the ability to elevate the eye and weakens the excycloduction to a lesser degree. Elliott and Nankin first reported that the inferior oblique was specifically attached immediately adjacent to the temporal margin of the insertion of the inferior rectus.² They showed that it was effective for treating severe and recurrent inferior oblique overaction. A subsequent report by Bremer et al emphasized the risk of this procedure producing a primary position hypotropia when used unilaterally for treating an overacting inferior oblique secondary to superior oblique palsy.¹¹ On the other hand, May et al., reported no primary position hypotropia in 12 patients with unilateral superior oblique palsy who had been treated using the same technique.¹²

Elliott and Nankin reported recurrence of inferior oblique overaction in 64% of patients who had received anterior transposition.² In this study, overaction of +1 was observed in 1 patient (3%) and 7 patients had residual hypertropia in the pri-

mary gaze. Abnormal head posture was corrected in 22 out of the 26 patients with head tilt.

Satisfactory results were obtained from most patients in this study with the exception of three who required additional surgery. Five patients (No. 5, 7, 11, 21, 27) subsequently developed signs of a contralateral inferior oblique overaction. Despite the careful examination for the preoperative signs of asymmetric bilateral superior oblique muscle paresis, these five patients showed masked bilateral superior oblique muscle paresis during the follow up period. Three patients (No. 11, 21, 27) underwent anterior transposition of the contralateral inferior oblique muscle thereby eliminating the inferior oblique overaction.

One patient (No. 19) developed a 1- underaction of the inferior oblique. However, there was no hypotropia or elevation deficiency in the primary position. This mild underaction was neither cosmetically noticeable nor functionally unacceptable. Although none of the patients in this study had consecutive deficiencies of up gaze at last post-operative assessment, this complication has been reported with anterior transposition of the inferior oblique. In addition, the possibility of this complication with this procedure, either as a transient or permanent phenomenon, should be considered.¹³ Kushner reported that transposition of the inferior oblique muscle more than 1 mm anterior to the insertion of the inferior rectus muscle and temporal displacement of its posterior fibers by more than 5 mm, may cause this phenomenon.¹⁴ In our patients, the tip of the disinserted inferior oblique muscle was sutured to the sclera, just anterior to the insertion of the inferior rectus muscle, and temporal displacement of the posterior fibers of the inferior oblique muscle was limited to within 2 mm. Using this type of anterior transposition, we found no hypotropia in the primary position or any marked limitation of up gaze in our patients.

In conclusion, the anterior transposition of the inferior oblique muscle was effective in eliminating inferior oblique overaction and abnormal head posture, as well as reducing the hyperdeviation in patients with superior oblique palsy. Although more experience will be needed to assess the long-term effects, this procedure was found to be generally safe and effective in the

treatment of superior oblique palsy with secondary overaction of the inferior oblique muscle.

REFERENCES

1. Parks MM. The overacting inferior oblique muscle. *Am J Ophthalmol* 1974;77:787-97.
2. Elliott RL, Nankin ST. Anterior transposition of the inferior oblique. *J Pediatr Ophthalmol Strabismus* 1981; 18:35-8.
3. Elliott RL, Parks MM. A comparison of inferior oblique muscle weakening by anterior transposition or denervation-extirpation. *Binocul Vis Eye Muscle Surg Q* 1992; 7:205-10.
4. Burke JP, Scott WE, Kutschke PJ. Anterior transposition of the inferior oblique muscle for dissociated vertical deviation. *Ophthalmology* 1993;100:245-50.
5. Kartz RE, Rogers GL, Bremer DL, Leguire LE. Anterior transposition of the inferior oblique muscle for dissociated vertical deviation. *J Pediatr Ophthalmol Strabismus* 1989;29:212-7.
6. Del Monte MA, Parks MM. Denervation and extirpation of the inferior oblique. *Ophthalmology* 1983;90: 1178-83.
7. Edward GB, MB Shields. *Atlas of Ophthalmic Surgery* 1st ed. Vol. 3. St. Louis: Mosby; 1995. p.96-9.
8. Duane A. Tenotomy of inferior oblique and consideration of the conditions that may call for the operation. *Br Med J* 1906;2:1867-70.
9. Maureen AM, George RB, Ronald LP. Recession and anterior transposition of the inferior oblique for treatment of superior oblique palsy. *Graefes Arch Clin Exp Ophthalmol* 1988;226:407-9.
10. Apt L, Call NB. Inferior oblique muscle recession. *Am J Ophthalmol* 1978;85:95-100.
11. Bremer DL, Rogers GL, Quick LD. Primary position hypotropia after anterior transposition of the inferior oblique. *Arch Ophthalmol* 1986;104:229-32.
12. May MA, Beauchamp GR, Price RL. Recession and anterior transposition of the inferior oblique for treatment of superior oblique palsy. *Graefes Arch Clin Exp Ophthalmol* 1988;226:407-9.
13. Farvardin M, Nazarpour S. Anterior transposition of the inferior oblique muscle for the treatment of superior oblique palsy. *J Pediatr Ophthalmol Strabismus* 2002;39:100-4.
14. Kushner BJ. Restriction of elevation in abduction after inferior oblique anteriorization. *J AAPOS* 1997;1:55-62.