Original Article

Comparing Inferior Oblique Muscle Myectomy with and without Displacement of Bilateral Rectus Muscles in Correction of Exotropia V Pattern with Severe Inferior Oblique Muscle Overreaction: A Pilot Study

Habibollah Zanjani [1], MD; Mohammad Sadeq Mohammadzadeh [*2], MD

1. Department of Ophthalmology, Alzahra Eye Hospital, Zahedan University of Medical Sciences, Zahedan, Iran.
2. General Ophthalmologist, Besat Hospital, Tehran, Iran.

***Corresponding Author:** Mohammad Sadeq Mohammadzadeh
E-mail: sadeq87@yahoo.com

Article Notes:

Received: Nov. 14, 2018
Received in revised form: Dec. 30, 2018
Accepted: Jan. 6, 2019
Available Online: Apr. 8, 2019

Keywords:

Exotropia
Myectomy
Treatment
Surgery

Abstract

Purpose: To evaluate a new method of inferior oblique muscle myectomy with displacement of the external rectus muscles on both sides for correction of exotropia V pattern with severe inferior oblique muscle overaction.

Patients and Methods: In a pilot study, 9 patients with exotropia V pattern strabismus who were referred to Al-Zahra Ophthalmology Hospital, Tehran, Iran, in 2011 were studied in two randomly divided groups: group A underwent conventional surgical treatment including external rectus resection and inferior oblique weakening and in addition received external rectus displacement upwards while group B only received the conventional treatment.

Results: The mean V pattern before surgery in group A was 41 ± 16.7 prism diopters which changed to 6 ± 10.7 prism diopters after surgery. The mean V pattern before surgery in group B was 37.2 ± 4.3 prism diopters which changed to 19.5 ± 3.1 prism diopters after surgery. In group A, V-pattern correction was 35.0 ± 11.6 prism diopters while it was 20.2 ± 1.2 prism diopters in group B, which indicated a statistically significant difference between the two groups (P = 0.04).

Conclusion: Our results suggest that the mean V Pattern correction among patients undergoing our modified surgical method was significantly higher than the conventional method. Further comparative studies with a higher number of participants are suggested to confirm our results.

How to cite this article: Zanjani H, Mohammadzadeh MS. Comparing Inferior Oblique Muscle Myectomy with and without Displacement of Bilateral Rectus Muscles in Correction of Exotropia V Pattern with Severe Inferior Oblique Muscle Overreaction: A Pilot Study. Journal of Ophthalmic and Optometric Sciences . 2019;3(2): 10-15.

Introduction

Inferior oblique muscle overaction is a relatively common eye movement disorder which is observed when one eye is too high when looking inward and is often accompanied by horizontal deviations [1]. It is reported in 70 % of patients with esotropia and 30 % of patients with exotropia [1]. There are two types of inferior oblique muscle overaction, the primary type is often bilateral and has an unknown cause, but the secondary type, which is unilateral, occurs due to ipsilateral superior oblique palsy or contralateral superior rectus palsy [1], and is commonly seen in new and recurrent cases of strabismus [2]. The exotropia pattern states that exotropia increases when looking upwards and that there is a difference of at least 15 prism diopter between looking up and down [3]. In many cases, inferior oblique muscle overaction is seen with this disorder [1]. Recognition and treatment of A and V patterns has become a very important factor in treatment of strabismus in recent decades, since it increases the therapeutic effect of correcting horizontal strabismus [4]. Different theories have been proposed to determine the cause of A and V patterns, including oblique muscle dysfunction, ocular circuit abnormalities, craniofacial abnormalities, changes in horizontal rectus muscle activity, and vertical rectus muscle paralysis [5].

Several surgical methods are used to weaken the inferior oblique muscle [6,7]. Myectomy is one of the common surgical treatments for these patients [8,9]. In oblique myectomy, part of the muscle between the neurofibrovascular bundle and the insertion is removed [2]. Therapies available to correct V pattern exotropia, in addition to correcting horizontal deviation (exotropia), are based on different methods of weakening the inferior oblique muscle to correct the V-pattern. Another way to correct the V pattern when there is no overaction of the inferior oblique muscle is to move the horizontal rectus muscles [10].

Considering that in previous studies, V pattern has not been completely corrected by inferior oblique muscle weakening methods when there is overaction in this muscle, in the present pilot study, we intended to examine a modified surgical technique including an extra step (displacement of the external right muscle upwards) in addition to weakening the inferior oblique muscle to better correct the V pattern and compare its results with weakening the inferior oblique muscle alone.

Patients and Methods

In this pilot study, all patients referred to Al-Zahra Ophthalmology Hospital Zahedan, Iran, from September 2010 to June 2011 who had V pattern and exotropia of more than 20 prism diopter, and had superior oblique muscle overaction and vertical deviation in addition to horizontal deviation were included. Patients with previous history of strabismus surgery and craniofacial anomaly were excluded. This study was approved by our ethics committee board and written consent was obtained from all patients before entering the study. Nine patients with exotropia V pattern were randomly divided into two groups: group A underwent conventional surgical treatment including external rectus resection and inferior oblique weakening and in addition received external rectus displacement upwards while group B only received the conventional treatment. For all patients, complete ocular examinations were performed before surgery, including fundoscopic examination with indirect ophthalmoscopy, slit lamp, and refraction examinations. A prism was used to measure the amount of deviation under examination and hyperactivity of the inferior

oblique muscle. Exotropia correction surgery was performed by taking back the joint of the external right muscle. In the control group (Group B) the inferior oblique muscle overaction surgery was performed by cutting the muscle joint to the eyeball by 8 mm. In the case group (Group A) in addition to above mentioned corrections a displacement upwards of external rectus muscle was performed. Patients were examined with a prism the day after surgery and four months after surgery. Exotropia V pattern levels were examined before and after surgery. In addition to the V pattern, the amount of exotropia in different positions (looking straight ahead, up and down) was measured and compared between the two groups. We used SPSS version 21 (Armonk, NY: IBM Corp.) software and Student's paired T test for comparisons and P values less than 0.05 were considered as statistically significant.

Results

Out of 9 patients (5 patients in group A and 4 patients in group B), 4 patients were male and 5 patients were female. The mean age of patients was 21.8 ± 9.6 years in group A and 21.5 ± 15.1 years in group B. The mean exotropia in looking straight ahead, up and down in group A before surgery and after surgery as well as V pattern is shown in table 1. Table two shows the same preoperative and postoperative results for group B. The mean V pattern before surgery in group A was 41 ± 16.7 prism diopters which changed to 6 ± 10.7 prism diopters after surgery (Table 1). In group B, the mean V Pattern before surgery was 37.2 prism diopters which changed to 19.5 ± 3.1 prism diopters after surgery (Table 2).

The rate of V pattern correction was compared in the two groups after surgery. In group A, the rate of V pattern correction was 35.0 ± 11.6 prism diopters and in group B it was 20.2 ± 1.2 prism diopters indicating a statistically significant difference (P = 0.04) (Table 3). In addition, there was a statistically significant difference between the two groups in the rate of correction of exotropia in looking upwards (P = 0.02) (Table 3). Regarding the rate of exotropia correction in the looking straight ahead and downward no statistically significant difference was observed between the two groups (Table 3). In the present study, the rate of external rectus muscle weakness was investigated in the two groups. In group A, this amount was 9.4 ± 0.8 mm and in group B it was 8.2 ± 2.2 mm, showing no statistically significant difference. The surgical success was defined as exotropia of 8 prisms or less and V pattern of 15 prism diopters or less. No

Table 1: Exotropia in group A before and after surgery

Variable / Group A	Before Surgery		After Surgery	
	Mean	Standard Deviation	Mean	Standard Deviation
Exotropia when looking Straight Ahead	56	14.7	2.8	7
Exotropia when Looking Upwards	66	19.4	7	14.1
Exotropia when Looking Downwards	23	12	-0.6	5.4
V Pattern	41	16.7	6	10.7

Table 2: Exotropia in group B before and after surgery

Variable / Group B	Before Surgery		After Surgery	
	Mean	Standard Deviation	Mean	Standard Deviation
Exotropia when looking Straight Ahead	41.2	16.5	1.0	6.2
Exotropia when Looking Upwards	52.5	12.5	17.5	6.4
Exotropia when Looking Downwards	8.7	4.7	-2.0	5.8
V Pattern	37.2	4.3	19.5	3.1

Table 3: Comparison of exotropia correction between groups A and B after surgery

Variable	New method (A)		Conventional surgery (B)		P value*
	Mean	Standard Deviation	Mean	Standard Deviation	
Exotropia correction when looking Straight Ahead	53.2	9.4	40.2	10.7	0.09
Exotropia correction when looking upwards	59	14.4	35	7	0.02
Exotropia correction when looking downwards	23.6	13.5	10.7	2	0.1
V Pattern correction	35	11.6	20.2	1.2	0.04

* Student's paired T test

patient in group B achieved post surgical V pattern of less than 15 prism diopters, while 4 patients out of 5 patients in group A achieved a post surgical V pattern of less than 15 prism diopters.

Discussion

A wide range of surgical procedures can be used to weaken the function of the inferior oblique muscle including myotomy, myectomy, disinsertion and denervation with extirpation. Although these methods are well described in previous studies, the results are varied and there is limited experience in these methods [2]. Several studies have focused on the efficacy of oblique muscle weakening to correct strabismus [11-14] and few studies have focused on the effects of oblique muscle weakening with horizontal deviations [15,16]. Previous studies have also reported the effects of oblique muscle surgery on horizontal deviations in the initial positions. A study by Stager et al.,[17] showed that no significant horizontal change was seen in 84 % of patients with a horizontal deviation of 10 prism diopters or less who underwent inferior oblique surgery. In another study, Sekeroglu et al., [16] found that after performing the muscle weakening procedure, a median of 4 prism diopters of horizontal lines correction occurred in near and distance.

In the present study the mean V pattern before surgery in group A (undergoing modified surgical method) was 41 ± 16.7 prism diopters which changed to 6 ± 10.7 prism diopters after surgery. In group B (undergoing non modified surgical method) the mean V Pattern before surgery was 37.2 prism diopters which changed to 19.5 ± 3.1 prism diopters after surgery. In a study by Ozsoy et al., 1 deviation was detected in 20.2 % of patients and all patients had V pattern. Although the prevalence of total pattern deviation in patients with strabismus has been reported to be between 12.5 % and 87.7 %, about 20 % of strabismus patients are expected to have a deviant pattern [13,18]. Regarding the amount of V pattern correction in groups A and B after surgery, our results showed that in group A, the amount of V-pattern correction was 35.0 ± 11.6 diopters and in group B it was 20.2 ± 1.2 prism diopter that indicated a statistically significant difference between the two groups (P = 0.04). Previous studies have shown that despite weakening of the inferior oblique muscle, the V pattern cannot completely be corrected 11,19,20. Rosenbaum in the book Strabismus Clinical Surgery states that any method used to weaken the inferior oblique muscle modifies the pattern by a maximum of twenty prism diopters [4]. Therefore, in V patterns higher than this, this method alone is not enough. For example, a study by Prakash et al., [19] in 1983 reported a mean exotropia V pattern correction by the conventional weakening method of 18 prism diopters, which is comparable to our non-modified surgical results but much less than the V pattern correction we achieved in our modified method. Another study by Kamlesh et al., [20] in 2002 reported a mean exotropia V pattern correction of 22 prism diopters using the conventional method. Although the mean V pattern correction in this study was more than the mean V pattern correction achieved in the control group of our study (conventional surgery), it was still less than the V pattern correction we achieved in our modified method.

Conclusion

Our results suggest that the mean V Pattern correction among patients undergoing our modified surgical method was significantly higher than the conventional method. Further comparative studies with a higher number of participants are suggested to confirm our results.

Authors ORCIDs

Habibollah Zanjani:
https://orcid.org/0000-0002-7605-1918
Mohammad sadegh Mohammadzadeh:
https://orcid.org/0000-0002-0680-9463

References

1. Ozsoy E, Gunduz A, Ozturk E. Inferior Oblique Muscle Overaction: Clinical Features and Surgical Management. J Ophthalmol. 2019;2019:9713189.

2. Stager D Jr, Dao LM, Felius J. Uses of the Inferior Oblique Muscle in Strabismus Surgery. Middle East Afr J Ophthalmol. 2015;22(3):292-7.

3. Stuart JA, Burian HM. Changes in horizontal heterophoria with elevation and depression of gaze. Am J Ophthalmol. 1962;53:274-9.

4. Rosenbaum AL, Santiago AP. Clinical strabismus management: principles and surgical techniques: Philadelphia: David

Hunter; 1999.
5. Lee YB, Rhiu S, Lee JY, Choi MY, Paik HJ, Lim KH, et al. Effect of horizontal rectus surgery for the correction of intermittent exotropia on sub-A or sub-V pattern. PLoS One. 2017;12(6):e0179626.
6. Akar S, Gökyiğit B, Yilmaz OF. Graded anterior transposition of the inferior oblique muscle for V-pattern strabismus. J AAPOS. 2012;16(3):286-90.
7. Awadein A, Fouad HM. Management of large V-pattern exotropia with minimal or no inferior oblique overaction. J AAPOS. 2013;17(6):588-93.
8. Shipman T, Burke J. Unilateral inferior oblique muscle myectomy and recession in the treatment of inferior oblique muscle overaction: a longitudinal study. Eye (Lond). 2003;17(9):1013-8.
9. Min BM, Park JH, Kim SY, Lee SB. Comparison of inferior oblique muscle weakening by anterior transposition or myectomy: a prospective study of 20 cases. Br J Ophthalmol. 1999;83(2):206-8.
10. Min BM, Park JH, Kim SY, Lee SB. Comparison of inferior oblique muscle weakening by anterior transposition or myectomy: a prospective study of 20 cases. Br J Ophthalmol. 1999 ;83(2):206-8.
11. Lee SY, Rosenbaum AL. Surgical results of patients with A-pattern horizontal strabismus. J AAPOS. 2003;7(4):251-5.
12. Ung T, Raoof N, Burke J. Effect of superior oblique weakening on vertical alignment and horizontal and vertical incomitance in patients with A-pattern strabismus. J AAPOS. 2011; 15(1):9-13.
13. Sekeroglu HT, Turan KE, Uzun S, Sener EC, Sanac AS. Horizontal muscle transposition or oblique muscle weakening for the correction of V pattern? Eye (Lond). 2014;28(5):553-6.
14. Ranka MP, Liu GT, Nam JN, Lustig MJ, Schwartz SR, Hall LS, et al. Bilateral posterior tenectomy of the superior oblique muscle for the treatment of A-pattern strabismus. J AAPOS. 2014;18(5):437-40.
15. Souza-Dias C. Horizontal effect of the surgical weakening of the oblique muscles. Arquivos brasileiros de oftalmologia. 2011;74(3):180-3.
16. Sekeroglu HT, Dikmetas O, Sanac AS, Sener EC, Arslan U. Inferior oblique muscle weakening: is it possible to quantify its effects on horizontal deviations? J Ophthalmol. 2012;2012:813085.
17. Stager DR, Parks MM. Inferior oblique weakening procedures. Effect on primary position horizontal alignment. Arch Ophthalmol. 1973;90(1):15-6.
18. Li Y, Ma H, Zhao K. Effects of Bilateral Superior Oblique "Hang-Back" Recession in Treatment of A-pattern Strabismus with Superior Oblique Overaction. Strabismus. 2016;24(1):1-6.
19. Prakash P, Menon V, Nath J. Surgical management of A & V patterns. Indian J Ophthalmol. 1983;31(5):463-9.
20. Kamlesh, Dadeya S, Kohli V, Fatima S. Primary inferior oblique overaction-management by inferior oblique recession. Indian J Ophthalmol. 2002;50(2):97-101.

Footnotes and Financial Disclosures

Conflicts of interest:

The authors have no conflicts of interest with the subject matter of the present manuscript.