Effect of Horizontal Strabismus Surgery on the Astigmatism

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Objective: *To investigate the effect of horizontal rectus muscle surgery on astigmatism.*
Material and Method: *A prospective descriptive study was conducted between July 2004 and June 2005, we recruited 16 strabismic patients with bilateral recession or recession of one horizontal muscle or monocular recession and resection for this study at Srinagarind Hospital. The authors measured the patients' best-corrected visual acuity and ocular alignment using the prism cover test and the Modified Krimsky tests, respectively. Auto-refraction was performed on the pre- operative and first post operative day by a technician not apprised of the type and/or amount of surgery. Any differences between the pre-operative and post operative astigmatism were calculated using the x-y coordinate system and the mean value for astigmatism. Descriptive statistics were used to analyze the data.*
Results: *Included were 23 eyes from 16 patients who met the inclusion criteria; 8 females; 8 males; average age 14.75 $\pm$ 11.76 (range, 4-40) years. Seven patients (43.75%) had esotropia and nine (56.25%) exotropia. For all procedures, the respective mean cylinder of the pre- operative and first post-operative day were 0.74 $\pm$ 1.20 D in 67.56° axis and 0.69 $\pm$ 0.86 D in 56.30° axis, in the same direction as the cylinders for each type. There was no statistically significant change in the refractive error between the pre- operative and first post-operative day.*
Conclusion: *In contrast to previous studies, astigmatism was not significantly affected by horizontal rectus muscle surgery; however, the present study population was small. Therefore, a larger prospective control trial would be necessary to definitively answer this question.*

Keywords: *Astigmatism, Horizontal strabismus surgery*

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Changes in refractive error have been reported after horizontal rectus muscle surgery. Previous studies found that changes in the refractive stage were myopia or with-the-rule astigmatism. Most of these changes are related to corneal changes secondary to tension of the extra-ocular muscles transmitted from the sclera to the cornea[1-13].

The authors investigated the refractive changes after the horizontal strabismus surgery.

Material and Method

After the consideration of the institutional review board, sixteen patients who planned to have unilateral or bilateral recession of horizontal muscles or monocular recession and resection were recruited into the present study with informed consent. Patients with irregular cornea, unilateral blindness, previous strabismus surgery, and/or poor co-operation were excluded.

All patients underwent surgery between July 2004 and June 2005. Pre-operative examinations were performed, including measurement of best-corrected visual acuity (BCVA) and ocular alignment. Automated refraction was measured with Humphrey automated refractor model 599 on the pre- and first post operative day by a technician, not apprised of the type and/or amount of surgery in each of the patients. (Demographic and refractive data are presented in Table 1).

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Table 1. Demographic and refractive data of all patients

Pt.	Age	Sex	Procedure	Eye	Mean pre-operative cylinder	Mean pre-operative axis	Mean post-operative cylinder	Mean post-operative axis
1	40	M	RMR recess	R	0.25	90.34	0.5	90.46
				L	0.25	90.34	0.5	90.34
2	16	M	RLR recess	R	0.25	0.48	0.25	179.49
				L	0	0	0	0
3	36	F	RLR recess	R	0.50	179.39	0.25	179.33
				L	0.25	90.16	0.50	89.60
4	12	F	BMR recess	R	0.25	179.76	1.00	0.31
				L	0.25	179.76	0.75	90.32
5	12	F	BMR recess	R	0	0	0.25	0.47
				L	0.25	0.63	0.25	89.75
6	6	F	BLR recess	R	0	0	0	0
				L	0	0	0	0
7	4	F	BLR recess	R	2.50	90.46	2.00	0.17
				L	1.00	179.61	1.50	90.74
8	6	M	BLR recess	R	4.75	90.60	4.50	90.02
				L	3.00	89.61	4.50	89.61
9	4	M	BMR recess	R	0.25	90.46	0.25	0.17
				L	0.25	0.59	0.50	89.90
10	17	M	BLR recess	R	1.00	179.5	1.00	0.63
				L	0	0	0	0
11	6	M	RMRrecess & RLRresect	R	0	0	0.50	90.43
				L	0	0	0	0
12	6	M	LMRresect & LLRrecess	R	0	0	0	0
				L	0	0	0.75	90.09
13	6	F	RMRrecess & RLRresect	R	0.75	179.98	0.75	89.98
				L	0.50	0.31	0.25	0.46
14	19	M	RMRresect & RLRrecess	R	4.25	179.62	2.00	89.45
				L	1.50	0.32	1.50	0.75
15	11	F	LMRrecess & LLRresect	R	0.25	90.61	0	0
				L	1.25	90.32	1.25	179.75
16	36	F	RMRresect & RLRrecess	R	0.25	89.32	0.75	90.72
				L	0	0	0	0

Standard procedures for recession and resection were performed by a single surgeon. The amount of muscle resection and recession were based on the pre-operative angle of deviation.

Refraction was measured and recorded in plus-cylinder form. The difference of refraction between pre- operative and the first post operative day was calculated by using the x-y coordinate system and mean value of astigmatism, which was developed by Holladay et al[13,14]. Descriptive statistic was analyzed. Paired t-test was used to find out the difference between pre and post operative. A p-value of less than 0.05 was considered significant difference.

Results

Twenty-three eyes from 16 patients were included in the present study. The average age of the patients was 14.75 $\pm$ 11.76 (range, 4-40) years, eight (50%) were males. Nine patients (56.25%) had exotropia and seven (43.75%) esotropia. Recession of one horizontal rectus muscle, bilateral recession, and monocular recession and resection, were performed in three (18.75%), seven (43.75%) and six (37.50%) patients, respectively.

For all types of surgery, the respective mean values for the pre- operative and post operative astigmatism were 0.74 $\pm$ 1.20 D in 67.56° axis and 0.69 $\pm$ 0.89

Table 2. Mean ± values of pre- and post-operative astigmatism

Procedures	Pre-operative cylinder		Post-operative cylinder		p-value
	power (D)	Axis	Power(D)	Axis	
Unilateral recession	0.25 ± 0.14	75.11	0.33 ± 0.18	119.70	0.36
Bilateral recession	0.96 ± 1.39	77.21	0.89 ± 1.15	32.29	0.20
Monocular recession and resection	0.72 ± 1.17	52.54	0.64 ± 0.64	52.62	0.70
All procedures	0.74 ± 1.20	67.56	0.69 ± 0.89	56.30	0.78

D in 56.30° axis: the difference was not statistically significant (p = 0.78). With regard to each type of operation, there were similar astigmatic changes but the differences were also not statistically significant (Table 2).

Discussion

The refractive stage of the human eye changes most rapidly in the first 2 to 3 years of life but continues to change throughout life, including changes in direction of with-the-rule astigmatism in children and young adults, then against-the-rule astigmatism in older individuals[15-17]. The authors' pre-operative refractive data of the patients were also with-the-rule astigmatic direction (0.74 ± 1.20 D, axis 67.56).

After horizontal strabismus surgery, the refractive changes in the with-the-rule astigmatic direction are explained by flattening in the horizontal meridian and steeping of the vertical meridian of the cornea. Many authors reported the surgical-induced refractive changes were usually transient and improved within 6 months[1,4,5,8,10]. Nardi et al reported the significant astigmatic changes on the first post-operative day compared to the pre-operative period[1]. In the presented patients, the surgically-induced astigmatic changes compared to the pre-operative period were with-the-rule astigmatism, but the amounts of changes were not statistically significant (Table 2).

In contrast to previous studies, the authors found astigmatism was not significantly affected by horizontal rectus muscle surgery; however, the enrolled patients in the present study were few in number and were followed for a shorter period of time. A prospective, controlled trial with long-term follow-up would have more power to find out the final refractive status of the patient.

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References

1. Nardi M, Rizzo S, Pellegrini G, Lepri A. Effects of strabismus surgery on corneal topography. J Pediatr Ophthalmol Strabismus 1997; 34: 244-6.
2. Bagheri A, Farahi A, Guyton DL. Astigmatism induced by simultaneous recession of both horizontal rectus muscles. J AAPOS 2003; 7: 42-6.
3. Snir M, Nissenkorn I, Buckman G, Cohen S, Ben Sira I. Postoperative refractive changes in children with congenital esotropia: a preliminary study. Ophthalmic Surg 1989; 20: 57-62.
4. Schworm HD, Ullrich S, Hoing C, Dittus C, Boergen KP. Effect of strabismus operation of corneal topography. Klin Monatsbl Augenheilkd 1996; 209: 275-82.
5. Wu X, Guo JQ. The effect of horizontal strabismus surgery on the refractive status in children. Zhonghua Yan Ke Za Zhi 1992; 28: 97-8.
6. Denis D, Bardot J, Volot F, Saracco JB, Maumenee IH. Effects of strabismus surgery on refraction in children. Ophthalmologica 1995; 209: 136-40.
7. Hainsworth DP, Bierly JR, Schmeisser ET, Baker RS. Corneal topographic changes after extraocular muscle surgery. J AAPOS 1999; 3: 80-6.
8. Thompson WE, Reinecke RD. The changes in refractive status following routine strabismus surgery. J Pediatr Ophthalmol Strabismus 1980; 17: 372-4.
9. Mai G, Wang Z, Yan J, Liu Z, Chen J, Deng D, et al. Corneal topographical changes following strabismus surgery. Yan Ke Xue Bao 1999; 15: 174-8.
10. Preslan MW, Cioffi G, Min YI. Refractive error changes following strabismus surgery. J Pediatr Ophthalmol Strabismus 1992; 29: 300-4.
11. Marshall D. Changes in refraction following operation for strabismus. Arch Ophthalmol 1936;

15; 1020-31.
12. Fix A, Baker JD. Refractive changes following strabismus surgery. Am Orthopt J 1985; 35: 59-62.
13. Holladay JT, Moran JR, Kezirian GM. Analysis of aggregate surgically induced refractive change, prediction error, and intraocular astigmatism. J Cataract Refract Surg 2001; 27: 61-79.
14. Holladay JT, Cravy TV, Koch DD. Calculating the surgically induced refractive change following ocular surgery. J Cataract Refract Surg 1992; 18: 429-43.
15. Lyle WM. Changes in corneal astigmatism with age. Am J Optom Arch Am Acad Optom 1971; 48: 467-78.
16. Gwiazda J, Scheiman M, Mohindra I, Held R. Astigmatism in children: changes in axis and amount from birth to six years. Invest Ophthalmol Vis Sci 1984; 25: 88-92.
17. Dobson V, Fulton AB, Sebris SL. Cycloplegic refractions of infants and young children: the axis of astigmatism. Invest Ophthalmol Vis Sci 1984; 25: 83-7.

ผลของการผ่าตัดตาเขในแนวนอนต่อภาวะสายตาเอียง

กิตติศักดิ์ กิจทวีสิน, ศันสนีย์ สิงหกุล

วัตถุประสงค์*: เพื่อศึกษาผลของการผ่าตัดตาเขในแนวนอนต่อภาวะสายตาเอียง*

วัสดุและวิธีการ*: ผู้ป่วยตาเขจำนวน 16 รายที่ได้รับการผ่าตัดกล้ามเนื้อตาในแนวนอนระหว่างเดือนกรกฎาคม พ.ศ. 2547 ถึง เดือนมิถุนายน พ.ศ. 2548 ที่โรงพยาบาลศรีนครินทร์ โดยผู้ป่วยทุกรายได้รับการวัดระดับสายตาและมุมเขโดยวิธี Prism cover และ Modified Krimsky ตามลำดับ และได้รับการตรวจวัดสายตาด้วยเครื่องวัดสายตาอัตโนมัติก่อนและหลังผ่าตัดโดยเจ้าหน้าที่ซึ่งไม่ทราบรายละเอียดการผ่าตัด คำนวณความแตกต่างของภาวะสายตาเอียงก่อนและหลังผ่าตัดโดยใช้ระบบ x-y coordinate*

ผลการศึกษา*: ศึกษาใน 23 ตาจากผู้ป่วย 16 ราย อายุเฉลี่ย 14.75 $\pm$ 11.76 ปี เพศหญิงและชายจำนวนเท่ากัน มีภาวะตาเขเข้าใน 7 ราย (ร้อยละ 43.75) ภาวะตาเขออกนอก 9 ราย (ร้อยละ 56.25) พบว่าค่าเฉลี่ยของภาวะสายตาเอียงก่อนและหลังผ่าตัดได้แก่ 0.74 $\pm$ 1.20 ไดออพเตอร์ในแกน 67.56 องศา และ 0.69 $\pm$ 0.86 ไดออพเตอร์ในแกน 56.30 องศา ซึ่งสอดคล้องกับเมื่อวิเคราะห์การผ่าตัดแต่ละชนิด ไม่พบการเปลี่ยนแปลงของสายตาอย่างมีนัยสำคัญทางสถิติระหว่างก่อนและหลังผ่าตัด*

สรุป*: พบว่าภาวะสายตาเอียงก่อนและหนึ่งวันหลังการผ่าตัดกล้ามเนื้อตาในแนวนอน ไม่แตกต่างกัน*