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Postoperative binocular visual function in 28 patients with congenital superior oblique palsy

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Abstract

• AIM: To investigate the postoperative changes of binocular visual function in patients with congenital superior oblique palsy.

• METHODS: Eye position and binocular visual function were examined in 28 patients with congenital superior oblique palsy pre- and post-operatively. The results were statistically analyzed.

• RESULTS: The normal eye position rate after operation was 89.3%. There were 9 patients who gained simultaneous perception after operation, while 13 patients gained fusion as many as that gained stereoacuity. There was statistically significant difference between postoperative and preoperative eyes ($P < 0.05$). Near stereoacuity was improved after operation. Patients who had better visual acuity and low strabismus degrees as well as fusion had a better recovery.

• CONCLUSION: The operation could improve the eye position and rebuild the binocular visual function of the congenital superior oblique palsy. The recovery of binocular visual function was related to visual acuity and strabismus degrees of the patients and whether they had fusion function.

• KEYWORDS: congenital superior oblique palsy; binocular visual function; operation
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INTRODUCTION

Congenital superior oblique palsy is the most common type of congenital ocular muscle paralysis[1], which is characterized by vertical strabismus, Bielschowsky sign and compensatory head posture. In order to obtain binocular single visual function and eliminate the compensatory head posture, a surgery should be done early. In this paper, a post-operative follow-up observation was done on the 28 patients with congenital superior oblique palsy who had received surgery in our hospital to explore binocular visual function changes after operation.

SUBJECTS AND METHODS

Subjects A total of 28 subjects who underwent congenital superior oblique palsy surgery in the department of Ophthalmology, the Affiliated Hospital of Medical College of Qingdao University (mean age 8.06 ± 2.80 years, 15 male, 13 female) were collected from January 2006 to January 2009. All patients' horizontal deviated degree was ≤10Δ, the primary position vertical strabismus angle was 5-45Δ. The follow-up period was 3-36 months.

Methods The naked and corrected eyesight, exophthalmos, IOP, refraction and ocular fundus were examined before and after operation. Extraocular muscle and orbital soft tissues were examined by B-ultrasonic. Eye position were measured by prism cover test at the distance of 33cm and 5m respectively. Parks three step was performed to examine the eyeball movement. All cases had the overaction of the inferior oblique. Some cases had horizontal squint, compensatory head posture and positive Bielschowsky sign. Triple visual function was examined with stereoacuity test chart and synoptophore for near and distant stereoacuity respectively. Most of them underwent operation with general anesthesia. The treatment will be given when the vertical deviation was more than 10△. When the vertical deviation is less than 20△, the inferior oblique muscle weakening or superior oblique muscle tucking was performed. When it is more than 20△, inferior rectus muscle and inferior oblique muscle weakening could be performed together. Patients with horizontal combined vertical strabismus would be corrected at the same time following the surgery method of horizontal strabismus. The fusion range -4°-+25° is taken as normal. The inspection results of twenty-eight patients were recorded. If the patient had the simultaneous perception, he or she would be recorded as having binocular visual function. The normal eye position means that strabismus angle within the ±10△.

Evaluation of Surgical Treatment Cure: in primary position, the vertical strabismus angle was ≤5△, and compensatory head posture disappeared, Bielschowsky sign (-). Improvement: strabismus angle >5△, compensatory head posture improved markedly, Bielschowsky sign (-). Invalidity: vertical strabismus angle >10△, compensatory head posture unchanged, Bielschowsky sign (+). Stereoacuity before and after surgery: 60 sec as stereoscopic vision of the central fovea; 100-200 sec as stereoscopic vision of the macula lutea;

400-1 000 sec as peripheral stereoscopic vision.

Statistical Analysis χ^2 test of CS10. 32 statistical software was performed to evaluate the change of binocular visual function of the patients before and after operation. $P < 0.05$ was considered statistically significant.

RESULTS

Triple Visual Function The patients who had simultaneous perception, fusion and stereoacuity before operation were 17, 5 and 5 cases respectively. While there were 26, 18 and 18 cases respectively after operation. They were significantly different ($\chi_1^2 = 8.11$, $\chi_2^2 = 12.47$, $\chi_3^2 = 12.47$, $P < 0.05$, Table 1). The number of patients whose stereoacuity below 60″ increased from 0 to 3 after surgery. That between 100″ and 200″ increased from 2 to 5. And that between 400″ and 800″ increased from 3 to 10. There was significant difference between pre- and postoperative stereoacuity ($\chi^2 = 8.60$, $P < 0.05$).

Strabismus Angle The normal eye position rate after operation was 89. 3%. Bielschowsky sign and compensatory head posture disappeared after surgery. Patients who had corrected visual acuity ≥0. 8 or strabismus degrees ≤40 △ or had fusion before surgery would had a better recovery, which showed a significant difference (Table 2).

Table 1 Comparison of pre-and post-operative binocular vision function *n*

Operation	Simultaneous perception		Fusion		Stereoacuity	
	+	−	+	−	+	−
Before	17	11	5	23	5	23
After[a]	26	2	18	10	18	10
Total	43	13	23	33	23	33

[a] $P < 0.05$ *vs*Before operation.

Table 2 The binocular visual function before operation and the recovery *n*

Operation	Strabismus degree(△)		Visual acuity		Fusion	
	≤40	>40	<0. 8	≥0. 8	+	−
Before	9	14	10	13	12	11
After[a]	8	5	2	11	10	3

[a] $P < 0.05$ *vs*Before operation.

DISCUSSION

Congenital superior oblique palsy is the most common type of congenital ocular muscle paralysis. The patient often have V-exotropia or esotropia, binocular excyclotropia, Bielschowsky sign, and a clear compensatory head posture at the same time because of the palsy of superior oblique. Strabismus not only affects the appearance of patients, but also the establishment of binocular visual function. Therefore, the purpose of the operation on the children more importantly is to restore binocular function and the establishment of stereo vision besides correcting eye position. A single object of visual perception would be obtained in our brain when we are watching an object with two eyes. This visual process was known as binocular vision, also known as binocular single vision, which could be described as the image of an external object was combined into a complete image with three-dimensional[2]. The conditions for the formation of binocular single vision include: similar or equivalent binocular visual acuity; the ability to simultaneously monitor the same goal; normal retinal correspondence; a well-developed neural reflex jointing binocular single vision; a perfect fusion function. Lu [3] found that there were 78. 3% of patients with congenital superior oblique palsy could have a normal binocular visual development, among which 40. 7% of patients with vertical deviation less than 15Δ. In his study of 176 cases of congenital superior oblique palsy, 49. 4% of patients had binocular single vision after operation[4]. In this group, 50. 6% of the patients had the same or similar binocular visual acuity, 60. 7% of the patients had compensatory head posture. It was possible for them to have their eyes watching the same goal and fusion capabilities.

It is in the early age that the stereopsis vision of visual cortex has developed in patients with congenital superior oblique palsy. Though the stereopsis vision is not obvious or does not exist due to strabismus and instable orthotopic vision, it could be recovered by stimulating of binocular disparity on the visual cortex once the patient got the normal eye position and visual acuity. Function of stereopsis weakens gradually following aging. At the age of 3 to 4 months[5], the stereopsis of people begins to develop. Hu *et al* [6] reported that the near stereoacuity of 4-year-old child had reached to normal levels and stereopsis continued to develop after that. By the time the child was 8-10 years old, the development rate of stereoacuity had slowed down. However, the stereopsis developed perfectly at the age of 9-10 years old. The purpose of surgical treatment of paralytic strabismus is not only to correct eye position deviation, but also to get a binocular single vision in the primary position and downward of gaze. Studies had shown that the period between 2 years and 6 years old was sensitive period of binocular vision development, which was also known as the period of plastic phase of binocular neurons. If the binocular vision were destroyed before or in this period, it would be recovered. However, if the binocular vision was destroyed after that period, it would be never recover[7]. Stereoscopic vision is composed of fine and rough stereoscopic vision. The former stands for the central fovea, the latter stands for peripheral retina. The surgery age of the patients was 5-12 years in this group. Thirteen cases restored stereoscopic vision to different degree after operation, including six cases restored stereoscopic vision of the macula lutea, seven cases restored peripheral stereoscopic vision. There was significant difference between pre- and postoperative stereoacuity. That was to say the strabismus surgery could improve the stereopsis of patients with congenital superior oblique palsy.

The recovery of binocular visual function of patients with congenital superior oblique palsy is affected by many factors. First, surgical methods affect the postoperative results. The principle of the operation is that doing recession of extraocular muscle on the more obvious palsy muscle. If the operation could not solve the problem, antagonistic muscle recession could be done at the same time. There are several surgical methods. The patients with congenital superior oblique palsy can be treated with inferior oblique truncation or the superior

oblique muscle transposition completely or partly. The surgery should be done on the paralysis eye as far as possible. If the strabismus degree was too big, it was necessary to operate on the corresponding eye [8]. In this group, the surgery was acted on the principle of weaking direct antagonistic muscles and yoke muscles, as well as strengthening paralytic muscles and indirect antagonistic muscle. The strabismus degree of the patients obtained by prismatic lens test decides surgical method and the operative quantity. Compensatory head posture gradually improved or disappeared accompanied with the corrected eye position and improved visual function. The younger the patient was, the sooner the compensatory head posture disappeared. As a result, patients have operation indication should be treated with surgery on time. Patients with horizontal combined vertical strabismus should be corrected at the same time. If the rectus muscle in the same eyes should be operated on, the number of it can not be more than two, otherwise, the anterior segment ischemia would take place. The normal eye position and the recovery of binocular single vision depend on the correct operative methods and operative quantity. Most of the patients with congenital superior oblique palsy could get binocular single vision partly once they got normal eye position after operation[3]. The normal eye position rate at postoperation of 28 patients was 89.3%, which had created conditions for functional recovery. In addition, the recovery of binocular visual function of patients with congenital superior oblique palsy was also affected by visual acuity, strabismus degree and weather they have fusion before operation. χ^2 test was performed to analyze the relation of changes of binocular visual function of the patients and these factors before and after operation. It was revealed that patients who had fusion had a high recovery rate, which showed a significant difference when compared with that before operation. That was to say, having fusion before operation was very important for the recovery of binocular visual function. Patients who had corrected visual acuity $\geq$0.8 or strabismus degrees $\leq$40$\triangle$or had fusion would had a better recovery, which showed a significant difference. This was similar to the research result of Wang *et al*[9]. He had found that patients with different strabismus degrees got different stereopsis. The group with low strabismus degree had a better recovery than that with high strabismus degree. In addition, he had found that the surgery age had no relation with the recovery of the stereopsis. In our study, the relation of them was not mentioned. However, at the point of the human stereoscopic vision development process, patients with clear diagnosis of congenital superior oblique palsy should be operated on as early as possible. Only by this way, could they have the better result and could create conditions for functional recovery. At the same time, the early operation is beneficial to physical and mental health development of children.

In conclusion, strabismus surgery can restore binocular function partly in patients with congenital superior oblique palsy. Patients who had better visual acuity and low strabismus degrees as well as fusion had a better recovery. Patient who has operative indication should have operation as early as possible. Postoperative recovery of binocular visual function is affected by many factors. As a result, further study is still needed.

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先天性上斜肌麻痹患者28例术后双眼视功能变化

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摘要

目的:探讨先天性上斜肌麻痹患者手术后双眼视功能变化。

方法:先天性上斜肌麻痹患者28例手术前、后分别行斜视度和双眼视功能检查,统计分析其变化。

结果:术后正位率89.3%。手术后有同时视、融合和立体视的患者分别增加9,13和13例,与术前相比差异具有显著性($P<0.05$)。近立体视觉有明显改善。术前斜视度小、视力好且有融合功能的患者术后双眼视功能恢复好。

结论:先天性上斜肌麻痹手术治疗在改善眼位的同时,双眼视功能部分得以重建。视功能恢复与视力、斜视度及有无融合功能有关。

关键词:先天性上斜肌麻痹;双眼视功能;手术