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Vision-related Quality of Life and Emotional Impact in Children with Strabismus: a Prospective Study

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The potential impact of the surgical correction of strabismus on vision-related quality of life (VRQOL) and the symptoms of anxiety and depression in children with strabismus remain unclear. The present study included 60 children with strabismus: 30 with heterophoria and 30 with heterotropia. A healthy age- and gender-matched control group ($n = 60$) was also recruited. The psychological instruments that were used were the short-form 25-item National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25) and the Hospital Anxiety and Depression

Scale (HADS). The results demonstrated that eight of the 12 NEI-VFQ-25 subscales were significantly impaired in children with strabismus compared with matched controls. Compared with pre-operative values, significant improvements were noted after surgery in the NEI-VFQ-25 summary score, and the anxiety and depression scores. This study demonstrated that the NEI-VFQ-25 instrument can be used in strabismus children and that surgical interventions can improve VRQOL, anxiety and depression in strabismus patients.

KEY WORDS: STRABISMUS; CHILDREN; SURGERY; VISION-RELATED QUALITY OF LIFE; HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS); NATIONAL EYE INSTITUTE VISUAL FUNCTIONING QUESTIONNAIRE (NEI-VFQ)

Introduction

Strabismus occurs in about 4% of children.^{1,2} It may compromise driving in adults, as well as reading or unaccompanied walking, make work difficult or impossible, curtail recreational activities requiring vision (such as watching television or gardening), and lead to functional blindness.² Surgical intervention is regarded as the first-line

treatment for strabismus and the success rates for surgery are between 50% and 90%.³

The Chinese version of the short-form of the National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25), a disease-specific health-related quality of life (HRQOL) instrument that specifically measures vision-related quality of life (VRQOL),⁴ has become an important outcome criterion for surgical

interventions, but little research has been undertaken in patients with strabismus (heterophoria or heterotropia). Assessments of VRQOL, which are quantitative measures of a patient's perceived well-being, have demonstrated the adverse psychosocial impact of strabismus,⁵ but little is known about the effects of strabismus on VRQOL after surgery and its correlation with anxiety and depression. The psychosocial benefits resulting from the surgical correction of strabismus have been demonstrated in adults;^{6,7} In children, the functional benefit afforded by early correction has provided the main rationale for surgical intervention. However, a negative perception of strabismic individuals has been reported to develop in children at an early age.⁸

The present study used the Chinese version of the Hospital Anxiety and Depression Scale (HADS),^{9,10} which is a survey instrument that explores anxiety and depression status through parental proxy, in order to provide extensive characterization of the impact of the surgical correction of strabismus on children's VRQOL. This study was conducted to enable differential assessment of VRQOL using validated instruments in patients with heterophoria and heterotropia undergoing surgery. The hypothesis being tested was that disease-specific HRQOL is impaired in patients with heterophoria and heterotropia, but there were no differences in disease-specific VRQOL between the two strabismus patient groups. Furthermore, the ability of the HADS in reflecting anxiety and depression in patients with strabismus was also assessed. Finally, the potential influence of visual function on the improvement of VRQOL after surgery was examined.

Patients and methods

PATIENTS AND STUDY DESIGN

This was a prospective interventional study,

performed with Institutional Review Board approval from Jiangxi Hospital, the Eye Institute and Affiliated Eye Centre of Xiamen University, and Jiangxi Children's Hospital. All studies were carried out in accordance with the tenets of the Declaration of Helsinki for human subjects. Informed consent was obtained in writing from all patients and their parents, and all control subjects and their parents.

The patients enrolled in the study were consecutively referred for examination at three hospitals in southern China (Jiangxi Hospital and Jiangxi Children's Hospital, both located in Nanchang, Jiangxi Province, and the Eye Institute and Affiliated Eye Centre of Xiamen University located in Xiamen, Fujian Province) from February 2007 through August 2008. They were required to be < 15 years of age, to have either heterophoria or heterotropia and were scheduled to undergo strabismus surgery. Patients who had undergone strabismus surgery within the previous year or those who had an unstable family situation, in which consistent guardianship during the study was uncertain, were excluded. Clinical data were abstracted from the medical records, including diagnosis and pre- and post-operative ocular alignment. Quality of life data were obtained by telephone interview to a parent or guardian pre-operatively and again 2 months post-operatively. A healthy age- and gender-matched control group (exclusion criteria: visual impairment and chronic illness) was also included, recruited by the Department of Medical Psychology at each of the same three hospitals in southern China.

DIAGNOSTIC QUALITY OF LIFE INSTRUMENTS

Disease-specific VRQOL was measured by the NEI-VFQ-25,⁴ which comprises 25 items that constitute 12 subscales. We ensured that

standard requirements were met in this Chinese population sample in terms of internal consistency, convergent and divergent validity, sensitivity and factorial structure. The NEI-VFQ-25 had not previously been applied in patients with strabismus, however its appropriateness for application in these patients was assumed if it could distinguish between patients and controls. Results of the NEI-VFQ-25 were subject to T-transformation, which is one of the scoring transformation formulae. The HADS self-assessment scale was used to provide data on the severity of anxiety and depression, as this is known to be a reliable instrument for detecting depression and anxiety status in a hospital outpatient clinic setting. Both quality of life instruments were applied to patients during their post-surgical outpatient visit and to the controls via the postal service at home.

STATISTICAL ANALYSIS

Analysis of sociodemographic and medical parameters between patient and control groups was performed by the χ^2 test or the two-tailed, paired Student's *t*-test. Analysis of the NEI-VFQ-25 parameters was performed by multivariate analysis of variance. Quality of life scores were calculated as the mean for each subscale, and pre- and post-operative scores were compared using the two-tailed, paired Student's *t*-test. A *P*-value < 0.05 was considered statistically significant. Guidelines for multiple testing were taken into account. To reduce the false negative rate, Holm adjustment was used. The SPSS® (SPSS Inc., Chicago, IL, USA) statistical analyses computer package version 13.0 was used.

Results

A total of 65 patients were asked to participate; three parents of children disagreed due to lack of time or interest and

in two patients the questionnaires were not analysed because of missing data. In total, therefore, 60 patients actually participated: 30 children (15 boys) with heterophoria with a mean \pm SD age of 8.3 ± 2.8 years and 30 children (13 boys) with heterotropia with a mean \pm SD age of 8.4 ± 2.6 years. Patients and controls (60 age- and gender-matched volunteers) did not differ statistically in any of the sociodemographic parameters (data not shown). The mean \pm SD time from diagnosis to participation in the study was 64 ± 59 months in patients with heterophoria and 63 ± 57 months in patients with heterotropia. There were no significant differences between the two groups of strabismus patients as determined by Student's *t*-test.

The HADS indicated that symptoms of anxiety and depression were experienced by subjects in both patient groups (Table 1). More patients with heterotropia had anxiety and depression than patients with heterophoria, although the differences were not statistically significant. Compared with their corresponding age- and gender-matched controls, however, there were significant differences in the anxiety and depression scores for both patient groups ($P < 0.05$).

Compared with control subjects, both patient groups showed significantly impaired disease-specific VRQOL in eight out of 12 NEI-VFQ-25 subscales, including 'general health', 'general vision', 'near vision', 'distance vision', 'social function', 'mental problems', 'dependency' and 'peripheral vision' ($P < 0.05$ or $P < 0.01$, Table 2). The remaining three subscales ('ophthalmological pain', 'social role' and 'colour vision') also showed impaired disease-specific VRQOL in patients compared with the control subjects, but the differences were not statistically significant (the subscale

TABLE 1:
Incidence of anxiety and depression, as determined by the Hospital Anxiety and Depression Scale (HADS), in the two groups of strabismus patients compared with their age- and gender-matched control group

	Strabismus patients		Control group	
	HT (<i>n</i> = 30) No. (%)	HP (<i>n</i> = 30) No. (%)	C-HT (<i>n</i> = 30) No. (%)	C-HP (<i>n</i> = 30) No. (%)
Anxiety	8 (26.7)*	5 (16.7)*	1 (3.3)	1 (3.3)
Depression	9 (30.0)*	7 (23.3)*	0.0 (0.0)	0.0 (0.0)
Anxiety and depression	4 (13.3)*	2 (6.7)*	0.0 (0.0)	0.0 (0.0)

**P* < 0.05 vs the respective control group.

HP, heterophoria; HT, heterotropia; C-HT, controls to patients with heterotropia; C-HP, controls to patients with heterophoria.

'driving' could not be examined since all the subjects were children). Regarding the subscale 'general health', patients with heterotropia were significantly more severely affected than patients with heterophoria (*P* = 0.003), and there was a tendency towards this for all other subscales (except 'driving', which was not measured).

The change in scores between the pre- and post-operative VRQOL and HADS are shown in Table 3. Statistically significant improvements were seen for anxiety, depression and the NEI-VFQ-25 summary score in patients with heterotropia and with heterophoria following surgery (*P* < 0.05).

Discussion

The physical appearance of strabismus is readily recognized even by young children and it has been shown that a negative attitude towards it appears to emerge at approximately 6 years of age.¹¹ In one study, children > 6 years of age almost uniformly gave a negative description of strabismic dolls and hesitated to play with them.¹²

The present study explored the impact of strabismus on visual performance and self-reported vision and VRQOL. To our knowledge, this is the first prospective study

to include consecutively referred patients with heterophoria or heterotropia. The use of VRQOL as a clinical endpoint when evaluating medical interventions has been proposed and is increasingly being implemented in ophthalmological research.^{13–16} Studies on VRQOL in patients with strabismus, such as heterophoria or heterotropia are, however, very few. The present study was, therefore, undertaken to improve our knowledge of the disease-specific VRQOL outcomes in patients with strabismus undergoing surgical correction. The HADS questionnaire indicated some anxiety and depression in strabismus patients but also revealed favourable results at a symptomatic level in both strabismus patient groups (heterophoria or heterotropia).

Disease-specific VRQOL was severely impaired in patients with strabismus, as shown by the statistically significant reductions in VRQOL observed in eight out of 12 NEI-VFQ-25 subscales, compared with control subjects. Considering the differences between the two patient groups, 'general health' was significantly more impaired in patients with heterotropia than in patients with heterophoria; similar tendencies were

TABLE 2: Visual-related quality of life in strabismus patients and control subjects, as determined on the 12 subscales of the National Eye Institute Visual Functioning Questionnaire

Subscales ^a	Strabismus patients			Control group		Two-factorial analysis of variance (F)		
	HT (n = 30)	HP (n = 30)	C-HT (n = 30)	C-HP (n = 30)	Dx	P/C	Dx × P/C interaction	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD				
General health (1)	49.4 ± 6.9	52.6 ± 8.1	64.8 ± 12.2	63.9 ± 11.9	1.9, NS	13.2, P < 0.01 ^b	1.8, NS	
General vision (1)	55.4 ± 13.2	59.4 ± 14.0	65.4 ± 15.9	64.8 ± 15.6	1.6, NS	3.8, P < 0.05	0.1, NS	
(n = 79)	(n = 19)	(n = 20)	(n = 20)	(n = 20)				
Ophthalmological pain (2)	73.4 ± 17.9	74.3 ± 17.5	77.8 ± 19.2	77.9 ± 19.4	0.3, NS	2.6, NS	1.0, NS	
Near vision (3)	55.1 ± 10.2	60.4 ± 15.5	68.9 ± 13.0	69.9 ± 13.2	4.8, P < 0.05	8.0, P < 0.01 ^b	0.3, NS	
Distance vision (3)	48.8 ± 8.9	53.7 ± 9.1	65.5 ± 14.8	66.3 ± 15.1	4.5, P < 0.05	8.8, P < 0.01 ^b	0.6, NS	
Social function (2)	47.5 ± 13.8	54.6 ± 12.9	60.8 ± 14.5	60.7 ± 14.7	1.4, NS	9.5, P < 0.01 ^b	0.0, NS	
Mental problems (4)	60.8 ± 13.8	61.5 ± 14.1	64.8 ± 15.2	64.9 ± 15.3	4.7, P < 0.05	14.5, P < 0.01 ^b	0.0, NS	
Social role (2)	46.7 ± 11.2	47.9 ± 10.7	58.9 ± 13.9	59.5 ± 14.3	2.2, NS	2.4, NS	1.8, NS	
Dependency (3)	47.8 ± 7.0	55.4 ± 4.0	63.4 ± 14.8	62.6 ± 14.6	6.6, P < 0.05	10.2, P < 0.01 ^b	1.8, NS	
Driving (3) (n = 0)	—	—	—	—	—	—	—	
Colour vision (1)	50.6 ± 7.7	51.2 ± 8.2	51.8 ± 8.8	51.6 ± 8.7	0.4, NS	0.3, NS	0.2, NS	
(n = 68)	(n = 14)	(n = 20)	(n = 14)	(n = 20)				
Peripheral vision (1)	53.3 (9.6)	59.5 (10.5)	62.3 (14.4)	62.6 (13.6)	6.0, P < 0.05	7.2, P < 0.01 ^b	2.6, NS	

^aNumbers in parentheses after each subscale represent the number of questions in that subscale.

^bStatistically significant after Holm adjustment.

A score of 100 represents the best possible quality of life.

HP, heterophoria; HT, heterotropia; C-HT, controls to patients with heterotropia; C-HP, controls to patients with heterophoria; Dx, diagnosis; P/C, patients versus control subjects; NS, not statistically significant (P > 0.05).

TABLE 3:
The effect of corrective surgery for strabismus on anxiety, depression and vision-related quality of life scores for patients with heterotropia or heterophoria

	Heterotropia patients		Heterophoria patients	
	Pre-op – Post-op	P-value	Pre-op – Post-op	P-value
Anxiety	0.15	< 0.05	0.12	< 0.05
Depression	0.21	< 0.05	0.16	< 0.05
NEI-VFQ-25 summary score	0.12	< 0.05	0.10	< 0.05

Pre-op – post-op, the difference between the pre- and post-operative scores. A positive value represents an improvement. P-values were derived from a two-tailed, paired Student's *t*-test.
NEI-VFQ-25, short-form 25-item National Eye Institute Visual Functioning Questionnaire.

also found for all the other subscales except 'driving' (not measured). It is clear from the present results that the NEI-VFQ-25 adequately reflects loss of disease-specific VRQOL in patients with strabismus. The NEI-VFQ-25 also indicated that patients with heterotropia seemed to experience a greater impaired disease-specific VRQOL than patients with heterophoria, which may be due to its more disabling characteristics, particularly in terms of vision.

We conclude that a diagnosis of strabismus is accompanied by a substantially impaired disease-specific VRQOL and that its treatment should, therefore, integrate VRQOL assessment as a measure of treatment outcome, and require the creation and implementation of specific psychosocial interventions. The NEI-VFQ-25 was identified as a suitable disease-specific tool, although its sensitivity to symptomatic changes awaits verification. Prospective studies with repeated data acquisition are required to examine the impact of surgery and psychosocial interventions on functional and VRQOL outcomes in patients with strabismus.

The HADS questionnaire,¹⁰ which involves self-assessment, has been found to be a reliable instrument for determining depression and anxiety status in a hospital

outpatient clinic setting. The anxiety and depressive subscales are also valid measures of the severity of emotional disorder. It has been suggested that the introduction of the HADS questionnaire into general hospital practice would facilitate the detection and management of emotional disorders in patients undergoing medical and surgical investigation and treatment.¹⁷ Olitsky *et al.*⁸ demonstrated that the treatment of strabismus should not be considered cosmetic, even when there is no hope of improving binocular vision, as it may positively alter the way that others perceive the individual and improve their ability to socialize normally. The present results give some credence to this concept in terms of it being harder for strabismic children to improve their emotional and psychiatric status, particularly in terms of the strong indication that patients with strabismus have the potential to develop symptoms of anxiety and depression. It has also been clearly demonstrated that socially noticeable strabismus is problematic for all age groups, including adults as well as school children and teenagers.^{5,18}

In conclusion, the present study showed that children derive psychological benefits from strabismus surgery. Correction of strabismus may reverse the negative social

implications and positively alter the perceived characteristics of children. This should be considered when evaluating strabismic children for surgical treatment, even when there is no hope of physiological gain.

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Conflicts of interest

The authors had no conflicts of interest to declare in relation to this article.

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References

- 1 Asbury T, Frederick DR: Strabismus. In: *General Ophthalmology* 15th edn (Vaughan D, Asbury T, Riordan-Eva P, eds). New York: McGraw-Hill, 2001; p 216.
- 2 Auzemery A, Andriamanamihaja R, Boisier P: A survey of the prevalence and causes of eye disorders in primary school children in Antananarivo. *Sante* 1995; **5**: 163 – 166 [in French].
- 3 Helveston EM: The value of strabismus surgery. *Ophthalmic Surg* 1990; **21**: 311 – 317.
- 4 Wang CW, Chan CL, Jin HY: Psychometric properties of the Chinese version of the 25-item National Eye Institute Visual Function Questionnaire. *Optom Vis Sci* 2008; **85**: 1091 – 1099.
- 5 Satterfield D, Keltner JL, Morrison TL: Psychosocial aspects of strabismus study. *Arch Ophthalmol* 1993; **111**: 1100 – 1105.
- 6 Burke JP, Leach CM, Davis H: Psychosocial implications of strabismus surgery in adults. *J Pediatr Ophthalmol Strabismus* 1997; **34**: 159 – 164.
- 7 Menon V, Saha J, Tandon R, *et al*: Study of the psychosocial aspects of strabismus. *J Pediatr Ophthalmol Strabismus* 2002; **39**: 203 – 208.
- 8 Olitsky SE, Sudesh S, Graziano A, *et al*: The negative psychosocial impact of strabismus in adults. *J AAPOS* 1999; **3**: 209 – 211
- 9 Ye W: An analysis of anxiety and depression of 957 inpatients in Chinese. *Zhong Guo Xing Wei Yi Xue Ke Xue* 1995; **4**: 198.
- 10 Zigmund AS, Snaith RP: The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983; **67**: 361 – 370.
- 11 Uretmen O, Egrilmez S, Kose S, *et al*: Negative social bias against children with strabismus. *Acta Ophthalmol Scand* 2003; **81**: 138 – 142.
- 12 Paysse EA, Steele EA, McCreery KM, *et al*: Age of the emergence of negative attitudes toward strabismus. *J AAPOS* 2001; **5**: 361 – 366.
- 13 Mello PR, Roma Ade C, Moraes Júnior HV: Analysis of the life quality of infectious and non-infectious patients with uveitis using the NEI-VFQ-25 questionnaire. *Arq Bras Oftalmol* 2008; **71**: 847 – 854 [in Portuguese].
- 14 Hariprasad SM, Mieler WF, Grassi M, *et al*: Vision-related quality of life in patients with diabetic macular oedema. *Br J Ophthalmol* 2008; **92**: 89 – 92.
- 15 Bradley EA, Sloan JA, Novotny PJ, *et al*: Evaluation of the National Eye Institute visual function questionnaire in Graves' ophthalmopathy. *Ophthalmology* 2006; **113**: 1450 – 1454.
- 16 Hall TA, McGwin G, Searcey K, *et al*: Health-related quality of life and psychosocial characteristics of patients with benign essential blepharospasm. *Arch Ophthalmol* 2006; **124**: 116 – 119.
- 17 Olsson I, Mykletun A, Dahl AA: The Hospital Anxiety and Depression Rating Scale: a cross-sectional study of psychometrics and case finding abilities in general practice. *BMC Psychiatry* 2005; **5**: 46.
- 18 Archer SM, Musch DC, Wren PA: Social and emotional impact of strabismus surgery on quality of life in children. *J AAPOS* 2005; **9**: 148 – 151.

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