

EXTENDED REPORT

The psychosocial benefits of corrective surgery for adults with strabismus

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Background: Few papers have addressed the psychological impact of strabismus in adults, with none comparing preoperative and postoperative data using standardised questionnaires relating surgical results and psychosocial outcomes.

Methods: 46 participants were seen at their 6 week preoperative and 3 month postoperative appointments. Standardised measures of anxiety and depression (Hospital Anxiety and Depression Scale), social anxiety (Derriford Appearance Scale), and quality of life (WHOQoLBref) were completed.

Results: Preoperatively, levels of depression were comparable to relevant population norms; however, levels of general anxiety were slightly raised and levels of social anxiety and social avoidance were significantly poorer than population norms. Surgery resulted in significant improvements in psychosocial adjustment with improvements on all study variables for the participant group as a whole. The non-diplopic group made more significant gains than the diplopic group. Approximately one third of study measures were significantly correlated with the objective measure of eye misalignment preoperatively dropping to only one variable postoperatively. Calculations involving the subjective measure of eye misalignment and study variables showed the opposite pattern with five variables achieving significance postoperatively. There were no clear sex or age effects apparent in the data.

Conclusion: Strabismus surgery offers significant improvements to psychological and physical functioning.

Three reports have examined the psychosocial effects of corrective surgery for adult strabismus.^{1–3} While all these studies reported psychosocial improvements for their study participants, results concerning certain issues—for example, the impact of the various types of strabismus, are conflicting.

Measures employed in previous research mainly focused on medical information.^{1–2} The use of standardised measures to assess the psychological state of participants has been limited. Satterfield *et al* used the Hopkins Symptom Checklist and Menon *et al* used the Postgraduate Institute Health Questionnaire (N2) as a screening tool (although the reasoning behind the choice of measure is unclear).^{1–5} The lack of consistency in the results of previous research, the dearth in standardised measures of adjustment, and the variability of methodologies employed, led to the following research questions:

(1) *What is the psychosocial status of adults seeking surgery?* Conditions resulting in a facial difference are associated with considerable distress for many of those affected.⁶ In the current climate of rationing of cosmetic procedures, clarity is needed concerning levels of psychological distress among those seeking surgical correction of strabismus.

(2) *Does surgical intervention decrease psychological distress?* 85% of participants in Satterfield *et al*'s study reported a positive impact on their lives although some aspects of surgery had been traumatic.¹ 95% of participants in Menon *et al*'s study reported positive changes in appearance, relationships with friends, self confidence and self esteem.³ Burke *et al* found that people with an esotropic strabismus recorded significantly greater appreciation of the effects of surgery than those with an exotropic strabismus.² Females viewed the surgery as having a more profound effect than males. This study will assess the impact of surgical intervention on distress using standardised measures of psychosocial adjustment.²

(3) *Is there a relation between strabismus characteristics and psychosocial distress?* Recent studies indicate that despite

widely held assumptions to the contrary, there is little relation between the severity of disfigurement and the amount of distress experienced by those affected—for example, by vitiligo, congenital malformation, scarring from trauma, burns, and disease.^{7–8} Research indicates that people with an esotropic strabismus are more negatively perceived by others than those with an exotropic strabismus.⁹ Menon *et al* found no influence of the type of strabismus on the problems perceived by their study participants.³

METHODS

Measures

Reports of difficulties with social interaction for people with strabismus led to the inclusion of a measure of social anxiety and social avoidance—the Derriford Appearance Scale (DAS-24).^{1–3 10–12} The higher the score on the DAS-24 the more the person is experiencing social anxiety and is using social avoidance as a coping strategy. The Hospital Anxiety and Depression Scale (HADS) is a widely used scale measuring general levels of distress using two subscales—anxiety and depression—where higher scores indicate greater distress.¹³

Previous research has not attempted to objectively measure the impact of strabismus on general quality of life. Accordingly, the WHOQoLBref was included measuring four quality of life domains: physical, psychological, social, and environmental.¹⁴ Higher scores on this questionnaire indicate greater satisfaction with quality of life. (For example questions from the standardised measures see appendix 1.)

In order to explore the impact of strabismus and its treatment on psychological adjustment and daily functioning more broadly, visual analogue scales (VAS) were also included in the study. VAS are easy for respondents to complete and are often used in clinical assessments.¹⁵ Data

Abbreviations: DAS, Derriford Appearance Scale; HADS, Hospital Anxiety and Depression Scale; PCT, prism cover test; PD, prism dioptres; VAS, visual analogue scales

from a subset of five VAS judged as most relevant to the research questions are included in this paper (see appendix 2). Scores range from 0–10 on each scale.

The ½ metre measurement obtained on the prism cover test (PCT) was used as the objective measure of eye misalignment preoperatively and postoperatively. This was chosen because of the two measures routinely taken (the other being 6 metres) it is closest to the standard measure of distance for communication in Western culture (that is, within 45 cm for communication with intimate friends and family members, and between 50 cm and 1.2 metres for other normal conversations).¹⁶

Procedure

A repeated measures design was employed with data collected from participants before and after surgery. Quantitative measures (in the form of standardised questionnaires) and a qualitative element (a structured interview) were used. Data from the qualitative element are not fully reported in this paper. A “control group” was not used for two reasons:

- (1) Adjustment to visible difference and changes to appearance comprises a whole myriad of factors that cannot adequately be matched in treatment and control groups; and
- (2) Some strabismic patients were undergoing surgery to correct diplopia as well as having their eye alignment corrected and it was considered unlikely that sufficient members of the general population with uncorrected diplopia would be found and recruited to the study.⁶

Participants

The study group comprised an opportunistic sample of patients over the age of 16 with a strabismus suitable for surgical correction attending the Bristol Eye Hospital and Great Western Hospital, Swindon, between May 2001 and February 2005. Patients were excluded from the study if they had other facial differences, physical disabilities, neurological disorders, or intraocular disease. Ethical approval was obtained from the relevant local research ethics committees and from University of the West of England, Bristol.

All potential participants were provided with a patient information sheet. They also completed a consent form. Participants were seen at the two hospitals at the presurgery assessment carried out between 1 weeks and 12 weeks before surgery (mode of 6 weeks). Postoperative data collection was carried out between 1 months and 6 months of surgery (mode of 3 months). All patients received the form of corrective surgery deemed most appropriate by the consultant in charge of their care.

Table 1 Demographic features of study participants preoperatively

Sex	male 24 (52%); female 22 (48%)
Ethnicity	white 45; black Caribbean 1
Age	16–61 years
Cause of strabismus	from birth 36 (80.4%); accident 4 (8.7%); unknown cause 3 (6.5%); illness 2 (4.3%)
Previous treatment	operation 27 (58.7%); other treatment 4 (8.7%); no treatment 15 (32.6%)
Presence/absence of diplopia	diplopia present 18 (39.1%); non-diplopia 28 (60.9%)
Direction of strabismus	esotropia 15 (32.6%); exotropia 31 (67.4%)

A power analysis using the Wilcoxon test was based on the decision that a primary focus of the investigation would be the change in anxiety (HADS scores) following surgery. A mean change of 2 was deemed to be of clinical significance. Assuming the standard deviation of the differences to be ≤ 3 , the minimum sample size needed to obtain 95% power was calculated to be 32. This figure was later revised upwards to 45 to enable multiple regression analyses to be carried out.¹⁷

Seventy nine (81%) of 98 patients invited to take part agreed to participate; 32 patients dropped out having completed time 1 (an attrition rate of 41%). Of these one had a stroke, six changed their minds about having the operation, and four changed their minds about being in the study with no reason given. The greatest majority (21) were lost because of administrative problems of scheduling postoperative appointments. Participants whose postoperative appointments were rescheduled a number of times were given the opportunity to complete the questionnaires by post and the interview by telephone. Five took this opportunity. One participant remains to complete the study. This report examines the complete data set from the 46 individuals who completed both time elements of the study—a 58% completion rate.

RESULTS

Demographic information regarding the study participants is shown in table 1. Clinic staff consider the sample to be representative of the larger population treated at these hospitals. The number of participants who changed their mind about completing the study is small (five) compared to the number lost through administrative problems (21) and is not considered a significant source of bias.

Sixteen of the participants had both a vertical and horizontal eye misalignment, however, in only four cases was the vertical misalignment greater than the horizontal. No significant difference was found when using the larger PCT result so the horizontal measure was used in all cases, since horizontal deviation was more noticeable to onlookers than vertical. Before surgery the mean measured eye misalignment for the whole group was 33.72 (SD 19.93) prism dioptres (PD). Postoperatively this reduced to 8.52 (10.09) PD with 42 (91%) of the participants having a measured eye misalignment of less than 15 PD. In some cases participants' visual function improved (measured stereopsis) but stereoacuity was not recordable in all patients and so these data were not included as a study variable. Of the 18 preoperatively diplopic participants, 11 still had some diplopia postoperatively. One person tested as diplopic postoperatively having been non-diplopic preoperatively.

Analyses were conducted using SPSS (Version 11.0).

Participants reported preoperative levels of social anxiety and social avoidance that were less favourable than normative values (see table 2).¹⁸ Levels for general anxiety were slightly raised compared to relevant norms but levels of depression were comparable.¹⁹ However, standard deviations and ranges indicate that the variation of scores between participants was considerable. Postoperatively, all scores on the standardised questionnaires and VAS improved with the majority achieving significance. Comparisons with normative values showed marked reduction in general anxiety, social anxiety, and social avoidance and a modest reduction in levels of depression.

Pearson's correlation calculations were carried out for both the preoperatively and postoperative standardised scales and VAS scores using age as the independent variable. No significant correlations were found.

To explore the possible effects of sex, diplopia, and direction of eye misalignment ANOVA calculations were carried out in a $2 \times 2 \times 2 \times (2)$ design. Sex, the preoperative

Table 2 Means (SD) preoperatively and postoperatively plus normative values from relevant populations for all study variables

Variable	Preoperative score	Postoperative score	Normative values
HADS anxiety	6.37 (3.48)	5.50 (4.36)	n = 1792, 6.14 (3.76)
HADS depression	3.70 (2.81)	3.02 (3.21)	n = 1792, 3.68 (3.07)
QOL physical	16.02 (2.77)	16.65 (2.72)	Under review*
QOL psychological	14.63 (2.80)	15.47 (3.04)	Under review*
QOL social relations	15.11 (3.17)	15.43 (3.26)	Under review*
QOL environment	15.60 (2.49)	15.80 (2.99)	Under review*
DAS-24	40.20 (10.31)	30.80 (11.27)	N=1004, 29.54 (12.39)
VAS A6 coping	6.87 (1.86)	8.28 (2.05)	NA
VAS C3 impact on lifestyle	5.09 (2.82)	2.13 (2.47)	NA
VAS C5 strabismus worry	5.49 (2.90)	1.95 (2.33)	NA
VAS C6 strabismus noticeability	6.62 (2.71)	2.01 (2.69)	NA
VAS C8 strabismus severity	5.69 (2.47)	1.98 (2.54)	NA

*Under review by WHOQoLBref authors.

presentation of diplopia, and preoperative direction of eye misalignment (esotropic/exotropic) were between subject factors with two levels. The operation was a repeated measures factor with two levels. The significant results are summarised in table 3.

The ANOVA results were indicative of complex relations between the various strabismus characteristics. As the factors were limited to two levels post hoc tests could not be carried out.²⁰ An example: group means indicated that on the VAS scale A6 (coping) the exotropic individuals show a greater improvement in coping after surgery (preop mean = 6.52 (1.86), postop mean = 7.99 (2.26)) compared to the esotropic individuals (preop mean = 7.59 (1.69), postop mean = 8.87 (1.45)) even though the esotropic individuals rate themselves as coping better than the exotropes preoperatively and postoperatively.

The preoperative presence or absence of diplopia featured as a component in several of the significant interaction effects. Paired *t* tests comparing preoperative and postoperative group means (see appendix 3) showed similar patterns of improvements for both groups on the VAS. The non-diplopic group showed improvements on all standardised scale scores, with those for anxiety (HADS), social anxiety and social avoidance (DAS-24), and psychological quality of life (WHOQoLBref) reaching significance. For the diplopic group, improvements in all standardised scores were apparent postoperatively, with the exception of general anxiety. Improvements in physical aspects of quality of life, social anxiety, and social avoidance reached significance.

In order to explore any relations between the degree of eye misalignment and psychosocial distress, Pearson’s correlation calculations were carried out for both the preoperative and postoperative data using the 1/3 m score from the PCT and the VAS providing a subjective measure of condition severity. Preoperatively, approximately one third of the adjustment variables significantly correlated PCT scores (see table 4). Postoperatively, five measures correlated significantly with subjective ratings of severity.

A further series of correlations were computed using PCT change scores (preoperative minus postoperative misalignment). These were not significantly associated with any of the study variables.

Two series of multiple regression analyses using the backward elimination method were carried out. The first examined the relations between preoperative scores and change scores, and the second used postoperative scores.

The best regression analysis model using postoperative scores explained only 35% of the variance of the change in scores for depression ($R^2 = 0.354$). The next best model was for the change scores in social anxiety (DAS-24) using preoperative scores explaining 33% of the variance ($R^2 = 0.335$). Other regression analyses returned equations with lower explanatory values ranging from 0.271 down to 0.08.

DISCUSSION

Preoperative scores indicate that study participants were experiencing more social anxiety and using more social

Table 3 Significant effects of surgery and strabismus characteristics on adjustment on all study variables for all study participants (n = 46)

Variable	Effects of surgery	Interaction effects of surgery and strabismus characteristics
HADS anxiety		Diplopia × direction (F = 5.564, p < 0.02)
HADS depression		Diplopia (F = 5.811, p < 0.02)
QOL physical	F = 5.791 p < 0.02	Diplopia (F = 6.972, p < 0.02)
QOL psychological	F = 5.050 p < 0.03	Sex × diplopia × direction (F = 6.042, p < 0.02)
QOL social relations		Diplopia (F = 6.843, p < 0.013)
QOL environment		Sex × diplopia × direction (F = 4.138, p < 0.05)
DAS-24	F = 30.004 p < 0.001	Gender × diplopia × direction (F = 6.085, p < 0.01)
VAS A6 coping	F = 8.122 p < 0.07	Diplopia (F = 6.375, p < 0.016)
VAS C3 impact on lifestyle	F = 31.794 p < 0.001	Sex × diplopia × direction (F = 5.246, p < 0.03)
VAS C5 strabismus worry	F = 39.050 p < 0.001	
VAS C6 strabismus noticeability	F = 69.815 p < 0.001	Direction of strabismus (F = 5.820, p < 0.02)
VAS C8 strabismus severity	F = 54.440 p < 0.001	Diplopia (F = 12.416, p < 0.001)

Table 4 Pearson's correlations for preoperative and postoperative data showing results for both the objective measure ($\frac{1}{3}$ metre score from the prism cover test (PCT)) and the subjective measure (VAS C8 strabismus severity) (n = 46, df = 44)

Variable	Preoperative		Postoperative	
	$\frac{1}{3}$ metre PCT	VAS C8 strabismus severity	$\frac{1}{3}$ metre PCT	VAS C8 strabismus severity
HADS anxiety	-0.39*	0.17	0.16	0.16
HADS depression	-0.33*	0.08	0.28	0.31*
QOL physical	0.25	-0.11	-0.28	-0.17
QOL psychological	0.37*	-0.13	-0.25	-0.18
QOL social relations	0.17	0.07	-0.27	-0.21
QOL environment	0.35*	-0.10	-0.13	-0.17
DAS-24	-0.09	0.21	0.39*	0.43**
VAS A6 coping	0.04	-0.22	-0.22	-0.09
VAS C3 impact on lifestyle	-0.04	0.39*	0.16	0.54**
VAS C5 strabismus worry	-0.23	0.38*	0.24	0.72**
VAS C6 strabismus noticeability	0.45**	0.13	0.17	0.79**
VAS C8 strabismus severity	0.20	1	0.24	1

*Significant at $p < 0.05$; **significant at $p < 0.01$.

avoidance strategies than a general population comparison group but less than groups of dermatology outpatients (n = 61, mean score 47.3 (13.3)) and those awaiting plastic surgery (n = 50, mean score 47 (11)) drawn from the same geographical catchment area.^{18, 21, 22} Postoperatively scores had reduced to levels broadly similar to normative values. In relation to quality of life strabismic adults in this study scored favourably on all domains compared with dermatology, burns, and general plastics patients.²¹

Both preoperative and postoperative mean scores indicate that participants reported relatively low levels of depression compared with outpatients with a range of disfiguring conditions.²¹ Preoperatively the mean score for general anxiety was within normal limits improving further postoperatively.¹³ Gray *et al* reported that strabismic patients showed lower levels of state anxiety than outpatients awaiting other invasive investigations and comparisons with other outpatient groups with disfiguring conditions supports this position.^{21, 23} However, on all standardised measures, the standard deviation of the scores is high. A small number of patients (n = 5 preoperatively, n = 9 postoperatively) displayed clinical case levels of anxiety (≥ 11).¹³ The subgroup of strabismic adults with high levels of psychological distress could be identified and helped if routine psychosocial screening and referral for appropriate support were available in outpatient clinics.

Following surgery, group means were indicative of significant improvements on all VAS scales and on measures of social anxiety and social avoidance. Surgery also impacted favourably on physical and psychological quality of life, anxiety, and depression.

Like Burke *et al* we found no significant correlations between participant age and the study variables.² ANOVA calculations exploring the effects of sex, diplopia, and direction of eye misalignment showed very limited support for a sex effect which was only significant as part of an interaction relating to the domains of the WHOQoL-Bref. Neither were the effects of the direction of the eye misalignment clear cut. As an example, esotropes rated themselves as coping better than the exotropes both preoperatively and postoperatively; however, exotropes obtained greater benefit from the surgery in relation to coping with their strabismus.

We found evidence for differences in the impact of strabismus and the benefits of the surgery relating to the presence or absence of diplopia. Again, the picture is complicated; however, the non-diplopic group achieved significant improvements on more of the study variables

than the diplopic group. The majority of the 11 with postoperative diplopia reported that life had become easier particularly in relation to the reduced frequency of eye strain and headaches. Three reported that the diplopia remained problematic.

Moss and Robinson have summarised the literature relating to the visibility and severity of a disfigurement and psychological distress.^{8, 24} Both concluded that there is no clear relation between the objective severity of a "visible difference" and adjustment. Preoperatively psychological quality of life, anxiety, depression and perceived noticeability of the strabismus to others were significantly correlated with objectively measured eye misalignment however these effects were not apparent postoperatively. This lack of correlation postoperatively may in part be explained by the fact that there may be up to 15 prism dioptres of either convergent or divergent misalignment present but not visible to the untrained observer.²⁵ The opposite pattern holds for the subjective measure of eye misalignment ("How severe do you feel your strabismus is?"). Preoperatively, only two variables reached significance rising to five variables postoperatively. The significant postoperative correlation between social anxiety and avoidance and the PCT scores, which was not significant preoperatively remains unexplained. No significant correlations were found between the preoperative or postoperative degree of eye misalignment and the degree of postoperative improvement in the measures of adjustment. Overall, therefore, the results confirm the lack of a clearcut relation between the severity of strabismus and psychosocial distress and more research is needed to clarify the nuances of perceived severity and adjustment.

The limited success of the multiple regression analyses in explaining the variance in the results highlights the limitations of reliance on standardised measures as well as the constraints of this statistical method in limiting the number of variables in relatively small sample sizes. Participant responses in interviews suggested strongly that key issues relating both to the motivation to undergo surgery and satisfaction with surgical outcome included the overt and covert responses of others to the eye misalignment, problems with communication in a variety of interpersonal situations, and physical limitations resulting from the strabismus. Further research is needed to clarify the influence of these factors and the potential advantages of developing a strabismus specific questionnaire.

In order to establish the longer term impact of surgical intervention follow up questionnaires and interviews 1 year postoperatively are planned.

CONCLUSION

This study shows that for the majority of patients, strabismus surgery results in significant benefits to psychological adjustment and to patients' evaluations of their own appearance. Although preoperatively a correlation was found between the size of the strabismus and the degree of psychological distress there was no relation between the change in angle of strabismus and postoperative psychological adjustment. At a time when healthcare providers are advocating rationing or "demand management" it is helpful to demonstrate that strabismus surgery offers significant improvements to psychological and physical functioning.

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APPENDIX 1

EXAMPLE QUESTIONS AND RESPONSES FROM THE STANDARDISED QUESTIONNAIRES

(1) **Derriford Appearance Scale (DAS-24)** (Carr et al¹²)

"How distressed do you get when you see yourself in the mirror/window?" Answers to choose from: "Extremely, Moderately, A little, Not at all."

"How distressed do you get when other people make remarks about your feature?" Answers to choose from: "NA, Not at all, Moderately, A fair amount, Extremely."

(1) **Hospital Anxiety and Depression Scale (HADS)** (Zigmund and Snaith¹³)

An example of a question from the anxiety subscale: "I feel tense or 'wound up.'" Possible answers: "Most of the time, A lot of the time, From time to time, Not at all." An example question from the depression subscale: "I can laugh and see the funny side of things." Possible answers: "As much as I always could, Not quite so much now, Definitely not so much now, Not at all."

(1) **WHOQoL-Bref** (The WHOQoL Group¹⁴)

Example question from the physical subscale: "Do you have enough energy for everyday life?" Example question from the psychology subscale: "To what extent do you find life meaningful?" Example question from the social relationships subscale: "How satisfied are you with your personal relationships?"

Example question from the environment subscale: "To what extent do you have enough money to meet your needs?"

All of the questions are marked against a 5 point Likert scale with components which vary to take account of the questions being asked.

APPENDIX 2

QUESTIONS AND RESPONSES FOR THE VISUAL ANALOGUE SCALES (VAS)

- (1) A6, coping "Overall, how well do you think you have coped so far?" Answers: "Poorly," scored as 0; and "Very well," scored as 10.
- (2) C3, lifestyle "To what extent has your strabismus affected your lifestyle?" Answers: "Not at all," scored as 0; and "Very much," scored as 10.
- (3) C5, worry "Do you worry about your strabismus?" Answers: "Not at all," scored as 0; and "Very much," scored as 10.
- (4) C6, noticeability "How noticeable do you feel your strabismus is to other people?" Answers: "Not at all," scored as 0; and "very much," scored as 10.
- (5) C8, strabismus severity "How severe do you feel your strabismus is?" Answers: "Not very severe," scored as 0; and "Extremely severe," scored as 10.

APPENDIX 3

Table A1 Means (SD) for both the diplopic and non-diplopic study participants

Variable	Non-diplopic (n = 28)		Diplopic (n = 18)	
	Preoperative	Postoperative	Preoperative	Postoperative
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
HADS anxiety	6.25 (3.27)	4.57 (3.88)*	6.56 (3.87)	6.94 (4.76)
HADS depression	2.93 (2.48)	2.39 (2.94)	4.89 (2.95)	4.00 (3.46)
QOL physical	17.00 (2.46)	17.28 (2.63)	14.48 (2.57)	15.68 (2.64)*
QOL psychological	15.28 (2.06)	16.24 (2.51)*	13.63 (3.51)	14.28 (3.46)
QOL social relations	15.64 (2.85)	15.74 (3.30)	14.29 (3.53)	14.96 (3.22)
QOL environment	16.36 (1.96)	16.67 (2.34)	14.42 (2.81)	14.44 (3.42)
DAS-24	40.75 (9.36)	29.82 (9.40)**	39.33 (11.87)	32.33 (13.86)*
VAS A6 coping	6.55 (1.73)	8.74 (1.44)**	7.36 (1.99)	7.57 (2.65)
VAS C3 impact on lifestyle	4.63 (2.97)	2.25(2.64)**	5.82 (2.46)	1.95 (2.23)**
VAS C5 strabismus worry	6.04 (2.65)	1.82 (2.30)**	4.64 (3.15)	2.16 (2.42)*
VAS C6 strabismus noticeability	7.92 (1.46)	2.41 (2.95)**	4.57 (2.96)	1.37 (2.14)**
VAS C8 strabismus severity	6.18 (2.27)	2.36 (2.87)**	4.92 (2.62)	1.41 (1.85)**

*:Significant at $p < 0.05$; **:significant at $p < 0.001$.