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Title: Does strabismus surgery improve quality and mood, and what factors influence this?

Running Title: Does strabismus surgery improve psychosocial well-being?

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Aims

To establish the impact of adult strabismus surgery on clinical and psychosocial well-being and determine who experiences the greatest benefit from surgery and how one could intervene to improve quality of life post-surgery.

Methods

A longitudinal study, with measurements taken pre-surgery and at 3 and 6 months post-surgery. All participants completed the AS-20 a disease specific quality of life scale, along with measures of mood, strabismus and appearance-related beliefs and cognitions and perceived social support. Participants also underwent a full orthoptic assessment at their preoperative visit and again 3 months postoperatively. Clinical outcomes of surgery were classified as success, partial success or failure, using the largest angle of deviation, diplopia and requirement for further therapy.

Results

210 participants took part in the study. Strabismus surgery led to statistically significant improvements in psychosocial and functional quality of life. Those whose surgery was deemed a partial success did however experience a deterioration in quality of life. A combination of clinical variables, high expectations, and negative beliefs about the illness and appearance pre-surgery were significant predictors of change in quality of life from pre- to post-surgery.

Conclusions

Strabismus surgery leads to significant improvements in quality of life up to 6 months postoperatively. There are however a group of patients who do not experience these

benefits. A series of clinical and psychosocial factors have now been identified, which will enable clinicians to identify patients who may be vulnerable to poorer outcomes post-surgery and allow for the development of interventions to improve quality of life after surgery.

INTRODUCTION

Strabismus can have debilitating effects on patient's self-esteem, quality of life and mood (1). Surgery to realign the eyes is associated with eliminating diplopia, expanding the visual field and reducing torticollis, as well as overall improvements in quality of life, patient satisfaction and confidence (2-7). However, this is not the case for everyone. Whilst 95% of patients achieve clinical success 6 weeks following surgery, only 60% of patients experience a meaningful improvement in quality of life (8). This suggests that other factors may act as cofounders to successful improvements in quality of life. Cross-sectional studies suggest that depression (1;9), beliefs the patient holds about their appearance, strabismus and its treatment (1), and the expectations patients have about post-surgical outcomes (10) are all factors associated with quality of life in this population, as opposed to clinical variables. There has however, been no exploration of how these factors may impact upon surgical success, or who experiences the optimal quality of life post-surgery.

The studies so far conducted are often flawed by small samples, retrospective designs or short follow-ups. Hence, larger studies with longer follow-up assessments are needed (2;11). This study therefore aims to assess how strabismus surgery impacts upon quality of life and mood in a larger population over a 6 month follow-up period. In order to understand who may benefit most from surgery and what factors could be targeted in an intervention to improve the impact of strabismus surgery on quality of life, this study will also identify the characteristics of patients who experience the greatest improvements in quality of life.

MATERIALS AND METHODS

Participants

This study presents the follow-up of participants who took part in a previous study (1). Between November 2010 and April 2012 consecutive adult strabismus patients listed for surgery at Moorfields Eye Hospital NHS Foundation Trust, London were prospectively identified. Patients were consented either on the day of being added to the waiting list or at their pre-operative assessment. Patients were excluded if they had significant co-morbidities, other facial or ocular abnormalities, or identifiable psychosis, dementia, or other cognitive impairment. Approval was obtained from the North London Research Ethics Committee.

Measures

All self-report questionnaires were completed prior to surgery and again 3 and 6 months post-surgery.

Demographic and clinical

Data were collected on age, gender, ethnicity, previous ocular and treatment history at baseline. All participants underwent a full orthoptic assessment at their preoperative visit and again at 2 weeks and 3 months postoperatively. Examination included the assessment of the direction and size of deviation at near (1/3m) and distance (6m) using the alternate prism cover test (PCAT) and assessment of binocular functions. For multiplanar deviations, the largest angles, targeted for surgical correction, be that at near or distance, were recorded for analysis. Diplopia/visual confusion when present was categorised into two groups based on the position of gaze in which it was present. Diplopia experienced in either primary position (straight ahead) and or downgaze (reading position), or diplopia experienced in another tertiary gaze position during ocular motility assessment. Self-

reported levels of pain, swelling, scaring and redness, as a result of surgery, were recorded on a 10-point Likert scale from 0 (no experience) to 10 (severe).

Classification of 3 month postoperative outcome

Three categories were defined: success, partial success or failure based on the surgical outcome 3 months following strabismus surgery. For success, all of the following categories had to be met (i) the largest angle of deviation for esotropia, exotropia or hypertropia <12 prism dioptres (PD) and hypotropia <20PD (12) (ii) diplopia/visual confusion either absent or rarely appreciated in primary position and reading (iii) no requirement for prism or bangerter foil therapy. For partial success at least one of the above categories should not be met and failure none of the above criteria met.

Primary outcome measure

The AS-20(13) is a validated, strabismus-specific quality of life instrument. The measure consists of two subscales; functional and psychosocial quality of life. Scores range from 0 to 100, with higher scores indicating better quality of life. Successful surgery has been defined as an increase in the psychosocial subscale of 17.7 points and 19.5 points for the function subscale, these are 95% limits of agreement (LOA) (14).

Psychosocial measures

Participants also completed a series of psychosocial measures taken from the framework of adjustment to strabismus (Figure 1) (1). Where possible existing validated measures were used. A full description of the measures employed can be found elsewhere.1 In addition to these measures the following questionnaires were also completed.

Expectations of, and reasons for seeking surgery

Patients' reasons for seeking surgery and their expectations about the benefits of surgery were measured pre-operatively using the Reasons for Strabismus Surgery Questionnaire (RSSQ) and Expectations of Strabismus Surgery Questionnaire (ESSQ) (10). Each consists of 3 subscales (i) intimacy and appearance-related issues, (ii) social relationships, (iii) visual functioning. Total subscale scores range from 1-5 for subscales i and ii, and 1-7 for subscale iii. Higher scores indicate stronger reasons for seeking surgery or higher expectations about the outcome of surgery.

Satisfaction

Participants were asked if they regretted having surgery, with responses on a 4-point Likert scale from 1 (yes definitely) to 4 (not at all). Participants also reported on a 4 point Likert scale from 1 (no hesitation at all) to 4 (certainly not) whether they would go through the surgery again.

Power calculation

The sample size was powered to look at differences in quality of life overtime. As data were hierarchically structured multi-level modelling was performed. This requires a sample size of at least 60, when there are fewer than 5 parameters to be estimated (15). However, in order to perform a hierarchical regression with the independent variables (IV) outlined in Figure 1, with an effect size of 0.15 and α=0.05, GPower 3.1.6 indicated a sample size of 217.

Statistical methods

Little's Missing Completely at Random (MCAR) test indicated no systematic differences between the observed and missing values (p>0.05). Ten scale-level imputation iterations were used to eliminate bias. All analyses, except for the multilevel models, were performed

on each of these 10 datasets and then pooled for multiple imputation to give a final combined result (16). Differences in quality of life between levels of surgical success were explored using one-way between-groups ANOVA. Multilevel modelling was used to explore changes over time. As clinical variables were measured at only two time points differences over time were assessed using either a Wilcoxon Signed Rank test or McNemar's test. Hierarchical multiple regression were performed to identify the baseline predictors of changes in quality of life and which changes in the intervening psychological processes predicted changes in quality of life. The variables were added into the regression based on the framework (Figure 1). Statistical significance was set at $p<0.05$.

RESULTS

Participants

Of the 335 patients who consented, 81.49% completed a baseline questionnaire. Of these 210 completed either a 3 (n=41) or 6 month (n=25) follow-up questionnaire, or both (n=144). Baseline characteristics of the sample can be found in Table 1.

Impact of surgery

Clinical variables

The angle of deviation decreased significantly from baseline (Mean difference (Md)=30, range 2-90) to 6 months (Md=10, range 0-90; z=-11.81, p<0.001, r=-0.57). There was a statistically significant reduction in the proportion of participants who experienced diplopia from prior (58.57%) to 6 months post-surgery (40%; $p<0.001$). A small proportion (5.85%) experienced surgery induced diplopia at 3 months, 11 in the primary and downgaze position and 1 in another gaze. Low levels of pain, swelling, scarring and redness were reported at

both 3 and 6 months post-surgery, with no significant changes in pain, swelling or scarring between these two follow-ups. Improvements in redness from 3 (Md=1, range 0-10) to 6 months (Md=0, range 0-10) post-surgery were significant (z=-3.51, *p*=0.001, r=-0.24).

Psychosocial variables

Statistically significant improvements in psychosocial and functional quality of life, anxiety and depression, social anxiety and social avoidance, illness and treatment beliefs, fear of negative evaluation, perceived visibility and, salience and valance of appearance (Table 2) were found from pre-surgery to 3 months and pre-surgery to 6 months. There were no significant changes from 3 to 6 months. Overtime the number of participants who were meeting moderate or 'caseness' levels of anxiety or depression, or scoring below normal in quality of life, reduced significantly from pre-surgery to 6 months post-surgery, whilst the proportion of patients in the normal classification for mood and above normal in quality of life increased. There was no statistically significant difference in the proportion of participants who exceeded the 95% LOAs at 3 and 6 months post-surgery (psychosocial quality of life: *p*=0.33; functional quality of life *p*=0.12).

Relationship between clinical success and quality of life

According to clinical criteria, 110 (52.38%) participants experienced successful surgery, 20 (9.52%) failed and 80 (38.09%) were partial successes. Of these 80 partial successes, 10 (12.5%) were scheduled for further surgery, 43 (53.75%) had been discharged from the service, 13 (16.25%) had a scheduled follow-up appointment, 9 (11.25%) were receiving prism therapy and 5 (6.25%) botulinum toxin therapy. Whilst there were no statistically significant differences between these three groups of patients on changes in functional quality of life from baseline to 6 months ($F_{2, 207}$= 0.89, *p*=0.42), there were differences in

changes in psychosocial quality of life ($F_{2, 207}$=4.22, p=0.02, η2=0.04). Post-hoc comparison indicated that the mean residualised change score for those who experienced partial success (M=-0.24, SD=0.84) was significantly lower than those who experienced success (M=0.18, SD=1.05).

Satisfaction

Over 80% of patients did not regret having surgery, approximately 6% had some regret either at 3 or 6 months. Between 70 and 80% of the sample would go through the operation, only 1-4% would not.

Who benefits most from surgery?

The final model for changes in psychosocial quality of life explained 85% of the total variance ($F_{49, 160}$= 18.60, p<0.001). The statistically significant predictors were the IPQ-R consequences subscale, the intimacy and appearance-related issues subscale of the RSSQ, the DAS24 and perceived visibility at baseline (Table 3). The final model for changes in functional quality of life explained 72% of the variance ($F_{49, 160}$=8.60, p<0.001). The statistically significant predictors were ethnicity, classification, the IPQ-R consequences subscale, the TRI treatment concern subscale, the visual functioning subscale of the ESSQ and RSSQ, and DAS24 at baseline (Table 3).

Which concepts should be targeted in order to improve the impact of surgery?

The final model for changes in psychosocial quality of life accounted for 78% of the variance ($F_{19, 190}$=35.78, p<0.001). The statistically significant predictors were changes in; the IPQ-R consequences subscale, salience, DAS24 and in perceived visibility (Table 4). The final model for changes in psychosocial quality of life accounted for 51% of the variance ($F_{19,190}$=10.48,

183 p<0.001). The statistically significant predictors were changes in; the IPQ-R consequences
184 subscale, perceived visibility, social support from significant others and depression (Table 4).

185 **DISCUSSION**

186 In line with previous research (17;18) strabismus surgery led to significant improvements in
187 psychosocial and functional quality of life from preoperative assessment through to 3
188 months post-surgery. No further improvements in quality of life were found at the 6 month
189 follow-up, supporting previous research (11). Although improvements in psychosocial, but
190 not functional quality of life, have been found up to 1 year post-surgery (19) this does not
191 negate the possibility that quality of life curtails 3 months after surgery. Contrary to what
192 might be expected, improvements in functional quality of life were not associated with how
193 successful surgery was from a clinical perspective. However, surgery deemed partially
194 successful was found to be more detrimental, leading to a reduction in psychosocial quality
195 of life from pre to post-surgery, than either success or failure, which both led to
196 improvements in psychosocial quality of life. This contradicts other findings, which suggest
197 no association between success of surgery and changes in psychosocial quality of life, but
198 small improvements in functional quality of life were in failed surgery and larger
199 improvements after successful surgery (20). The criteria used to define success and failure
200 between these studies did however differ and could explain these differences (20).

201 This study also provides unique evidence that strabismus surgery not only leads to
202 improvements in quality of life, but other psychosocial domains. The proportion of people
203 with strabismus living with clinical anxiety or depression is considerably greater than that of
204 the general population and those with a chronic conditions (1), therefore a reduction in the
205 number of patients meeting these criteria is an important step towards improving the

mental health of this population. As a result of the restorative nature of strabismus surgery, it is unsurprising that patients perceived their strabismus as being less visible after surgery and felt more positive about their appearance, this appears to have enabled participants to feel more confident and less fearful of interacting and socialising with others, leading to reductions in social anxiety, and consequently improvements in quality of life.

Greater improvements in quality of life from pre- to post-surgery was more likely in those who held more positive beliefs about their strabismus and treatment, experienced less social anxiety and social avoidance and had lower expectations about the outcome of their surgery prior to surgery. Although one might expect that targeting surgery towards those who are less able to cope would be more beneficial, these negative beliefs, high expectations and inability to socialise may impinge on the success of surgery. Being able to predict who will benefit most from surgery is clearly more complex than targeting those who appear more severely affected clinically or psychologically. Careful consideration therefore needs to be taken when listing patients for surgery who report more distress, as these patients maybe more likely to request further surgery as a result of not meeting high expectations for example, and may benefit from additional psychosocial support in order to optimise the benefits of surgery.

This study suggests that quality of life post-surgery could be improved by addressing people's beliefs about the negative consequences of their strabismus, challenging the value they place on appearance and how visible they think their squint is, as well as improving social skills. The evidence for improving the psychosocial well-being of people with a visible difference is at present weak, with more theoretically driven interventions, evaluated in RCTs, required (21). This could involve adapting and tailoring CBT-based or social skills

interventions that have been developed and evaluated in people with a visible difference (22) for the specific needs of people with strabismus.

The present study is limited by the lack of a randomised control group, which means that the changes observed from pre- to post-surgery cannot be directly attributed to surgery. This is however unlikely given the significant psychological impact of living with strabismus, which is not predicted by disease duration (1).

An appearance that differs from the norm can prove challenging in a society which is focused on appearance. Restorative surgery, such as ocular realignment, which reduces the perceived visibility and negative perceptions of one's own appearance, may therefore provide a mechanism via which people feel better able to interact and cope in social situations, and hence reduces fear of negative reactions and social anxiety. It is however clear that not all experience these benefits despite successful clinical outcomes, therefore by intervening both psychologically and clinically the findings of this study may provide a unique mechanism via which the benefits of strabismus surgery can be optimised.

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CONFLICTS OF INTEREST

The authors have nothing to disclose

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305 Titles and legends to figures

306 Figure 1. Framework outlining the process of psychological adjustment to strabismus

Table 1. Baseline characteristics of the sample

	All n=210
Age (years)	46 (17-88)
Female/Male	118/92
Ethnicity	
White	170
Black African/Caribbean	9
South Asian	19
Other	12
Concomitant/Incomitant	124/86
Classification[a]	
Primary	35
Residual	33
Secondary	10
Secondary (Iatrogenic)	9
Consecutive	39
Neurogenic	47
Mechanical	37
Other	3
Disease duration (years)	24 (0-88)
Age of onset (years)	23 (0-76)
Previous surgery (yes/no)	98/112
Total no. of previous strabismus surgeries	1 (0-6)
Previous Botulinum toxin type A therapy (yes/no)	81/129
Previous prism therapy for diplopia (yes/no)	47/163
Worse eye visual acuity - LogMAR Conversion[b]	0.40 (-0.20 – 2.20)
Best eye visual acuity - LogMAR Conversion[b]	-0.06 (-0.20 – 0.80)
Deviation in primary position	
Esotropia	59
Exotropia	78
Hypotropia & Hypertropia	61
Other	12
Deviation in primary position	33.87 (2-90)
Diplopia/No diplopia	123/87
Mood (Anxiety/Depression)	
Normal	123/172
Moderate	45/21
Caseness	42/18
AS20 Function/Psychosocial	
Below normal threshold	152/179
Above normal threshold	58/31

[a] Secondary refers to a squint occurring following the loss or impairment of vision. Secondary (iatrogenic) refers to squint occurring secondary to sight saving surgery e.g. retinal detachment surgery; [b] Visual acuity. Vision acuity measured as Snellen's acuity but converter into LogMAR scale for statistical analysis. LogMAR values ranged between -0.20 and 2.1. The score of 2.2 LogMAR being assigned to vision of counting fingers, hand movements, perception of light and non-perception of light

Table 2. Changes over time, estimated marginal mean (SE)

	Baseline	**3 month**	**6 month**	**Statistic**
AS20 Psychosocial	**56.45 (1.62)**	**71.94 (1.75)***	**74.65 (1.87)***	**$F_{2,273.84}$ = 82.19, p < 0.001**
AS20 Function	**56.44 (1.44)**	**68.29 (1.57)***	**69.42 (1.67)***	**$F_{2,280.03}$ = 53.70, p < 0.001**
Depression	**4.69 (0.23)**	**3.52 (0.25)***	**3.21 (0.26)***	**$F_{2,286.28}$ = 24.28, p < 0.001**
Anxiety	**6.94 (0.26)**	**5.69 (0.28)***	**5.79 (0.30)***	**$F_{2,295.11}$ = 17.31, p < 0.001**
DAS24	**39.29 (0.86)**	**34.66 (0.93)***	**34.46 (0.98)***	**$F_{2,242.42}$ = 24.03, p < 0.001**
IPQ-R Personal control	2.51 (0.06)	2.46 (0.06)	2.43 (0.06)	$F_{2,313.36}$ = 0.72, p = 0.49
IPQ-R Consequences	**2.99 (0.06)**	**2.35 (0.07)**	**2.23 (0.07)**	**$F_{2,262.84}$ = 80.64, p < 0.001**
IPQ-R Timeline	**3.66 (0.07)**	**3.11 (0.07)**	**3.04 (0.07)**	**$F_{2,283.44}$ = 41.71, p < 0.001**
TRI Treatment value	**2.97 (0.04)**	**2.86 (0.05)**	**2.83 (0.05)***	**$F_{2,314.04}$ = 3.99, p = 0.02**
TRI Treatment Concerns	**2.76 (0.05)**	**2.33 (0.06)***	**2.19 (0.06)***	**$F_{2,282.80}$ = 52.12, p < 0.001**
TRI Decision satisfaction	**3.97 (0.04)**	**4.13 (0.04)***	**4.16 (0.04)***	**$F_{2,295.88}$ = 11.86, p < 0.001**
TRI Cure	**3.61 (0.04)**	**3.27 (0.05)***	**3.24 (0.05)***	**$F_{2,348.88}$ = 26.66, p < 0.001**
FNE	**37.11 (0.57)**	**35.60 (0.61)***	**35.52 (0.64)***	**$F_{2,272.66}$ = 7.19, p = 0.01**
Perceived visibility	**4.87 (0.12)**	**3.06 (0.13)***	**2.79 (0.14)***	**$F_{2,333.02}$ = 120.55, p < 0.001**
CARSAL	**32.46 (0.42)**	**30.92 (0.46)***	**31.03 (0.48)***	**$F_{2,299.58}$ = 10.51, p < 0.001**
CARVAL	**20.38 (0.49)**	**17.64 (0.54)***	**17.41 (0.57)***	**$F_{2,286.99}$ = 22.65, p < 0.001**
Social support - Family	16.19 (0.23)	16.10 (0.25)	16.46 (0.26)	$F_{2,309.33}$ = 1.56, p = 0.21
Social support - Friends	16.00 (0.21)	16.02 (0.23)	16.04 (0.24)	$F_{2,303.20}$ = 0.02, p = 0.98
Social support - Significant others	16.02 (0.27)	15.73 (0.30)	15.76 (0.31)	$F_{2,292.73}$ = 0.87, p = 0.42
Anxiety				
Normal	**123 (58.57)**	**131 (70.81)**	**115 (68.05)**	**χ^2 (2, n=210) =20.19, p < 0.001**
Moderate	**45 (21.43)**	**33 (17.84)**	**35 (20.71)**	
Caseness	**42 (20.00)**	**21 (11.35)**	**19 (11.24)**	
Depression				
Normal	**172 (81.90)**	**165 (89.19)**	**151 (89.35)**	**χ^2 (2, n=210) =13.90, p=0.001**
Moderate	**21 (10.00)**	**11 (5.95)**	**11 (6.51)**	
Caseness	**18 (8.57)**	**9 (4.86)**	**7 (4.14)**	

	Baseline	3 month	6 month	Statistic
AS20 Psychosocial				
Below norm	**179(85.24)**	**124(67.03)**	**116(68.64)**	**χ^2 (2, n=210) =47.50, *p*=0.001**
Above norm	**31(14.76)**	**61(32.97)**	**53(31.36)**	
AS20 Function				
Below norm	**152(72.38)**	**87(47.03)**	**76(44.97)**	**χ^2 (2, n=210)=55.93, *p*=0.001**
Above norm	**58(27.62)**	**98(52.97)**	**93(55.03)**	
AS20 Psychosocial	-			-
Exceeded 95% LOAs		68(36.76)	74(43.79)	
Did not exceed 95% LOAs		117(63.24)	95(56.21)	
AS20 Function	-			-
Exceeded 95% LOAs		61(32.97)	64(37.87)	
Did not exceed 95% LOAs		124(67.03)	105(62.13)	

*significant difference from baseline $p<0.01$

Table 3. Baseline predictors of change in psychosocial and functional quality of life

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper bound**
Outcome: Psychosocial quality of life					
(Constant)	**0.00**	**4.50**	**0.00**	**1.70**	**4.34**
Age	0.00	-0.01	0.99	-0.01	0.01
Gender	0.03	0.70	0.48	-0.10	0.20
Ethnicity					
Black	0.02	0.48	0.63	-0.28	0.47
South Asian	-0.04	-0.98	0.32	-0.40	0.13
Other ethnicity	0.02	0.49	0.62	-0.23	0.38
Classification					
Primary	0.03	0.62	0.54	-0.17	0.33
Residual	0.02	0.41	0.68	-0.24	0.37
Secondary	-0.03	-0.71	0.48	-0.57	0.27
Secondary iatrogenic	0.05	1.18	0.24	-0.16	0.63
Consecutive	0.00	0.00	1.00	-0.31	0.31
Mechanical	-0.04	-0.90	0.37	-0.35	0.13
Other classification	0.01	0.41	0.68	-0.46	0.71
Disease duration (years)	-0.05	-0.61	0.54	-0.01	0.01
Age of onset (years)	-0.10	-1.24	0.22	-0.01	0.00
Previous surgery (yes/no)	-0.04	-0.61	0.54	-0.31	0.16
Total no. of previous strabismus surgeries	-0.03	-0.50	0.62	-0.13	0.08
Previous Botulinum toxin type A therapy (yes/no)	0.01	0.24	0.81	-0.13	0.17
Previous prism therapy for diplopia (yes/no)	-0.06	-1.32	0.19	-0.34	0.07
Worse eye visual acuity - LogMAR Conversion†	-0.02	-0.43	0.67	-0.15	0.10
Best eye visual acuity - LogMAR Conversion†	0.04	1.14	0.25	-0.24	0.91

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper bound**
Deviation in primary position	0.01	0.31	0.75	0.00	0.01
Deviation in primary position					
Esotropia	-0.01	-0.17	0.87	-0.23	0.19
Hypertropia or hypotropia	0.01	0.13	0.90	-0.25	0.28
Other direction	0.01	0.26	0.79	-0.32	0.43
Diplopia	0.09	1.65	0.10	-0.03	0.38
IQP-R Timeline	-0.01	-0.28	0.78	-0.10	0.07
IQP-R Consequences	**-0.18**	**-3.41**	**0.00**	**-0.32**	**-0.09**
IQP-R Personal control	-0.02	-0.51	0.61	-0.10	0.06
TRI Treatment value	0.01	0.30	0.77	-0.13	0.17
TRI Treatment concerns	-0.03	-0.63	0.53	-0.13	0.07
TRI Decision satisfaction	0.00	-0.06	0.95	-0.18	0.17
TRI Cure	-0.02	-0.37	0.71	-0.19	0.13
FNE	-0.06	-1.21	0.23	-0.02	0.00
ESSQ Intimacy and appearance-related issues	-0.05	-0.73	0.46	-0.28	0.13
ESSQ Visual functioning	0.08	1.17	0.25	-0.09	0.36
ESSQ Social functioning	0.02	0.40	0.69	-0.23	0.34
RSSQ Intimacy and appearance-related issues	**-0.24**	**-3.57**	**0.00**	**-0.33**	**-0.09**
RSSQ Visual functioning	0.02	0.36	0.72	-0.09	0.13
RSSQ Social functioning	-0.06	-1.11	0.27	-0.19	0.05
DAS24	**-0.25**	**-4.39**	**0.00**	**-0.03**	**-0.01**
Appearance concern	-0.08	-1.57	0.12	-0.40	0.04
Perceived visibility	**-0.26**	**-4.43**	**0.00**	**-0.19**	**-0.07**
Salience	-0.01	-0.11	0.91	-0.01	0.01
Valence	0.01	0.15	0.88	-0.01	0.01

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper bound**
Social support - Family	-0.05	-1.11	0.27	-0.04	0.01
Social support - Friends	0.04	0.95	0.34	-0.01	0.04
Social support - Significant others	0.05	1.20	0.23	-0.01	0.03
Anxiety	-0.03	-0.60	0.55	-0.03	0.02
Depression	-0.01	-0.10	0.92	-0.03	0.03
Outcome: Functional quality of life					
(Constant)	0.00	4.66	0.00	2.35	5.76
Age	-0.01	-0.12	0.91	-0.01	0.01
Gender	0.05	0.91	0.36	-0.11	0.29
Ethnicity					
Black	0.05	0.97	0.33	-0.23	0.69
South Asian	0.06	1.12	0.26	-0.16	0.57
Other ethnicity	**0.10**	**2.12**	**0.03**	**0.03**	**0.83**
Classification					
Primary	-0.05	-0.73	0.47	-0.45	0.21
Residual	-0.01	-0.18	0.86	-0.44	0.36
Secondary	0.00	0.00	1.00	-0.56	0.56
Secondary iatrogenic	**-0.14**	**-2.62**	**0.01**	**-1.22**	**-0.17**
Consecutive	0.08	0.92	0.36	-0.22	0.61
Mechanical	-0.10	-1.58	0.11	-0.58	0.06
Other classification	-0.06	-1.25	0.21	-1.25	0.28
Disease duration (years)	-0.10	-0.96	0.34	-0.01	0.01
Age of onset (years)	-0.09	-0.79	0.43	-0.01	0.01
Previous surgery (yes/no)	-0.11	-1.34	0.18	-0.52	0.10

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper bound**
Total no. of previous strabismus surgeries	0.07	0.83	0.41	-0.08	0.19
Previous Botulinum toxin type A therapy (yes/no)	0.09	1.76	0.08	-0.02	0.38
Previous prism therapy for diplopia (yes/no)	0.08	1.41	0.16	-0.08	0.46
Worse eye visual acuity - LogMAR Conversion†	0.05	0.78	0.44	-0.10	0.23
Best eye visual acuity - LogMAR Conversion†	0.01	0.28	0.78	-0.65	0.86
Deviation in primary position	0.01	0.10	0.92	-0.01	0.01
Deviation in the primary position					
Esotropia	0.00	0.05	0.96	-0.27	0.29
Hypertropia or hypotropia	0.15	1.85	0.07	-0.02	0.68
Other direction	0.06	1.03	0.30	-0.23	0.75
Diplopia	-0.10	-1.46	0.14	-0.48	0.07
IQP-R Timeline	-0.01	-0.21	0.83	-0.12	0.10
IQP-R Consequences	**-0.28**	**-3.81**	**0.00**	**-0.45**	**-0.14**
IQP-R Personal control	0.04	0.88	0.38	-0.06	0.16
TRI Treatment value	-0.03	-0.52	0.60	-0.25	0.15
TRI Treatment concerns	**-0.15**	**-2.49**	**0.01**	**-0.30**	**-0.04**
TRI Decision satisfaction	-0.05	-0.78	0.44	-0.31	0.14
TRI Cure	-0.02	-0.26	0.80	-0.24	0.18
FNE	-0.06	-0.85	0.39	-0.02	0.01
ESSQ Intimacy and appearance-related issues	0.15	1.68	0.10	-0.04	0.51
ESSQ Visual functioning	**-0.17**	**-2.04**	**0.04**	**-0.54**	**-0.01**
ESSQ Social functioning	-0.02	-0.31	0.76	-0.43	0.31
RSSQ Intimacy and appearance-related issues	0.11	1.26	0.21	-0.05	0.25
RSSQ Visual functioning	**-0.20**	**-2.42**	**0.02**	**-0.33**	**-0.03**
RSSQ Social functioning	0.00	-0.06	0.96	-0.16	0.15

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper bound**
DAS24	**-0.21**	**-2.78**	**0.01**	**-0.03**	**0.00**
Appearance concern	0.00	0.01	0.99	-0.29	0.29
Perceived visibility	0.05	0.60	0.55	-0.05	0.10
Salience	-0.07	-1.09	0.27	-0.03	0.01
Valence	0.00	-0.06	0.95	-0.02	0.02
Social support - Family	-0.06	-0.85	0.40	-0.05	0.02
Social support - Friends	0.05	0.72	0.47	-0.02	0.05
Social support - Significant others	-0.08	-1.32	0.19	-0.04	0.01
Anxiety	-0.06	-0.92	0.36	-0.04	0.02
Depression	-0.14	-1.94	0.05	-0.07	0.00

Table 4. Changes in clinical and psychosocial variables that predict change in psychosocial and functional quality of life

	β	t	*p*	95% CI for β	
				Lower Bound	**Upper Bound**
Outcome: Psychosocial quality of life					
(Constant)	0.00	0.39	0.69	-0.08	0.12
Success					
Partial success	-0.03	-0.78	0.44	-0.22	0.09
Unsuccessful	0.00	-0.13	0.90	-0.27	0.24
Change in IPQ-R Timeline	0.00	0.04	0.97	-0.08	0.08
Change in IPQ-R Consequences	**-0.16**	**-3.09**	**0.00**	**-0.26**	**-0.06**
Change in IPQ-R Personal control	-0.01	-0.15	0.88	-0.08	0.07
Change in TRI Treatment value	0.02	0.48	0.63	-0.07	0.12
Change in TRI Treatment concerns	-0.03	-0.78	0.43	-0.11	0.05
Change in TRI Decision satisfaction	-0.02	-0.40	0.69	-0.10	0.07
Change in TRI Cure	-0.04	-0.77	0.44	-0.14	0.06
Change in FNE	-0.04	-0.85	0.39	-0.14	0.06
Change in Salience	**-0.11**	**-2.33**	**0.02**	**-0.20**	**-0.02**
Change in DAS24	**-0.31**	**-5.42**	**0.00**	**-0.41**	**-0.19**
Change in Valence	-0.05	-0.93	0.35	-0.14	0.05
Change in Perceived visibility	**-0.42**	**-8.68**	**0.00**	**-0.51**	**-0.32**
Change in Social support - Significant others	0.07	1.53	0.13	-0.02	0.16
Change in Social support - Family	-0.06	-1.20	0.23	-0.16	0.04
Change in Social support - Friends	0.02	0.38	0.70	-0.07	0.11
Change in Anxiety	-0.06	-1.13	0.26	-0.16	0.04
Change in Depression	0.04	0.73	0.47	-0.07	0.14
Outcome: Functional quality of life					

(Constant)	0.00	-0.36	0.72	-0.17	0.12
Success					
Partial success	0.01	0.22	0.83	-0.21	0.26
Unsuccessful	0.00	0.01	0.99	-0.36	0.36
Change in IPQ-R Timeline	0.01	0.15	0.88	-0.11	0.13
Change in IPQ-R Consequences	**-0.38**	**-4.83**	**0.00**	**-0.51**	**-0.22**
Change in IPQ-R Personal control	0.06	1.06	0.29	-0.05	0.16
Change in TRI Treatment value	-0.09	-1.20	0.23	-0.22	0.05
Change in TRI Treatment concerns	-0.12	-1.97	0.05	-0.24	0.00
Change in TRI Decision satisfaction	-0.06	-0.94	0.35	-0.19	0.07
Change in TRI Cure	0.05	0.64	0.52	-0.10	0.19
Change in FNE	0.02	0.29	0.77	-0.12	0.16
Change in DAS24	-0.07	-0.82	0.41	-0.22	0.09
Change in Salience	0.01	0.08	0.94	-0.13	0.14
Change in Valence	-0.02	-0.26	0.79	-0.16	0.12
Change in Perceived visibility	**0.23**	**3.28**	**0.00**	**0.09**	**0.36**
Change in Social support - Significant others	**-0.13**	**-2.07**	**0.04**	**-0.26**	**-0.01**
Change in Social support - Family	-0.02	-0.29	0.77	-0.16	0.12
Change in Social support - Friends	0.09	1.30	0.19	-0.04	0.22
Change in Anxiety	-0.05	-0.60	0.55	-0.19	0.10
Change in Depression	**-0.34**	**-4.39**	**0.00**	**-0.49**	**-0.19**