

Gain beyond cosmesis: Demonstration of psychosocial and functional gains following successful strabismus surgery using the adult strabismus questionnaire adult strabismus 20

Danish Alam, Adeb Alam Khan, Sadat AO Bani, Richa Sharma, Abadan K Amitava

Background: Strabismus adversely affects psychosocial and functional aspects; while its correction impacts positively. **Aim:** The aim was to evaluate the gains in scores: Overall scores (OASs), psychosocial subscale scores (PSSs) and functional subscale scores (FSSs) following successful surgical alignment. **Settings and Design:** We evaluated changed scores in the adult strabismus 20 (AS-20) questionnaire, administered before and after successful surgery. **Materials and Methods:** Thirty adults horizontal strabismics, were administered the AS-20, at baseline, and at 6-week and 3-month. Group-wise analysis was carried out based on gender, strabismus type (esotropia [ET] or exotropia [XT]), back-ground and amblyopia. **Statistical Analysis:** We used Wilcoxon, and Mann-Whitney U-tests. Significance was set at $P \leq 0.05$. **Results:** At baseline, there were no significant differences within the groups, except that those with amblyopia significantly scored less than nonamblyopes in OAS (median scores: 53.8 vs. 71.3; $P = 0.009$) and FSS (56.3 vs. 85.3; $P = 0.009$). OAS, PSS and FSS showed significant gains at 6-week and 3-month (all Wilcoxon $P < 0.001$). Compared with males, females showed significantly more gain at 3-month (OAS: 37.9 vs. 28.7; $P = 0.02$), on account of PSS gain (49.6 vs. 37.5; $P = 0.01$). The ET performed better than XT only on the FSS at 6-week (28.7 vs. 15.0; $P = 0.02$). Vis-à-vis the nonamblyopes, the amblyopes showed significantly more benefit at 6-week alone (OAS: 18.7 vs. 28.7; $P = 0.04$), largely due to gains in PSS. **Conclusions:** Successful strabismus surgery has demonstrated significant gains in psychosocial, functional and overall functions. There is some evidence that gains may be more in females; with a trend to better outcomes in ET and amblyopes up to 6-week.

Key words: Adult strabismus-20, functional, psychosocial, strabismus, surgery

Strabismus is known to adversely affect self-esteem, self-confidence and interpersonal relationships in individuals and families.^[1-4] It not only negatively impacts appearance,^[2] but also social aspects such as marriage,^[5] job, binocularity and depth perception.^[5,6] From a quality of life (QoL) perspective, it is considered to be as detrimental as macular degeneration and cerebrovascular accidents, and more than diabetic retinopathy.^[7] The correction of strabismus restores normalcy, and should not be considered as merely cosmetic.^[5,8,9] Some of the other benefits that accrue from corrected alignment are: Improved head posture,^[10] expansion and centralization of visual fields,^[11,12] elimination of diplopia,^[13] restored binocularity including stereopsis, and ocular motility,^[14] and a positive impact on psychomotor development.^[15-17]

The negative effects of strabismus, and the benefits of surgical correction, have been confirmed using various generic questionnaires, including the Behavior Assessment System for Children,^[18] the hospital anxiety and depression scale (HADS),^[19] WHO Qol Bref,^[19] RAND Health Insurance Study Qol instrument,^[20] as well as telephonic questionnaires.^[21] The amblyopia and strabismus questionnaire (ASQE) a 26-item

instrument, in which the ASQE scores highly correlate with disability, only four deal with the psychosocial elements of strabismus.^[22] The 20-item adult strabismus questionnaire (AS-20) has recently been made available,^[23] and as yet only few studies have used this tool,^[24-29] although psychosocial and functional benefits of corrective surgery have been reported using other instruments.^[19-21,30]

We planned a study to evaluate the change in psychosocial and functional domains following successful corrective surgery for strabismus in adults using the AS-20, particularly since no such study has been reported on an Indian population using this instrument.

Materials and Methods

After Institutional review board clearance we prospectively recruited strabismus patients (January 2011-December 2012) qualifying for corrective surgery. We included all patients of concomitant manifest strabismus (preoperative deviation ≥ 15 prism diopters [PDs]) who were successfully aligned postoperatively (within 10 PDs of orthophoria). We excluded patients of paralytic or restrictive strabismus or with associated facial dysmorphism, disfigurement (ptosis, corneal scar, thyroid eye disease or facial palsy) or those unable to consent or comprehend the questionnaire. We also excluded children under the age of 10 years, and patients who seemed uncomfortable with the personal nature of the questionnaire. No financial or other incentive was offered. A detailed general, ocular and strabismus work up was done; including vision (log MAR equivalent), dry and wet retinoscopy (cyclopentolate 1%,

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Department of Ophthalmology, Institute of Ophthalmology, Aligarh Muslim University, Aligarh, Uttar Pradesh, India

Correspondence to:

Dr. Abadan K Amitava,
Institute of Ophthalmology, Aligarh Muslim University,
Aligarh - 202 001, Uttar Pradesh, India.
E-mail: akamitava@gmail.com

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two drops 5 min apart with refraction done after 15-20 min of the second drop), bio-microscopy, ophthalmoscopy, and clinical photography. Ocular deviation was measured with prism bars (prism and alternate cover test or Krimsky test). We undertook strabismus correction under peri-bulbar block using standard technique. All patients were administered the AS-20, first preoperatively followed by postoperatively at 4-6 weeks and at 3 months (± 1 week). The AS-20 is a 20 question strabismus-specific questionnaire; using a five-point Likert scoring scale for each question: Never (score 100), rarely (75), sometimes (50), often (25), and always (score 0). The AS-20 is concerned with both the psychosocial aspects of strabismus (the first 10 questions) and its functional aspects (last 10). The AS-20 permits calculation of mean scores: All 20 questions for overall scores (OASs), questions 1-10 for the psychosocial subscale scores (PSSs), and questions 11-20 for functional subscale scores (FSSs). Thus in this paired design, before and after AS-20 scores would permit evaluation of the impact of alignment on the psychosocial and visual aspects.

Secondarily, we performed sub group analysis according to the patients' background (rural vs. urban), gender and type of strabismus (esotropes [esotropia [ET]] vs. exotropes [exotropia [XT]]) to assess whether these had a bearing on the outcome.

Statistical analysis

Change in AS-20 scores following surgery were assessed using Wilcoxon signed rank test, while between groups analysis was done using Mann-Whitney U-test significance was set at $P \leq 0.05$.

Results

Thirty patients with horizontal strabismus undergoing first time surgery were recruited. The demographic details are given in Table 1. From the best-corrected visual acuity (VA) perspective 22 patients had vision classified as "normal" (WHO blindness classification, that is, 20/20-20/60 in both eyes); while eight had less than "normal" vision (i.e. VA $< 20/60$ in at least one eye). Twelve patients (40%) had unilateral amblyopia (interocular VA difference of at least two lines Snellen).

We recorded the ocular deviation at baseline (prior to surgery) and at 6 weeks and 3 months follow-up [Table 2]. Deviations in various subgroups are also shown. At baseline, based on their responses to the AS-20, the PSS, FSS and OAS were calculated; Group wise comparison showed no significant differences, other than those with amblyopia scored significantly less than those without, in the OAS and FSS [Table 3]. Both at 6 weeks and 3 months follow-up, there were a significant increase in all scores (OAS, PSS and FSS) from baseline (Wilcoxon signed rank test P values at both time points uniformly < 0.001) [Table 4].

We looked for significant differences on changed scores (scores obtained when baseline scores were subtracted from 6 weeks and from 3 months). This was done for psychosocial and FSSs and for OASs in different subgroups. We performed the Mann-Whitney U-test to detect significant differences on the changed scores between genders (males vs. females), type of strabismus (ET vs. XT) kind of background (rural vs. urban) and presence of amblyopia [Table 5].

Table 1: Demographic characteristics of the subjects (n=30)

Characteristics	Appropriate units/counts(%)
Age (years)	
Mean (SD)	19.5 (5.0)
Range	11-34
Gender	
Female:Male (numbers)	11:19
Background: Number (%)	
Rural	12 (40)
Urban	18 (60)
Education level number (%)	
No schooling	3 (10)
Up to 8 th standard	9 (30)
$\geq 9^{\text{th}}$ standard	18 (60)
Strabismus type	
ET (n=22) (in PD)	
Mean (SD)	54
Median (range)	52.5
XT (n=8) (in PD)	
Mean (SD)	50.0
Median (range)	52.5
Amblyopia status (%)	
Present	12 (40)
Absent	18 (60)

SD: Standard deviation, ET: Esotropia, XT: Exotropia, PD: Prism dioptre

Table 2: Ocular deviation (in PD: mean (SD)) at baseline and at 6 weeks and 3 months postoperatively in the 30 strabismic patients sub-group wise

Group/ sub-group	Deviation at baseline (PD)	Deviation at 6 weeks (PD)	Deviation at 3 months (PD)
Gender			
Female (n=11)	55.9 (16.4)	6.1 (4.3)	5.8 (4.2)
Male (n=19)	52.1 (18.5)	6.1 (3.9)	4.4 (3.9)
Background			
Rural (n=12)	55.8 (19.1)	8.0 (2.8)	6.0 (3.8)
Urban (n=18)	51.9 (16.8)	4.8 (4.1)	4.2 (4.1)
Strabismus type			
ET (n=22)	50.0 (13.3)	6.3 (4.1)	6.2 (4.0)
XT (n=8)	54.7 (18.9)	6.0 (4.0)	4.4 (3.9)
Amblyopia status			
Present (n=12)	53.3 (20.5)	6.6 (3.8)	5.3 (4.3)
Absent (n=18)	53.6 (16.0)	5.8 (4.2)	4.7 (3.9)

SD: Standard deviation, ET: Esotropia, XT: Exotropia, PD: Prism dioptre

Discussion

Following successful surgical alignment in 30 adult horizontal-strabismus patients, we showed a significant improvement in PSS, FSS, and OAS (Wilcoxon test: $P < 0.05$; [Table 4]). Most of this benefit was evident in changes in the PSS rather than in the FSS. At baseline, we could not find any significant differences in scores on account of gender, type of strabismus (esotropes vs. exotropes), or

Table 3: A group wise comparison of baseline PSS, FSS and OAS

Group/ sub-group	Median		
	PSS	FSS	OAS
Gender			
Female (n=11)	62.5	62.5	57.5
Male (n=19)	47.5	82.5	70.0
P value	0.07	0.35	0.11
Background			
Rural (n=12)	57.5	61.2	55.0
Urban (n=18)	61.2	85.0	71.2
P value	0.31	0.07	0.06
Strabismus type			
ET (n=22)	58.7	55.0	60.6
XT (n=8)	61.2	82.5	65.6
P value	0.21	0.34	0.67
Amblyopia status			
Present (n=12)	50.0	56.3	53.8
Absent (n=18)	60.0	85.3	71.3
P value	0.08	0.007	0.009

Q1: First quartile, Q3: Third quartile P value quoted are from Mann-Whitney U-test. All values are median scores. OAS: Overall scores, PSS: Psychosocial subscale scores, FSS: Functional subscale scores, ET: Esotropia, XT: Exotropia

Table 4: OAS , PSS and FSS at baseline and follow-ups

Scores	Baseline	6 weeks	3 months
OAS	65.6 (54-77)	87.5 (76-93)	97.5 (91-100)
PSS	60.0 (45-66)	82.5 (77-88)	97.5 (94-100)
FSS	81.2 (47-86)	95.0 (78-95)	97.5 (88-100)

All values are median (IQR limits) scores. OAS: Overall score, PSS: Psychosocial subscale scores, FSS: Functional subscale scores, IQR: Interquartile range

Table 5: Group-wise comparison of gain in scores (OAS, PSS and FSS) at 6 weeks and 3 months follow-up

Groups	Difference in PSS at 6 weeks	Difference in PSS at 3 months	Difference in FSS at 6 weeks	Difference in FSS at 3 months	Difference in OAS at 6 weeks	Difference in OAS at 3 months
Gender						
Female (n=11)	27.5	49.6	20.0	25.6	26.9	37.9
Male (n=19)	25.0	37.5	9.5	14.5	17.5	28.7
P value	0.43	0.01	0.09	0.26	0.16	0.02
Background						
Rural (n=12)	25.0	40.0	22.0	20.0	22.0	31.2
Urban (n=18)	20.2	38.7	20.6	12.5	20.6	28.7
P value	0.84	0.68	0.44	0.12	0.44	0.17
Strabismus type						
ET (n=22)	28.7	40.0	13.7	13.7	21.2	30.0
XT (n=8)	15.0	32.5	23.7	33.7	17.6	33.1
P value	0.02	0.09	0.46	0.16	0.38	0.68
Amblyopia status						
Present (n=12)	27.5	40.0	23.7	20.0	28.7	34.3
Absent (n=18)	23.7	40.0	8.5	13.5	18.7	28.7
P value	0.16	0.19	0.03	0.35	0.04	0.09

All values are medians of difference in scores at the time points mentioned. P values quoted are from Mann-Whitney U-test. OAS: Overall scores, PSS: Psychosocial subscale scores, FSS: Functional subscale scores, ET: Esotropia, XT: Exotropia

background (rural vs. urban); but compared with nonamblyopes, the amblyopes performed significantly poorly in the FSS, which was reflected in the OAS [Table 3]. Jackson *et al.* concluded that strabismus surgery offered significant improvements to psychosocial and physical functioning.^[19] However compared with the AS-20, they used standardized measures of anxiety and depression (HADS), social anxiety (Derriford appearance scale 24), and WHOQoLBref along with a visual analog scale. Jackson, in a more recent paper on a cohort of 46 patients also showed that those without diplopia fared significantly better, possibly because of the 18 diplopic patients prior to surgery, 11 continued to have diplopia postoperatively.^[31] It is likely that on account of partial correction, the diplopic images would have come closer and thereby have become more problematic. Preoperative measured scores significantly correlated with the objective angle; although such effect was lacking postoperatively. On regression, a complex association emerged: With no clear-cut relationship between the amount of strabismus and psychosocial distress. This could be on account of limited sample size, and a worrying high attrition rate, with 58% of 91 failing to complete the protocol. Hatt has similarly shown detrimental impact of strabismus, evident on low scores on AS-20, both in diplopic (n = 80) and nondiplopic (n = 26) cases.^[32] Interestingly there was no significant difference (P = 0.97) on the preoperative AS-20 composite (akin to our OAS) median scores between diplopic (57.5) and nondiplopic (61.3). Understandably, the diplopic patients fared significantly poorly on the FSS (42.5 vs. 66.3; P < 0.001), with the nondiplopic on the PSS (50 vs. 72.5; P = 0.001). Previous surgery made no significant difference (61.3 vs. 56.9; P = 0.9). None of our patients had diplopia or prior surgery. In contrast, Koc on a cohort of 61 patients, using both AS20 and AS and Q, found no significant differences in health-related QoL (HRQoL) gains, both functionally and psychosocially, between those who demonstrated binocularity (n = 26) and those who did not (n = 35).^[33] Only when amblyopes were excluded, was significant functional superiority seen in those with

binocularity restored compared to those without (gain of scores: AS20 45 vs. 31; AS and Q 28 vs. 16, both $P < 0.05$).

Although mixed outcomes are reported depending on type of strabismus, with some papers finding no difference, while others suggesting that esotropic males rate themselves worst, while in general strabismic females are rated worse than males,^[34] we did not find any difference on account of gender or strabismus type. It is likely that benefits of strabismus alignment will depend on how patients perceive themselves preoperatively; generally those who rate themselves worse are likely to report maximum gains; although this notion needs to be formally tested. A similar situation may obtain in our amblyopes versus nonamblyopes comparison: Compared with nonamblyopes, the amblyopes fared significantly poorly on FSS (and therefore on OAS) at baseline ([Table 3]; $P = 0.007$ and 0.009); at 6 weeks their gains on FSS (and OAS) were also significantly more following strabismus correction ([Table 5]; $P = 0.03$ and 0.04). However for some reason, this gain dissipated at 3 months follow-up ([Table 5]; $P = 0.35$ and 0.09). Glasman in his study of 86 patients could demonstrate a significant although clinically low correlation between gain in AS-20 scores following surgery and the change in measured deviation ($r = 0.291$, $P = 0.006$).^[35]

Quite recently Hatt explored the idea whether HR(QoL) changes following surgical correction, persisted or improved over time.^[28] For the 51 cases (of 73) successfully aligned significant further improvement in median scores were observed from 6 weeks to 1 year, both for PSS (83.8 vs. 93.8; $P < 0.001$) and the FSS (72.5 vs. 77.5; $P = 0.007$). Similarly Jackson demonstrated that HR(QoL) measures showed improvement with time, with scores at 18 months postoperatively being significantly better than at 3 months.^[31] Interestingly in our study too, significant improvements in median scores were evident from 6-week to 3 months, in OAS (from 87.5 to 97.5; $P < 0.001$), PSS (from 82.5 to 97.5; $P < 0.001$) and the FSS (from 95.0 to 97.5; $P = 0.003$). Others have also shown that psychosocial problems seem to improve following surgical correction of strabismus.^[34] Burke in 31 adult strabismics observed significant improvements in the quality of psychosocial functioning ($P < 0.001$).^[36] There was no correlation with age, suggesting that correction is of value whatever the age. Females demonstrated a more profound effect ($P < 0.05$), a finding similar to ours at 3 months both on the PSS and OAS, although not on FSS [Table 5]. In Burke's sample esotropes demonstrated significantly greater appreciation than exotropes ($P < 0.05$), a result comparable to ours only on the PSS at 6 weeks (Table 5; $P = 0.02$). Menon studied 40 patients, 15-25 years of age, with childhood onset strabismus (≥ 30 PD) using two self-designed questionnaires, to assess the psychosocial difficulties of strabismus patients and the impact of correction.^[37] Following surgery, a majority reported a statistically positive change in appearance (97.5%) and self-esteem and confidence (95%). We too demonstrated significant gain following surgery using the AS-20. In her study, cosmetic correction of squint before marriage was the most common reason given by the patients for undergoing the surgery in their series, while we found this in 8 of 30 patients (37.5%). Unlike us, they found no difference in the outcome on account of the type of strabismus or gender.

Beauchamp in a retrospective study on 101 strabismus patients, through a six item questionnaire asked them to rate the before-surgery and after-surgery severity of

problems.^[4] Overall all burden reduced after surgery ($P < 0.001$), but importantly patients who were not successfully aligned were left with significantly higher problem ratings on "specific health" ($P = 0.005$), "daily tasks" ($P = 0.003$) and "social interaction" ($P = 0.024$). Similarly, Dickman, in his cohort of 20 patients, showed that in the seven patients not satisfactorily aligned, the mean QoL scores did not alter with surgery.^[38] In an interesting study, Hatt had divided her outcomes into success (corrected to within 10 PD, diplopia free), partial success (corrected to within 10-20 PD; with mild symptomatology) and failures (persistently > 20 PD).^[32] It is pertinent to note that (among nondiplopic patients; $n = 26$) the median change in AS-20 scores was just statistically significantly greater ($P = 0.05$) only between success ($n = 19:23.8$) and failure group ($n = 2; -3.1$): while on subscale scores no statistical differences were detected. This would almost suggest a "placebo" effect of surgery even on those not considered successful, although since the failure group had merely two patients, definite conclusions are difficult to draw. Never the less, careful preoperative counseling about the nature of strabismus surgery is essential; although QoL gains may accrue in those not successfully aligned. Unfortunately, our cohort included only those with successful outcomes.

We are aware that we have not included cases who had not achieved our definition of success, nor did we have any patients with diplopia. While we do not have many cases of the latter variety coming for surgical correction, it would be interesting to see what gain, if any, occurs in patients not achieving success as conventionally defined.

Our study, perhaps the first to use the AS-20 in our country, reveals the negative impact nondiplopic strabismus causes, especially on psychosocial issues; and the significant and remarkable benefit that successful surgical correction offers to these patients, a benefit that increases over time.

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