Improvement in specific function-related quality-of-life concerns after strabismus surgery in nondiplopic adults

Laura Liebermann, CO, Sarah R. Hatt, DBO, David A. Leske, MS, and Jonathan M. Holmes, BM, BCh

BACKGROUND
We have previously reported improvement in psychosocial scores after strabismus surgery on the patient-derived health-related quality of life (HRQOL) Adult Strabismus 20 (AS-20) questionnaire in adults with nondiplopic strabismus. Unexpectedly, we also found improvement in the function domain. The aim of the present study was to identify which specific aspects of function-related quality of life improved postoperatively.

METHODS
We retrospectively identified non diplopic adult patients with a history of childhood onset strabismus who underwent surgery and who had preoperative and 1-year postoperative AS-20 questionnaires (scored from 0 [worst] to 100 [best]). Change in scores for each item was evaluated using signed-rank tests.

RESULTS
A total of 20 patients were included. Of the 10 function-related AS-20 items, 9 showed significant mean improvement postoperatively (improvement ranged from 12.5 to 32.5 points, all \( P < 0.05 \)). Rasch-derived mean scores improved in both reading function and general function domains (71.0 to 86.5 and 66.4 to 87.5, respectively; both \( P < 0.0001 \)). Specific areas of function-related benefit were concentration, depth perception, hobbies, strain, reading, stress, and worry.

CONCLUSIONS
We found specific function-related quality of life benefits after strabismus surgery in non-diplopic adult patients, particularly those with childhood onset strabismus. (J AAPOS 2014;18:105-109)

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Improvement in health-related quality of life (HRQOL) in adult strabismic patients after strabismus surgery has been previously reported.\(^1\)\(^,\)\(^2\) In previous studies we have quantified this improvement in HRQOL using the Adult Strabismus 20 (AS-20) questionnaire.\(^3\)\(^,\)\(^4\) As expected, we found improvement in the function domain for diplopic patients\(^5\) and in the psychosocial domain for nondiplopic patients,\(^7\) but unexpectedly, we also found improvement in function domain scores for nondiplopic patients.\(^7\) Other investigators have also reported function-related improvement in nondiplopic patients.\(^1\)\(^,\)\(^2\)\(^,\)\(^8\)\(^-\)\(^10\) The aim of the present study was to identify which specific aspects of function-related quality of life reported on the AS-20 improve postoperatively in nondiplopic patients with childhood-onset strabismus.

Subjects and Methods
Mayo Clinic Institutional Review Board approval was obtained for this study. All procedures and data collection were conducted in a manner compliant with the Health Insurance Portability and Accountability Act of 1996.

We retrospectively identified nondiplopic adult patients presenting with a history of childhood onset strabismus who underwent surgery for strabismus and completed the AS-20 questionnaire at both their preoperative and 1-year postoperative visits (median, 12 months; range, 6-19 months). If a patient had more than one surgery performed at our institution, only the first surgery and associated examinations were analyzed in this study. Patients with intermittent strabismus or oculomotor, trochlear, or abducens nerve palsies were excluded. For inclusion, absence of diplopia was required at both the pre- and postoperative visits and was either recorded by the patient using the diplopia questionnaire\(^11\) (diplopia rated as “never” or “rarely” in all gaze positions), or taken from the history documented in the patient’s medical record.

The AS-20 questionnaire is a patient-derived, strabismus-specific, health-related quality of life questionnaire.\(^12\) It contains
Table 1. Adult strabismus 20 questionnaire: 10 function-related items (11-20)*

11) I cover or close one eye to see things better
12) I avoid reading because of my eyes
13) I stop doing things because my eyes make it difficult to concentrate
14) I have problems with depth perception
15) My eyes feel strained
16) I have problems reading because of my eyes
17) I feel stressed because of my eyes
18) I worry about my eyes
19) I can’t enjoy my hobbies because of my eyes
20) I need to take frequent breaks when reading because of my eyes

*Response options: Never, Rarely, Sometimes, Often, Always.

Individual Item Scores
Nine of the 10 AS-20 function-related items showed statistically significant improvement pre- to postoperatively using the original scoring (Figure 1). The greatest improvement in scores was found for the following 5 items: “I feel stressed because of my eyes” (means, 52.50-85.00; \( P < 0.0001 \)); “I worry about my eyes” (45.00-73.75; \( P = 0.0002 \)); “I need to take frequent breaks when reading because of my eyes” (61.25-86.25; \( P = 0.001 \)); “I can’t enjoy my hobbies because of my eyes” (60.00-83.75; \( P < 0.0001 \)); and “My eyes feel strained” (46.25-65.79; \( P = 0.0002 \)). The response distribution and change in response category for the 10 individual items of the function-related subscale of the AS-20 are shown in Figure 1.

Using Rasch-derived response scores for the 8 Rasch-scored items, 6 items showed statistically significant improvement (data not shown, \( P < 0.04 \)). The two items that did not show significant improvement were “I cover or close one eye to see things better” (\( P = 0.06 \)) and “I stop doing things because my eyes make it difficult to concentrate” (\( P = 0.08 \)).

Rasch-derived Domain Scores
Rasch-derived scores for both the general function domain and the reading function domain were significantly improved after surgery (mean, 66.4 to 87.5 \( [P < 0.0001] \) and 71.0 to 86.5 \( [P < 0.0001] \) respectively; Figure 2).

Stereaoacuity
Stereaoacuity was nil in all patients preoperatively, both on the FD2 and on the near Frisby. Stereaoacuity was measured...
in refractive correction but without neutralizing the deviation with prism. At 1 year postoperatively, a total of 5 patients showed improvement in stereoacuity: 3 patients had stereoacuity of 80 arcsec or better on the FD2 (1 with 40 arcsec and 2 with 80 arcsec) and 3 patients had stereoacuity of 400 arcsec or better on the near Frisby test (1 with 60 arcsec and 2 with 400 arcsec). For the 3 patients who had distance stereoacuity postoperatively, their distance alignment measured by simultaneous prism cover test was 1°D, 2°D, and 2°D of esotropia. For the 3 who had near stereoacuity, the near alignment measured by simultaneous prism cover test was 2°D, 3°D, and 4°D of esotropia.

**Discussion**

In patients with childhood onset strabismus who were not experiencing diplopia, function aspects of health-related quality of life improved significantly following strabismus surgery. When analyzing each item of the AS-20 individually, we found that nearly every aspect of the function-related domain improved.

Very few studies have quantified improvement in function-related HRQOL after strabismus surgery. Beauchamp and colleagues reported improvement in scores on a 6-item disability questionnaire, but in their study, patients were asked to complete both their preand postoperative questionnaires after surgery. The 6 items of the disability questionnaire used in that study were more general than the AS-20 items used in the present study, making comparison of results difficult. Dickmann and colleagues reported quality-of-life outcomes in 20 adult patients with longstanding childhood-onset constant strabismus, using the Short Form Health Survey (SF-36) and the Amblyopia and Strabismus Questionnaire (A&SQ) preoperatively and 3 months postoperatively. Similar to our study, they found that successful surgery improved quality of life in function-related domains. Using the SF-36, a generic HRQOL questionnaire, patients in the study of Dickman and colleagues showed postoperative improvement in most domains (eg, physical function, vitality). Using the A&SQ, developed specifically for strabismus and amblyopia, Dickman and colleagues found domains such as distance estimation and visual disorientation showed significant improvement, nevertheless, they did not report change on individual questions. In the present study we used the AS-20 questionnaire, specifically designed to measure HRQOL in patients with strabismus, and were able to assess the responsiveness (ability to detect change when it has occurred) of specific questionnaire items in a population of adults for whom function...
HRQOL concerns have not previously been well described.

Several studies have discussed and demonstrated the psychosocial benefits of strabismus surgery, but very few have analyzed and quantified improvement in binocular function, particularly in nondiplopic patients. Kushner found that 86% of adult patients with longstanding strabismus demonstrated sensory fusion using Bagolini lenses after successful strabismus surgery (defined as <10Δ manifest tropia) but did not report more robust measures of binocular function such as stereoacuity. Some studies have reported the presence of stereopsis after strabismus surgery for longstanding strabismus. In our present study of adults with childhood onset strabismus, although we were primarily interested in changes in HRQOL, we also analyzed measures of stereoacuity and found that 5 patients (25%) gained measurable stereoacuity from a baseline of no measurable stereoacuity preoperatively. An additional function-related benefit of strabismus surgery is expansion of the binocular field, reported first by Wortham and Greenwald and later by Kushner. Improvement in stereoacuity and binocular field may underlie some of our findings of improvement in function-related HRQOL after successful strabismus surgery.

The results of the present study have important implications for the management of adult strabismus patients who are not experiencing diplopia. These patients are not typically expected to gain function after strabismus surgery because of the childhood onset and long-standing misalignment. Nevertheless, they showed improvement on almost all function-related items of the AS-20 HRQOL questionnaire. These results suggest that in addition to psychosocial-related benefits, function-related benefits might also be obtained by performing strabismus surgery. A limitation to our study is that in order to simply answer the question of whether function-related concerns improve in adults with childhood onset strabismus, we limited our cohort to patients who did not have diplopia at both preoperative and postoperative examinations, which resulted in a rather small cohort. We did not measure binocular field of vision in our patients. Another limitation is that due to this small cohort, we did not have any surgical failures so we cannot rule out a placebo effect of surgery on HRQOL, although previous studies have found no such effect.

In nondiplopic patients with childhood onset strabismus, function-related aspects of HRQOL can be significantly improved with strabismus surgery, in particular in the areas of reading, stress, hobbies, strain, worry, concentration and depth perception. These specific function-related concerns should be considered when discussing the benefits of strabismus surgery with nondiplopic adult strabismus patients.

References
First Person

When I was examining an 8-year-old boy with a “reading problem,” I asked him to read the near card. I pointed to a line, which he read fluently. Then I asked him to read the smaller lines underneath. Instead of reading, he pursed his lips and blew on the card repeatedly. I wondered what he was doing and laughed aloud when I realized he had misunderstood me. After he read the larger print I had instructed him with the words “below that.” He was the first child in my 23 years of practice to hear “blow that,” which he did!

Contributed by Mark Steckel, MD, Fairfield, Connecticut