



Critical Appraisal of Functional Outcomes after Surgical Correction of Childhood Large-Angle Exotropia in Adults

Ewa Witowska-Jeleń 

1. ORTO-OPTICA - Centre for Good Vision, Kraków, Poland

Abstract: Surgical correction of longstanding childhood exotropia in adults has traditionally been regarded as a cosmetic procedure with limited potential for restoring binocular vision. However, published evidence suggests that functional improvement, including recovery of stereopsis in selected patients, may also be achieved. This critical review evaluates the available evidence regarding postoperative binocular vision, stereopsis, sensory fusion, and health-related quality of life (HRQOL). The strengths and limitations of the published studies, together with factors influencing surgical outcomes, are critically discussed. Although the available evidence is limited by relatively small study populations and methodological heterogeneity, most studies report improvements in ocular alignment, binocular function, and quality of life following successful surgery. The findings suggest that adult strabismus surgery may provide functional as well as cosmetic benefits. Further well-designed studies are needed to strengthen the evidence base.

Keywords: exotropia, adult strabismus, stereopsis, sensory fusion, ocular alignment, health-related quality of life

INTRODUCTION

The belief that stereopsis cannot be restored after surgical correction of longstanding childhood strabismus in adults has persisted among many vision care professionals for decades. However, is this assumption supported by scientific evidence? The study entitled *Does successful surgical correction of childhood large exotropia in adults make any difference to binocularity and quality of life?* by Jing Yao, Xiaomei Qu, Jing Lin, and Hong Liu, published in *Strabismus* in 2019, challenges this traditional view by suggesting that successful surgical alignment may improve not only ocular alignment but also binocular vision and health-related quality of life.

The primary objective of the study was to evaluate binocular function and quality of life following successful surgical correction of longstanding childhood large-angle exotropia in adults.

This critical review aims to assess the methodological quality, strengths, limitations, and clinical relevance of the study and to determine whether the presented evidence provides sufficiently robust support for its conclusions and their application in everyday clinical practice.

Large-angle strabismus, particularly exotropia, represents a significant psychosocial burden in adults, adversely affecting both social functioning and quality of life. Raising awareness that adult strabismus surgery should not be denied solely because of the patient's age, nor considered merely a cosmetic intervention, remains an important clinical

objective. Figure 1 presents a 43-year-old female patient with a large-angle right exotropia from the authors' clinical archive.



Figure 1: Large-angle exotropia, authors' own archive

PAPER ANALYSIS

Introduction paragraph refers to the approach to strabismus surgery so far, which has been divergent in adulthood and the possibility of obtaining a stereopsis, in which the main emphasis has been placed on the benefits in terms of cosmetics. The authors of this paper, based on residual neural plasticity in adulthood, as well as the papers of Currie, Zl., et al., (2003) and Li, JH., et al., (2013), indicate that it is possible to achieve satisfactory motor alignment.

Orthotropy or residual angle, no more than 10 PD, is considered to be this effect. In the Li JH., Zhang LJ., (2013) study, in a group of 23 patients with a strabismus angle of more than 100 PD, the success of motor alignment was possible in more than 80%.

This is consistent with the research results from the analyzed paper, where 29 patients, out of 34, achieved a satisfactory postoperative effect, which is 85% of the respondents. The improvement of stereopsis in adult patients after exotropia surgery may be difficult to achieve.

As it has been emphasized, it has been shown in few studies conducted so far, and the results are inconsistent. Promising results in this aspect were presented by Fatima et al., (2009), with a group of 15 persons with chronic strabismus without fusion, including 12 with exotropia. After strabismus surgery, with a residual angle of less than 10 PD, stereopsis on the Titmus test was achieved in 13 persons. Symmetrical visual acuity, no worse than 20/60, was considered a beneficial factor. In the Jing Yao et al. study, patients with a difference in visual acuity exceeding two lines were excluded, which had a beneficial effect after surgery.

The authors also drew attention to the Health-related quality of life (HRQOL), which was evaluated before and after the surgery, using Adult Strabismus-20 test (AS-20) and Amblyopia and Strabismus questionnaire (A&SQ). Determination of the correlation between stereopsis and HRQOL constituted another aim of this study.

The study had a prospective, non-interventional nature. No hypothesis was accepted. The size of the finally selected cohort was 29 persons who achieved orthotropy or deviation ≤ 10 PD. The surgery was performed on 2, 3 or 4 muscles, by two out of four authors of this study. Indications for surgery were large strabismus angle, no or reduced stereopsis and impaired HRQOL. Before the surgery all subjects had an ophthalmic examination including: best corrected VA, slit-lamp and fundus examination, eye motility

and sensory fusion using Bagollini and Worth 4 dot test. The strabismus angle was determined using alternating prism cover test with loose prisms. The analysis of the static stereopsis was based on: near Titmus, near-random dot stereogram, distance RDS and distance Yan's RDS. Dynamic stereopsis was determined using a computer program.

Normal stereopsis was found to be ≤ 60 arcsec, in at least 2 near-random dot tests and good in the dynamic test. No suppression in sensory balance tests was considered a normal sensory fusion.

The psychological and functional HRQOL assessment tests and the assessment of binocular vision were performed before and one month after surgery. The data collecting tools were included. Statistically significant factor was considered *p value* less than 0,05.

Results of the postoperative eye positioning, in a group of IXT, turned out to be more favorable. Success was noted in 94.74% of patients, while in the group of CXT in 73.33%.

Stereopsis was improved in all subjects. Significantly in 15 of 29 subjects, again better in the group of IXT. The factors that had a positive effect on the surgery outcome were smaller preoperative angle of deviation at near and earlier age of surgery. The study showed no significant correlation between stereopsis and onset of strabismus. In case of patients with IXT, better results of sensory fusion were also obtained. Postoperative results in HRQOL (composite, psychological and functional) in relation to better binocular vision showed statistically significant differences. Also, in this aspect, IXT patients obtained better results. The authors answered a question about the relationship between HRQOL and stereopsis, indicated that there is no significant correlation between functional scores and normal stereopsis. A similar result was obtained for the size of strabismus angle, which is consistent with studies conducted by Shin B. Lim et al., (2015), who also showed no correlation between strabismus angle size and HRQOL.

Discussion includes among others references to studies on the possibility of obtaining postoperative stereopsis, depending on the size of residual angle. The cited studies by Andalib et al., (2015) point to the impossibility of obtaining stereopsis at an angle ≤ 10 PD.

According to Leske and Holmes (2004), the threshold for true stereopsis tested by Titmus, Preschool Randot and Frisby is even more sensitive and has an angle ≤ 4 PD. The authors pointed out that the research results are consistent with the study of Andalib et al., (2015) in terms of no correlation between the size of strabismus angle before surgery and the improvement of stereopsis. The age of surgery was assessed as a disputable factor. Abrams et al., (2001) point out that the sooner the surgery is undertaken, the better chances of recovering the stereopsis. However, a strabismus duration of more than 10 years does not exclude postoperative success (Andalib et al., 2015). On the other hand Koç et al., (2016) in a retrospective study on a group of 104 adults with exotropia achieved stereopsis in 86% of cases and considered 20 years as the optimal duration of strabismus until surgery.

Strengths of this paper are the choice of a clinically important and poorly understood issue. The complexity of presented research problem should be appreciated as well as strict success criteria, i.e. the size of postoperative strabismus angle, stereopsis parameters and exclusion of patients with amblyopia. The advantage of the paper is detailed data contained in tables and diagrams, enabling additional analysis of individual variables. The references to subject literature and the selection of bibliography are noteworthy, in which the paper

“Predictors of stereoacuity outcome in visually mature subjects with exotropia” by Koç et al., (2016) should be additionally included.

Weaknesses of the data are the small sample size and the lack of representativeness of conducted studies. The data should be interpreted with caution because of unequal groups of subjects: 18 of IXT and 11 of CXT and the difficulty in reproducing the data presented. The methodology of study was mostly focused on the evaluation of stereopsis, it was analyzed with 5 tests.

Sensory fusion was analyzed with two tests and defined as normal with no suppression present. However, this criterion may be insufficient in subjects without stereopsis, due to the possibility of superimposition. The purpose of excluding such doubts would be to use one test assessing sensory fusion and another motor fusion. A short period of postoperative observation also represents weakness. Stacy L. Pineles et al., (2010) has shown that long-term post-surgical IXT sensor-assisted observation of effects may be unfavorable and require reoperation. HRQOL was evaluated by two questionnaires. Disproportionately little attention was shown in the strabismus angle range, which was measured with a single test tool (PCT). In line with the other studies, this measurement should include two methods, e.g.: PCT and synoptophore. In addition, due to the special emphasis on stereopsis, the following paper title would be more appropriate: *Does successful surgical correction of childhood large angle exotropia improve stereopsis and quality of life?*

CONCLUSION

The study successfully addressed its primary objectives and provides further evidence that surgical correction of longstanding childhood exotropia in adults may result in benefits extending beyond cosmetic improvement. Together with previous studies by Koç et al. (2016) and Fatima et al. (2009), the findings support the possibility of improving binocular vision and, in selected patients, restoring clinically meaningful stereopsis despite longstanding ocular misalignment.

Patients with intermittent exotropia (IXT), a smaller preoperative angle of deviation, and earlier surgical intervention appear to have the greatest likelihood of achieving favourable sensory outcomes. Significant postoperative improvements in health-related quality of life further emphasise that adult strabismus surgery should be regarded as both a functional and psychosocial intervention rather than a purely cosmetic procedure.

Although larger prospective studies with longer follow-up are still required, the available evidence challenges the long-held belief that recovery of binocular function is impossible in adults with childhood-onset exotropia. Instead, it suggests that carefully selected adult patients should be offered surgical treatment not only to improve ocular alignment but also to maximise the potential for sensory fusion, stereopsis, and quality of life.

Conflict of Interest

The author declares no conflict of interest.

REFERENCES

1. Abroms AD., Mohney BG., Rush DP., Parks MM., Tong PY., (2001). Timely surgery in intermittent and constant exotropia for superior sensory outcome. *American Journal of Ophthalmology* [online]. 131(1), 111-116. [Viewed 15 October 2020]. Available from: doi:10.1016/s0002-9394(00)00623-1.
2. Andalib D., Nabie R., Poormohammad B., (2015). Factors affecting improvement of stereopsis following successful surgical correction of childhood strabismus in adults. *Strabismus* [online]. 23(2),80-84. [Viewed 17 October 2020]. Available from: doi:10.3109/09273972.2015.1025985.
3. Currie ZI., Shipman T., Burke JP., (2003). Surgical correction of large-angle exotropia in adults. *Eye (London)* [online]. 17(3), 334-339. [Viewed 10 October 2020]. Available from: doi:10.1038/sj.eye.6700347.
4. Fatima T., Amitava AK., Siddiqui S., Ashraf M., (2009). Gains beyond cosmesis: recovery of fusion and stereopsis in adults with longstanding strabismus following successful surgical realignment. *Indian Journal of Ophthalmology* [online]. 57 (2), 141-143. [Viewed 15 October 2020]. Available from: doi:10.4103/0301-4738.45505.
5. Jing Y., Xiaomei Q., Jing L., Hong L., (2019). Does successful surgical correction of childhood large angle exotropia in adults make any difference to binocularity and quality of life? *Strabismus* [online]. 27 (3), 149-155. [Viewed 28 September 2020]. Available from: doi:10.1080/09273972.2019.1643895.
6. Koç, F.,Sefi-Yurdakul N., (2016). Predictors of stereoacuity outcome in visually mature subjects with exotropia. *Eye (London)* [online]. 30(2), 264-269. [Viewed 10 October 2020]. Available from: doi:10.1080/09273972.2019.1643895.
7. Li, JH., Zhang, LJ., (2013). Three-muscle surgery for very large-angle constant exotropia. *Journal of AAPOS* [online].17(6), 578-581. [Viewed 15 October 2020]. Available from: doi:10.1016/j.jaapos.2013.07.015.
8. Lim, Shin.B., Wong, Wan L., Wong, Inez B., (2015). Childhood intermittent exotropia from a different angle: does severity affect quality of life? *Journal of AAPOS* [online]. 19(4), e51. [Viewed 10 October 2020]. Available from: doi:10.1016/j.jaapos.2015.07.158.
9. Leske DA., Holmes JM., (2004). Maximum angle of horizontal strabismus consistent with true stereopsis. *Journal of AAPOS* [online]. 8(1) 28-34. [Viewed 15 October 2020]. Available from: doi:10.1016/S1091853103002568.
10. Pineles, Stacy L., Ela-Dalman, N., Zvansky, A.G., Yu, F., Rosenbaum, A., (2010). Long-term results of the surgical management of intermittent exotropia. *Journal of AAPOS* [online]. 14 (4), 298-304. [Viewed 10 October 2020]. Available from: doi: 10.1016/j.jaapos.2010.06.007.