

# On Cyclodeviation – Strategies for Investigation, Management and Quality of Life

## Akademisk avhandling

som för avläggande av medicine doktorexamen vid Sahlgrenska akademien,  
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Academicum, Medicinaregatan 3, Göteborg.  
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av **SARA FLODIN**

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### Avhandlingen baseras på följande delarbeten

- I. Flodin S, Karlsson P, Andersson Grönlund M. Cyclotorsion Measured in a Patient Population Using Three Different Methods: A Comparative Study. *Strabismus* 2016; 24(1); 28-36.
- II. Flodin S, Pansell T, Rydberg A, Andersson Grönlund M. Clinical Measurements of Normative Subjective Cyclotorsion and Cyclofusion in a Healthy Adult Population. *Acta Ophthalmol.* 2020; 98(2): 177-181.
- III. Flodin S, Karlsson P, Rydberg A, Andersson Grönlund M, Pansell T. A Modified Harada-Ito Procedure Based on Cyclofusion Ability Improves Surgical Outcome in Individuals with Cyclodeviation. *Submitted manuscript 2020.*
- IV. Flodin S, Rydberg A, Pansell T, Andersson Grönlund M. Measuring Health-Related Quality of Life in Individuals with Cyclodeviation Using the Adult Strabismus-20 (AS-20) Questionnaire. *Submitted manuscript 2020.*

**SAHLGRENSKA AKADEMIN  
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# On Cyclodeviation – Strategies for Investigation, Management and Quality of Life

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## Abstract

**Introduction:** Cyclodeviation is a form of strabismus that is not externally visible. It is measured subjectively and in degrees, as incyclotorsion or excyclotorsion. The perception of subjective tilting does not always accompany ocular torsion, and vice versa; and patients rarely complain specifically about cyclodiplopia. Therefore, it is important to have a good understanding of the processes behind cyclodeviation, how the condition affects compensatory mechanisms, binocularity, and the implications in everyday life.

**Aims and Methods:** To (1) evaluate measurement techniques for reliability and repeatability in adult patients with a vertical deviation. Cyclotorsion was measured using three different clinical tests, the single Maddox rod (SMR), KMScreen and the synoptophore; (2) to investigate normative subjective cyclotorsion values and cyclofusion ranges in a non-strabismic adult population aged 18–69 years, using the synoptophore and SMR; (3) to evaluate surgical outcomes and the management of cyclodeviation by reviewing pre-operative assessments and post-operative surgical results from 2012 to 2019; (4) to assess the effect of cyclodeviation on health-related quality of life (HRQoL) using the Adult Strabismus-20 (AS-20) questionnaire, in adults with cyclodeviation. Scores were collected pre- and post-operatively and pre-operative scores were compared with scores from a non-strabismic control group.

**Results:** We found: (1) significant differences between clinical tests, especially between the synoptophore and the SMR. All tests showed high correlation and repeatability; (2) all age groups showed low values of subjective torsion, demonstrating excyclotorsion with mean values of -1 degree; (3) post-operative results of the modified Harada-Ito procedure corresponded well to the aimed-for correction of cyclodeviation, yet the dose-effect assessment showed variable effects. (4) There was a significant difference in pre-operative scores between patients and controls. Post-operative scores overall improved significantly for patients, specifically the functional subscale score, which differs from other forms of strabismus.

**Conclusion:** Investigation for the presence of cyclodeviation requires detailed diagnostic testing, as it can greatly influence the management and outcome of patient care. Reference data of what to expect as normal values of cyclotorsion and cyclofusion in clinical situations suggests that already a small increase in cyclotorsion (>-2 degrees) may disrupt the ability to fuse binocular images. Fusion evaluation and individually based pre-operative assessments are key factors in determining individual doses for successful surgical outcomes. Including HRQoL evaluation in strabismus management expands assessments. Patients complaining of double vision or difficulties in maintaining binocularity without other obvious strabismic signs should be assessed for cyclodeviation as this may be the disruptive factor to fusion.

**Keywords:** cyclodeviation, cyclofusion, HRQoL, orthoptics, strabismus, synoptophore