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Investigating the root cause of strabismus in children

Submission date
28/01/2026

Recruitment status
Recruiting

Registration date
02/02/2026

Overall study status
Ongoing

Last Edited
10/03/2026

Condition category
Eye Diseases

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Strabismus (also known as squint or crossed eyes) is a common childhood eye disorder where the eyes cannot align to look at the same object. Current treatments, such as surgery or glasses, are not always effective, which suggests that the underlying cause may not be fully addressed. One possible explanation is that some children may have inaccurate oculoproprioception — the sense of eye position provided by the muscles that move the eye. This study aims to test whether oculoproprioception is impaired in children with a specific type of strabismus, Partially Accommodative Esotropia (PAE), compared with children whose strabismus is purely due to visual factors (Fully Accommodative Esotropia, FAE) and healthy children without strabismus. By doing so, we aim to establish whether oculoproprioceptive dysfunction could be a root cause of strabismus.

Who can participate?
Children with a diagnosis of PAE or FAE who have not had surgery of the extraocular muscles, as well as healthy children without strabismus who are matched with the strabismus groups with respect to age and refractive error. The typical age for surgery correction for children with PAE is 4- to 5-years-old. The typical refractive error for children with PAE/FAE is hyperopia (long sightedness).

What does the study involve?
In this study the researcher will assess children's sense of eye position. Participation involves attending one study session lasting about one hour at the University of St Andrews. First, the researcher would tell the parent and the child what the task will involve using simple language and videos. Then, the child would sit on the parent's lap with their chin resting on a chin support. If the child wears glasses, the researcher would ask them to take them off. The child would be asked to do two tasks in complete darkness.
Task 1 is to position a red target – a butterfly on a screen – relative to their nose. This involves the child using response buttons to move the butterfly so that it appears straight in front of their nose. This task measures the accuracy of the sense of eye position.
Task 2 is to look straight ahead at a target that appears and disappears on the screen, while the researcher records the movement of their eyes. This task measures how well the eyes sense each other's position.

Sometimes during these tasks, the researcher would ask the parent to place their index finger on the child's eyelid and to gently and very briefly (less than one second) press at the corner of the child's eye to gently move their eyeball slightly. The parent's finger would never actually touch the child's eyeball – this would be done by pressing gently on the eyelid. The parent would remain with the child the entire time, and, if they wish to, they can stop participating at any time without giving a reason.
The visit would take approximately 1 hour. At the end, the researcher would offer the child a lab tour during which they would be able to play with toy equipment. The researcher would also offer them their choice of a book and a science kit to take home to thank them for participating.

What are the possible benefits and risks of participating?
The study does not testing a treatment, so this research will not be of direct and immediate benefit to the participants. However, they will contribute to scientific knowledge and, potentially, to the understanding of some vision impairments like strabismus (squint). Thus, the results may form the basis of a more effective treatment in the future. The child will be shown a research laboratory and parents and children will be given the opportunity to ask questions about the research while the child plays with night-vision goggles.
There are no significant risks. There may be some inconvenience in travelling to the University to take part, but the team will do their best to fit around the parent's schedule.
The tasks may cause tiredness, and some children may be afraid of the dark. The parent and the child will be able to stop the tasks at any time and take breaks whenever they wish. The parent will be present at all times and the child will be on their lap during the tasks.
The eye press could cause discomfort, if done incorrectly. The parent will be trained in how to press the child's eyes very gently without causing discomfort or injury. The tasks will not start until the researcher is sure that the parent can do the eye press safely, every time. For safety, in darkness, the researcher will monitor how the eye press is done using a night-vision camera.

Where is the study run from?
The study is led by the University of St Andrews in collaboration with NHS Fife.

When is the study starting and how long is it expected to run for?
The study has started June 2025 and will run for three years.

Who is funding the study?
The study is funded by the UK Medical Research Council (MRC).

Who is the main contact?
Dr Daniela Balslev, University of St Andrews (Principal Investigator), db87@st-andrews.ac.uk.

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Additional identifiers

Integrated Research Application System (IRAS)
337390

Central Portfolio Management System (CPMS)
59782

Study information

Scientific Title
The role of oculoproprioception in the neural control of ocular alignment: Understanding disease mechanisms in strabismus

Study objectives

This study aims to assess the presence of an oculoproprioceptive impairment in children with partially accommodative esotropia (PAE, a subtype of strabismus that can only be partially corrected visually e.g. with glasses or eye patches) compared with children with strabismus of visual aetiology (fully accommodative esotropia, FAE, which can be fully corrected using glasses) and healthy controls.

Ethics approval required
Ethics approval required

Ethics approval(s)
1. Approved 28/02/2025, South West - Cornwall & Plymouth Research Ethics Committee (2 Redman Place, Stratford, London, E20 1JQ, United Kingdom; 02071048071; cornwallandplymouth.rec@hra.nhs.uk), ref: 25/SW/0001

2. Approved 24/03/2025, School of Psychology and Neuroscience Ethics Committee (A sub-committee of the University Teaching and Research Ethics Committee) (School of Psychology and Neuroscience, University of St Andrews, St Mary's Quad, South Street, St Andrews, KY16 9JP, United Kingdom; +44 (0)1334 46 2071; psyethics@st-andrews.ac.uk), ref: 0216 - PS-0216-150-2025

Primary study design
Observational

Secondary study design
Cross sectional study

Study type(s)

Health condition(s) or problem(s) studied
Strabismus (squint or crossed eyes), specifically Partially Accommodative Esotropia (PAE) and Fully Accommodative Esotropia (FAE).

Interventions
This is an observational study, there is no intervention. Below is a description of the measurements.

The study assesses oculoproprioceptive function in children with primary accommodative esotropia (PAE) through two experiments. Performance of children with PAE is compared with two control groups: children with fully corrected accommodative esotropia (FAE) and healthy controls. The three groups are matched for age and refractive error. Each child completes two behavioural tasks, with a planned sample of 34 children per group.
Prior to testing, the children are shown a short instructional video explaining the task in simple terms, and the parents are trained on administering the eyelid press (explained below).

Experiment 1a: Oculoproprioceptive accuracy
Oculoproprioceptive accuracy is measured using an established task (Balslev et al., 2012) adapted for children.
Children are seated on their parent’s lap in a darkened room, with their head stabilised using a chin rest and cheek pads. One eye is patched while the other is open. The children view the target (a red butterfly) on a computer screen. The children use left and right response buttons to move the target on the screen until it appears directly in front of their nose.

During some trials, the parent gently presses the child's closed eyelid for a brief, duration (<1 second) in response to an auditory cue, causing a small passive movement of the eyeball. The child then moves the target to the perceived straight ahead position. The experimenter records the final target location using a key press, and a new trial begins. There are a total of 10 trials (excluding 2 dummy trials).
In children with normal oculoproprioception, as in healthy adults, no difference is expected between conditions with and without eye press.

Experiment 1b: Oculoproprioceptive coupling
Oculoproprioceptive coupling between the two eyes is measured by recording the movement of one eye while the other eye is gently and briefly moved using the eye-press method described above. This is an established task (Balslev et al., 2022) adapted for children.
The child sits in the parent's lap with their head stabilised in a chin rest. The testing session begins with calibration of an Eyelink 1000 eye tracker. Children fixate on a central visual target on a computer monitor, which then disappears while they continue fixating the same location. One second later, a sound prompts the parent to gently press the child's eyelid, producing a passive eye movement. The eye tracker records the active movement of one eye in response to passive movement of the other eye. The session involves a total of 6 trials.
Decreased oculoproprioceptive coupling is defined as a reduced amplitude of active movement in one eye in response to the passive movement of the other eye. In control groups, typical coupling is expected. In PAE, a reduced response would indicate an association between ocular misalignment and impaired oculoproprioceptive function.

References:
1. Balslev, D., Himmelbach, M., Karnath, H.-O., Borchers, S. & Odoj, B.Journal of Neuroscience 32, 8569–8573 (2012).
2. Balslev, D., Mitchell, A. G., Faria, P. J. M., Priba, L. & Macfarlane, J. A.Hum Brain Mapp 43, 5081–5090 (2022).

Intervention Type
Behavioural

Primary outcome(s)
1. Oculoproprioceptive accuracy measured using the precision and accuracy of visual localisation in the condition with vs. without an eye press at each trial

2. Oculoproprioceptive coupling measured using the amplitude of the active movement of one eye, while the other is passively displaced using the eye press method at each trial

Key secondary outcome(s)

Completion date
30/04/2028

Eligibility

Key inclusion criteria
For the children with strabismus:
1. Diagnosis – FAE or PAE

For All Children:
1. Hyperopia corrected to normal using glasses
2. Age 4- to 5-years-old
3. No previous surgery on the eye muscles

Healthy volunteers allowed
Yes

Age group
Child

Lower age limit
4 Years

Upper age limit
5 Years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. No underlying neurological disease such as a brain lesion or extraocular muscle paresis
2. The parents do not have the capacity to give informed consent, and the child has the capacity to assent.
3. Inability to speak English
4. Previous surgery on the extraocular muscles

Date of first enrolment
13/08/2025

Date of final enrolment
30/04/2028

Locations

Countries of recruitment
United Kingdom

Scotland

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Sponsor information

Organisation
University of St Andrews

ROR
https://ror.org/02wn5qz54

Funder(s)

Funder type

Funder Name
Medical Research Council

Alternative Name(s)
Medical Research Council (United Kingdom), UK Medical Research Council, Medical Research Committee and Advisory Council, MRC

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan
Fully anonymised participant-level data, including software and technical details, will be shared in open-access repositories (University of St Andrews Research Portal (PURE)) with explicit consent from participants (or parents for children). Data will be assigned accession numbers or DOIs for discoverability and made available upon acceptance of peer-reviewed papers, retained for a minimum of 10 years.

IPD sharing plan summary
Available on request