Comparability of optic nerve head assessment using two optical coherence tomography machines in children with craniosynostosis

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The RIO Study Information Video

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Introduction:

Ophthalmological monitoring is important in craniosynostosis to exclude papilloedema. Optical coherence tomography (OCT) can detect papilloedema due to intracranial hypertension[1], but table-mounted systems are not designed for young children (Figure 1). Handheld OCT can recognise papilloedema in a more child-friendly manner[2,3] (Figure 2). No study has compared handheld versus table-mounted optical coherence tomography (OCT) assessment in craniosynostosis. This study assessed comparability between two machines and clinicians.

Methods:

Single-centre, cross-sectional study at GOSH

Dataset

- 20 children with craniosynostosis
- Recruited from 21/10/2021-24/03/2022
- Bilateral optic nerve head scans with both Envisu C2300 handheld OCT (Leica Microsystems) and Spectralis (Heidelberg Engineering)

Masked randomised qualitative OCT grading (Figure 4) by:

- Expert grader (Sohaib Rufai)
- Novice grader (Riddhi Shenoy) before and after brief training.

Main outcome measures:

- Inter-grader agreement before and after brief training
- Intermachine agreement before and after brief training



Figure 1: Table-mounted OCT

Table-mounted OCT system (Spectralis, Heidelberg Engineering) – useful in adults but not designed for infants/young children.



Figure 2: Handheld OCT in infant with craniosynostosis

Envisu C2300 (Leica Microsystems); Image taken with parental consent.

Results:

Bilateral OCT scans were successful in all children using both machines. Ten participants (50%) were female. Median age was 6 years (range: 4-16; IQR: 5-8). Seven patients had syndromic craniosynostosis and thirteen patients had non syndromic craniosynostosis. Expert grading delivered 100% intermachine agreement (40/40). Untrained novice grading delivered 96% intergrader agreement (77/80) and 93% intermachine agreement (37/40); following training, 100% intergrader (80/80) and intermachine agreement (40/40) were achieved (Figure 3). Of the 20 participants, one demonstrated bilateral anterior displacement of Bruch's membrane, seven displayed bilateral raised rim and cup, two displayed unilateral cup obliteration and none displayed severe optic atrophy.

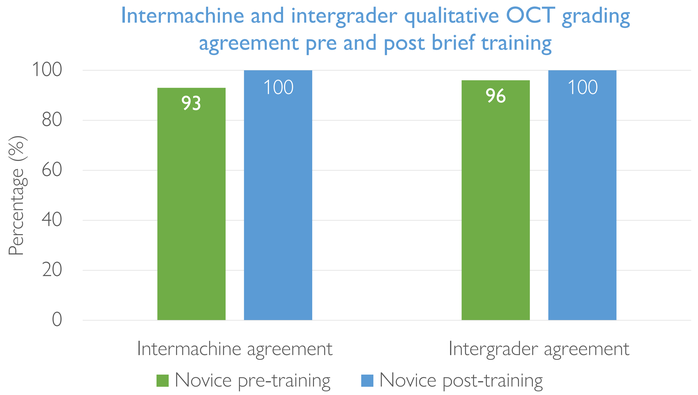


Figure 3: Agreement between expert grader and novice grader before and after brief training for qualitative OCT grading for papilledema between two machines: Envisu C2300 handheld OCT (Leica Microsystems) and Spectralis (Heidelberg Engineering)

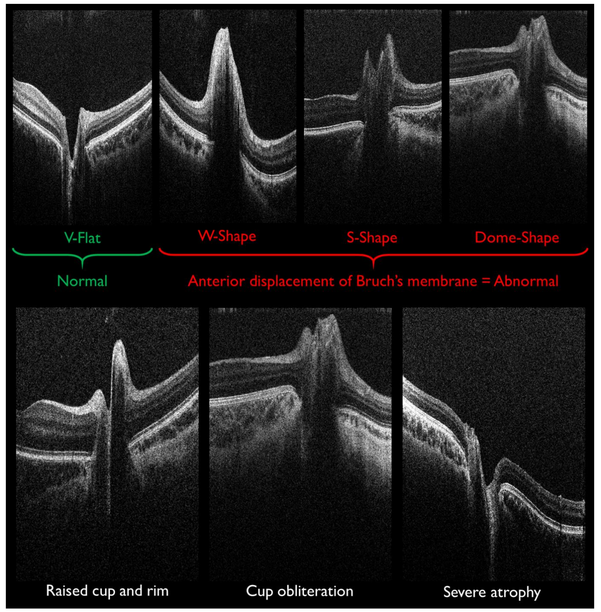


Figure 4: Qualitative OCT signs for assessing ICP

The top row displays possible configurations of Bruch's membrane, graded as per Sibony et al.[1] The normal configuration of Bruch's membrane is 'V-flat', while any anterior displacement of Bruch's membrane is abnormal and suggestive of IH. The bottom row displays further OCT signs proposed[4]. The cup and rim is deemed raised if the cup is above the level of the disc edges and the rim is bilaterally upward-sloping. The cup is deemed obliterated if the criteria for raised cup and rim are met, plus the normal 'U' shaped profile of the cup is disturbed. Severe atrophy is deemed present if the retinal nerve fibre layer appears extremely thin or is no longer visible.

Conclusions:

This qualitative optic nerve head grading system was robust across both machines. The novice grader achieved 100% intergrader and intermachine agreement with brief training. Both machines can be used to qualitatively assess the optic nerve head in craniosynostosis.

References:

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