OCT capture of disease state in childhood anterior uveitis: results of a multi-centre mixed-methods study

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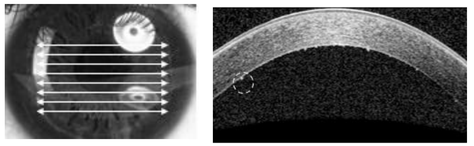
PURPOSE:

Anterior segment optical coherence tomography (AS-OCT) assessment of anterior chamber inflammation is an emerging tool. We describe the performance of AS-OCT in the assessment of childhood onset uveitis.

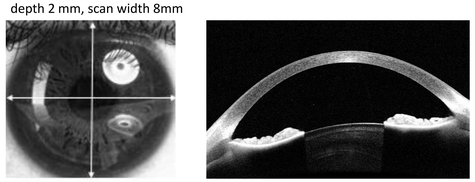
METHODS:

Prospective study, using routine clinical assessment with Standardization of Uveitis Nomenclature (SUN) scale as reference standard and AS-OCT (Tomey CASIA2/ Heidelberg Spectralis HS1) (fig.1) as index test. Extracted images analysed using ImageJ; regions of interest (RoI) drawn, with automated 'cell' detection on binarized images (fig. 2).

Diagnostic indices, responsiveness to clinical change, and clinical correlations of imaging-based metrics ('cell' count, size, density and brightness) were assessed, with construction of receiver operated characteristic curves. Data were also collected on uveitis diagnosis and perceptions of imaging, with exploratory thematic analysis of responses.



Heidelberg Spectralis HS1: Axial resolution 7 µm, 40KHx scan speed, scan depth 2 mm, scan width 8mm



Tomey Casia2: Axial resolution 10 µm, 50KHz scan speed, scan depth 13mm, scan width 16mm

Figure 1. Scan acquisition and image acquired of anterior segment by HS1 and Casia 2

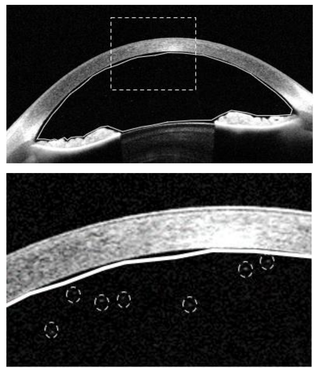


Figure 2. Demonstrating the manual drawing of RoI and automated 'cell' detection algorithm by ImageJ

RESULTS:

90 children (180 eyes, with anterior +/- intermediate uveitis) recruited. Juvenile Idiopathic Arthritis (JIA) uveitis was the most common disease entity (26 children, 29%), and idiopathic uveitis was the most common 'diagnosis' (40 children, 44%).

Clinical activity on slit lamp examination ranged from 0 to +3 SUN anterior chamber cells (ACC). CASIA2 imaging had higher sensitivity of 0.92 (95%CI 0.78 to 0.97) versus HS1 imaging 0.17 (95%CI 0.07 to 0.34), with positive correlation between clinical grade and CASIA2 cell count (coefficient 12.8, p=0.02, 95%CI 2.2 to 23.4, fig 3). Change in clinical grade at follow up examinations correlated with change in image based cell count ($r^2$0.79, p<0.001). Cell characteristics (size) had some correlation with diagnosis (fig. 4).

Emerging themes from responses were around the potential positive impact of seeing their disease activity and standardising care.

"I think that it is a good idea because we can see what is actually going on"

"people could…look and see what is happening with their eyes"

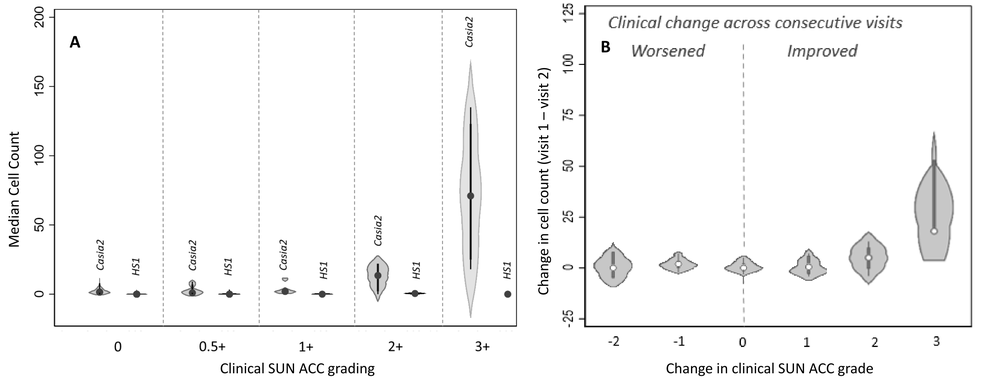


Figure 3. Correlation of clinical examination of disease activity with OCT imaging cell count
A) Distribution of median OCT image cell count across the different grades of inflammation
B) correlation between changes in CASIA2 cell count and changes in clinical grading across consecutive visits

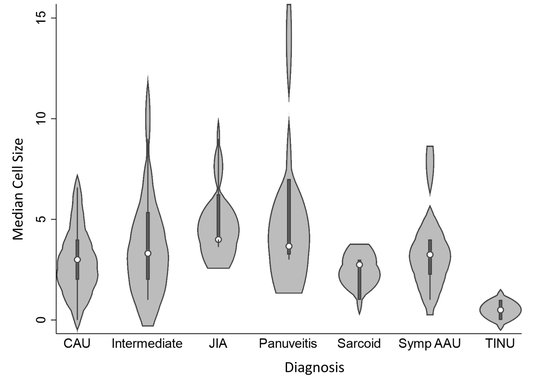


Figure 4. Distribution of 'cell' size on CASIA2 imaging by diagnosis
CAU: chronic anterior uveitis, Symp AAU: symptomatic onset (acute) anterior uveitis, TINU: Tubulointerstitial Nephritis and Uveitis Syndrome

CONCLUSIONS: Our findings suggest that AS-OCT based imaging holds the promise of deeper understanding of disease, improved patient experience, and more granular monitoring of activity with resultant improved outcomes. Further work is underway to refine and standardise acquisition and analysis protocols across different imaging platforms, and to understand the power of AS-OCT in defining disease remission, augmenting clinical decision making on increasing / reducing treatment and supporting patient-clinician communication of disease.

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DISCLOSURES: None