



Reduced asymmetry with growth in patients with a less severe phenotype in Unicoronal synostosis

Authors :

H. Lif MD¹, M. Taverne PhD², J. Nysjö PhD¹, M. Geoffroy², R. Khonsari MD PhD², D. Nowinski MD PhD¹



Institutions :

¹Plastic surgery, Uppsala Academic Hospital, Uppsala University, Sweden

²Plastic- and maxillofacial surgery, Hôpital Necker-Enfants Malades, Paris, France

Abstract :

Background

Unicoronal synostosis present great variability without any identified cause or standardized method to determine severity. The aim of this study was to use image analysis to identify explanatory factors behind the phenotypic variability.

Methods

Patients with non-syndromic Unicoronal synostosis from Uppsala University Hospital and Necker Hospital, Paris between 2006-2021 with preoperative CT scans of sufficient quality were included and age matched to healthy controls. Skulls and orbits were semi-automatically segmented (OrbSeg, BoneSplit). Mirroring, alignment, and calculation of objective 3D asymmetry as the Dice similarity coefficient was automatically conducted in Python.

Results

129 patients and 94 controls met the inclusion criteria. Patients had a mean age of 8 ± 6 months, the right to left lateralisation ratio was 2:1. Skull and orbital asymmetries were significantly higher in patients compared to controls ($p < 0.001$) and there was a substantial linear correlation between skull and orbital asymmetry ($p < 0.001$). Lateralisation was unrelated to differences in asymmetry ($p = 0.42$, $p = 0.89$), but age at CT was related to orbital asymmetry which was significantly higher in the younger patients ($p = 0.001$). Separate analysis of patients with two preoperative CT scans (mean days between scans = 172) indicated that patients with an early first CT could not improve spontaneously over time whereas patients with a later first CT improved up to 8% in skull asymmetry before surgery.

Conclusions

Growth decreases asymmetry in patients with a less severe phenotype. A more severe phenotype is found in patients with early CT. There is a clear correlation between skull and orbital asymmetry, but future studies are needed to correlate these findings to aesthetic and ophthalmological outcome. Dice similarity coefficient is a promising 3D objective severity measure in Unicoronal synostosis.