



Skull Vertex Position as A Novel Craniometric Measurement to Assess Severity and Surgical Outcomes in Sagittal Craniosynostosis



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Introduction/Background

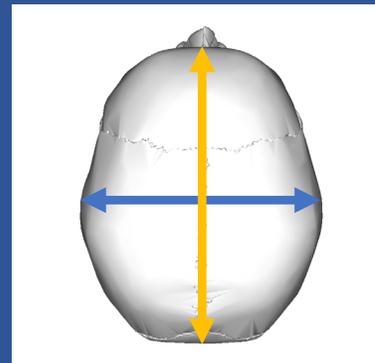
Sagittal craniosynostosis (SCS) is the most common non-syndromic single suture craniosynostosis. SCS classically presents as an elongated head shape, or scaphocephaly. If untreated, SCS can negatively impact vision, hearing, respiration, and cognitive development. Surgical intervention is recommended to prevent sequelae and correct the head shape abnormality by increasing the biparietal diameter and caudally repositioning the cranial vertex. Traditionally, cephalic index (CI), the ratio of the maximum head width to maximum length, has been used as a surrogate for analysis of preoperative severity and outcomes following surgical correction of SCS. However, CI fails to describe overall head shape.

Purpose

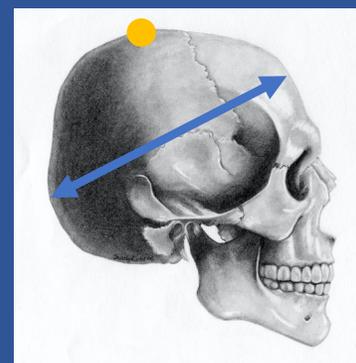
To define a novel measurement, skull vertex position, in patients who undergo surgical correction of SCS to evaluate craniometric and aesthetic outcomes

Methods

Our cohort consisted of patients with a history of isolated, nonsyndromic SCS who underwent surgical repair at a tertiary care children’s hospital from 2009-2020. Cases were age and gender matched to patients without any cranial bony pathology. Craniometric analysis was performed using Analyze Pro (V12, Overland Park, Kansas). Measurements included CI and cranial vertex. We defined vertex as the highest point on the skull, and its position was designated as a fraction of the occipitofrontal diameter.



Cephalic Index =
Skull Width/Skull Length



Occipitofrontal Diameter
Vertex

Results

34 patients met inclusion criteria. There were significant differences in both the CI and vertex position when comparing controls with pre-operative sagittal synostosis patients ($p < 0.00001$ and $p < 0.006$, respectively). Importantly, there was significant improvement in both the caudal repositioning of the vertex as well as CI in patients with SCS post-operatively ($p < 0.001$ for both) in addition to a normalization of vertex position and CI compared to controls ($p = 0.10$ and $p = 0.085$, respectively). When comparing SCS patients only, there was significant improvement in both vertex position and CI immediately post-operatively ($p < 0.001$ and $p < 0.001$, respectively), while these measurements were found to trend towards significance in the long-term.

Conclusions

Cephalic index is the currently accepted measure of deformity severity and postoperative efficacy in SCS. Our study introduces a novel measurement, skull vertex position, as an objective and reproducible measure for guidance in surgical planning to maximize aesthetic and clinical outcomes.