# Cranial morphology associated with syndromic craniosynostosis: A potential detection of abnormality in patient's cranial growth using angular statistics

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**ABSTRACT**

**Introduction:** Apert, Crouzon, and Pfeiffer syndromes are common genetic syndromes related to syndromic craniosynostosis (SC), whereby it is a congenital defect that occurs when the cranial growth is distorted. Identifying cranial angles associated with these 3 syndromes may assist the surgical team to focus on a specific cranial part during the intervention planning, thus optimizing surgical outcomes and reducing potential morbidity. **Objective:** The aim of this study is to identify the cranial angles, which are associated with Apert, Crouzon, and Pfeiffer syndromes. **Methods:** The cranial computed tomography scan images of 17 patients with SC and 22 control groups aged 0 to 12 years who were treated in the University Malaya Medical Centre were obtained, while 12 angular measurements were attained using the Mimics software. The angular data were then divided into 2 groups (patients aged 0 to 24 months and >24 months). This work proposes a 95% confidence interval (CI) for angular mean to detect the abnormality in patient's cranial growth for the SC syndromes. **Results:** The 95% CI of angular mean for the control group was calculated and used as an indicator to confirm the abnormality in patient's cranial growth that is associated with the 3 syndromes. The results showed that there are different cranial angles associated with these 3 syndromes. **Conclusions:** All cranial angles of the patients with these syndromes lie outside the 95% CI of angular mean of control group, indicating the reliability of the proposed CI in the identification of abnormality in the patient's cranial growth.

**KEYWORDS**

Craniofacial morphology; Apert syndrome; Craniofacial growth; Syndromic craniosynostosis

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