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Journal of Cranio-Maxillo-Facial Surgery

journal homepage: [www.jcmfs.com](http://www.jcmfs.com)

# A scanographic study of asymmetry of the frontal process of zygoma in unilateral coronal synostosis

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## ARTICLE INFO

### Article history:

Paper received 22 October 2017

Accepted 7 June 2018

Available online xxx

### Keywords:

Facial asymmetry

Unilateral coronal synostosis

Orbito-nasofrontal

Bandeau

Fronto-parietal suture

Frontal process of zygoma

## ABSTRACT

**Introduction:** Unilateral coronal synostosis (UCS) is a complex craniosynostosis, combining malformations of the upper (frontal bone, orbito-naso-frontal bandeau (ONFB)) and the middle thirds of the face. In our centre, the surgical correction consists in the repositioning of the ONFB in front of the zygomaticofrontal suture on the affected side. Defects in the corrections have been observed post-operatively for some patients with a persistent asymmetry in the side walls of the orbits. The purposes of our study were to perform an analysis of the frontal process of zygoma (FPZ) in children affected by UCS using preoperative CT-scans and to consider the modification of surgical techniques in order to achieve a better ONFB repositioning and thus, better symmetry.

**Material and method:** The preoperative CT-scans of 13 children with UCS who underwent corrective surgery in our department from 2005 to 2016, were analyzed. After the selection of 6 morphological points in 2 and 3 dimensions using planning software, the sutures constituting the coronal arch and the sagittal distances between the coronal plane and the zygomaticofrontal sutures were analyzed. We compared the measurements on the pathological side to the healthy side, the non-affected side being the reference side. The patients included were those for whom the lack of symmetry between the healthy side and the affected side was more than 2 mm. Statistical analyses were carried out using a Student t-test.

**Results:** Of the 13 children, 10 (1 day to 42 months old) met the inclusion criteria. The mean sagittal distance between the coronal plane and the healthy zygomaticofrontal suture was  $33.8 \text{ mm} \pm 5.43 \text{ mm}$  [range: 25.9; 40.9] [median: 34.3]. On the pathological side, the distance was  $28.75 \text{ mm} \pm 4.76 \text{ mm}$  [range: 20.8; 36.3] [median: 29.55], ( $p = 0.04$ ).

**Discussion:** There is a significant asymmetry between the FPZ on the healthy and the pathological sides in children affected by UCS. This asymmetry is variable, therefore justifying a personalized surgical correction which takes into account not only the shape of the ONFB but also the degree of asymmetry of the FPZ. A prospective study with immediate preoperative CBCT image acquisition and long-term clinical and radiological follow-up, will be our next step.

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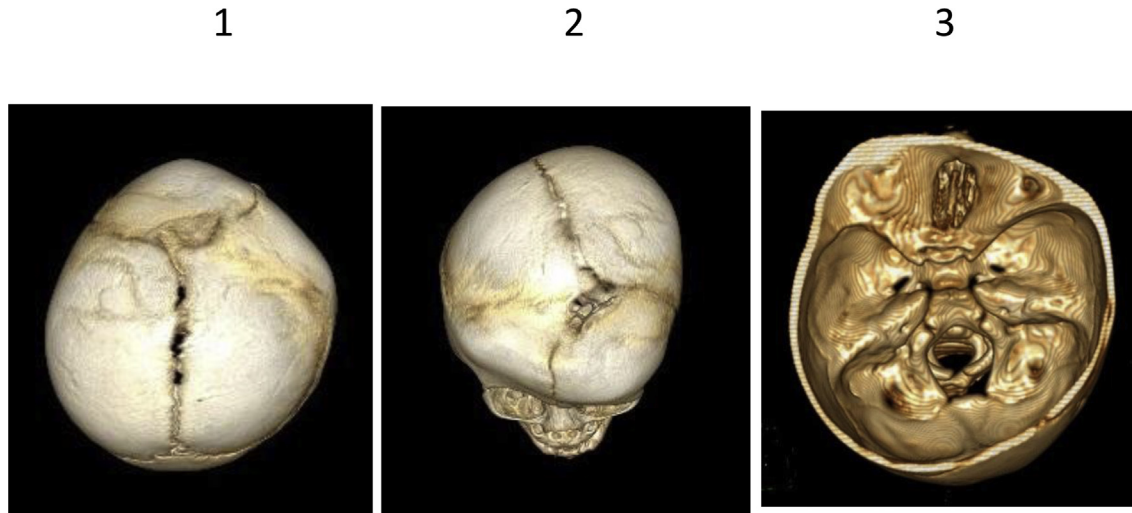
## 1. Introduction

Unilateral coronal synostosis (UCS) is the third most common type of craniosynostosis, after scaphocephaly and trigonocephaly, with an incidence of 13–16% (Selber et al., 2008; Di Rocco et al., 2009; Kolar, 2011).

Clinically, children with UCS also have a growth defect in the lateral edge of the orbit, which only a few studies have evaluated to

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**Fig. 1.** 3D reconstruction of a brain scan and facial mass. Superior views of the skull: 1-strict upper view, 2- upper view grazing with visualization of the zygomatic bones, 3-Top view visualizing the base of the skull.

date. The child's face shows facial scoliosis associated with a "Harlequin" deformity of the orbit (upward and outward deviation). There are different degrees of severity, depending on the age of the closure of the sutures during embryological development and the location and extent of the synostosis.

The surgical management of UCS currently consists of a bilateral frontal craniotomy with the creation of a bilateral supraorbital band [orbito-naso-frontal bandeau] (ONFB), repositioned on the synostosed (affected) side, in front of the frontal process of the zygoma. The aim of this intervention is two-fold: to normalize the ONFB in order to achieve symmetry of the face (aesthetic) and to prevent intracranial hypertension (functional).

During the postoperative follow-up of children who underwent surgery for UCS, we observed a persistence of the asymmetry of the upper third of the face. We hypothesized that this persistent asymmetry was related to an under-correction of the lateral part of the orbit, which was the result of the excessive posterior repositioning of the ONFB on the frontal process of the zygoma (FPZ) of the affected side.

The purpose of our study was to perform a scanographic assessment of the asymmetry of the frontal process of zygoma, and to consider the modification of surgical techniques in order to achieve a better ONFB repositioning on the frontal process of zygoma and thus, better symmetry.

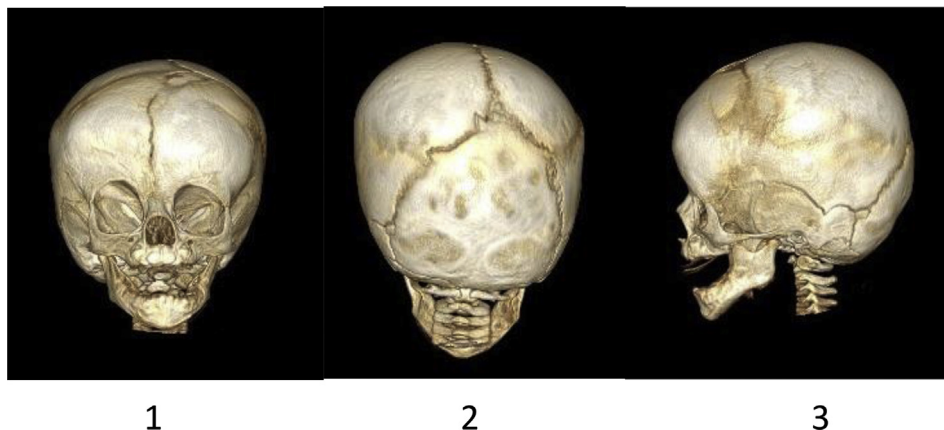
## 2. Material and methods

We collected the data (age, height, birth weight and cranial perimeter size) of 22 children who underwent surgery for isolated non-syndromic UCS in our center between 2005 and 2016, and who had no other craniofacial malformations. Of the 22 children, 13 scans, stored in the institution's imaging library (Carestream® Rochester, USA) were appropriate for analysis. The other 9 scans had artefacts and were excluded from the analysis.

The scans were carried out according to a protocol established by one of the authors (AC), in infra-millimeter sections, from above the vertex at the top to below the mandibular symphysis at the bottom, with the following views:

- The upper views included a strict upper view, a grazing upper view to visualize the zygomatic bones and a superior view to show the base of the skull (Fig. 1)
- An anterior view, a posterior view, right and left lateral views (Fig. 2)
- A lower view to visualize the orientation of the occipital condyles (Fig. 3).

Sutures and synchondrosutures involved in the formation of the coronal arch, frontoparietal suture (FPS), parieto-temporal suture



**Fig. 2.** 3D reconstruction of a facial mass scan. 1-Front view, 2- Rear view, 3- Left side view.

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