

# Detecting skeletal deformity in patients with unilateral coronal craniosynostosis – perceptions of the general public

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## Introduction

- Unilateral coronal synostosis (UCS) affects the shape of an infant's skull, often resulting in an asymmetric forehead
- Children with untreated UCS may face psychosocial discrimination<sup>1,2</sup>
- Cranial vault remodeling (CVR) surgery aims at improving the aesthetic appearance of the infant by reshaping the bones that form the contour of the forehead<sup>3</sup>
- Surgeon's perceptions of people's appearance is a frequently used method to report surgical outcomes following CVR surgery<sup>4</sup>
- However, studies have shown that patients' perceptions may not always correlate with experts' perceptions<sup>5</sup>

## The Problem

There are no outcome measurements described that relate surgical outcome with laypersons' perception of skull normality. In addition, there is limited data on public perceptions of craniosynostosis deformities.

## Objectives

- 1) Determine if laypersons are able to perceive the difference between normal and abnormal skulls when displayed briefly
- 2) Determine if laypersons' responses can be predicted by an objective value of skull deformity

## Methods and Materials

- 40 participants from the general public with non-surgical backgrounds were recruited as lay person skull raters, and asked to rate a series of skull images as 'normal' or 'abnormal'
- Maximum surface distances between each UCS skull and an age and sex-matched normal skull at the frontal bones were calculated.
- Logistic regression was performed to predict raters' response based on surface distance values

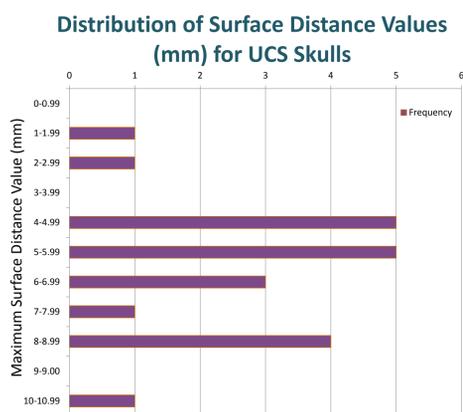


Figure 1. The distribution of deformity severity as calculated by surface distance values within the UCS skull group (larger value = more severe deformity).

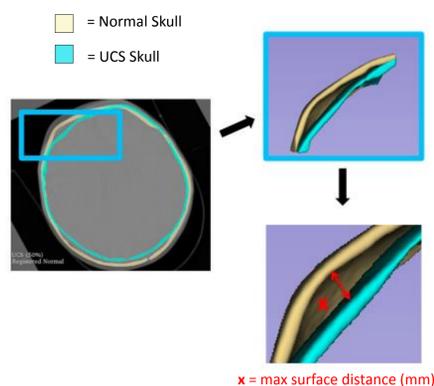


Figure 2. The method used to assign objective values of deformity to the UCS skulls. Maximum Hausdorff surface distances were automatically calculated between the UCS and normal frontal bone segments.

## Experimental Design

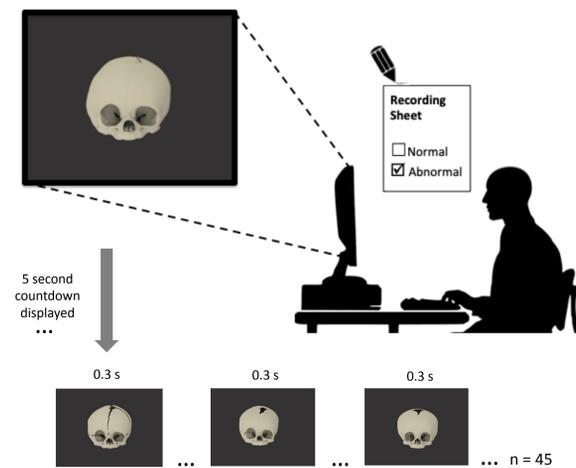


Figure 3. Skull raters observed each skull 3D model on a screen for 0.3 seconds, followed by 5 seconds to record a response. Normal and abnormal skull groups were balanced in terms of age (0-24 months) and sex.

## Results and Discussion

- Layperson raters were able to distinguish between normal and abnormal skulls
- Raters' responses were predicted by the surface distance values assigned to the UCS skulls ( $F, (1,838) = 0.09, p = 0.016$  [CI: 0.02-0.17]).
- A 50% threshold value of 2.8 mm [CI: 2.0-3.8] was derived from the regression model
- This data suggests that the use of surface distance measurements between UCS and age/sex matched normal skulls to determine an objective value of deformity predicts layperson raters' responses of skull perception

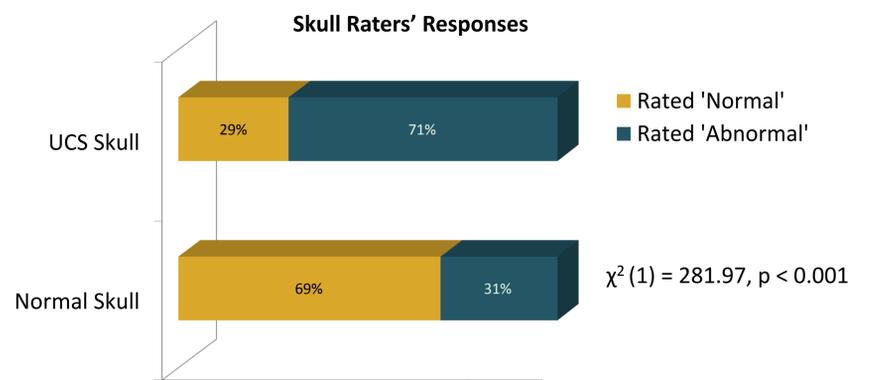


Figure 4. Laypersons' perceptions of normal versus abnormal skulls with a Chi-square analysis.

## Conclusions

- This is the first study investigating the relationship between objective skull deformity in UCS and public perception
- Layperson raters were effective at correctly categorizing normal and abnormal infant skulls based on their perceptions
- Laypersons' perceptions of normality were predicted by an objective value of skull deformity, determined by maximum surface distance values measured at the forehead region
- The brevity of interaction between the raters and the skull images simulates a first impression scenario, and this information may be helpful when counselling patients

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