Journal of Cranio-Maxillo-Facial Surgery 45 (2017) 1394–1398

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Comparison of endocranial morphology according to age in one-piece fronto-orbital advancement using a distraction in craniosynostotic plagiocephaly

Woo Shik Jeong [a], Ersin Altun [b], Jong Woo Choi [a, *], Young Shin Rah [c]

[a] Department of Plastic and Reconstructive Surgery, Ulsan University, College of Medicine, Seoul Asan Medical Center, Seoul, South Korea
[b] Department of Plastic Reconstructive and Aesthetic Surgery, Medical School of Karadeniz Technical University, KTU Farabi Hospital, Trabzon, Turkey
[c] Department of Neurosurgery, Ulsan University, College of Medicine, Seoul Asan Medical Center, Seoul, South Korea

ARTICLE INFO

Article history:
Paper received 10 July 2016
Accepted 9 June 2017
Available online 17 June 2017

Keywords:
One-piece cranioplasty
Fronto-orbital advancement
Plagiocephaly
Skull base
Endocranial morphology
Cranial distraction

ABSTRACT

The capacity for cranial remodelling is known to be better at younger ages. The timing of cranioplasty could affect the axis of the skull base. We investigated whether age at the time of distraction is related to the outcome of endocranial morphology correction. In this retrospective study, we investigated the surgical outcome of 14 patients with unilateral craniosynostotic plagiocephaly who underwent one-piece fronto-orbital advancement without bandeau by using a distraction technique between April 2005 and December 2015. Satisfactory results were achieved in all 14 patients with unilateral coronal suture craniosynostosis. An average distraction of 27.3 mm was obtained without detachment from the dura mater. The endocranial angulation of the anteroposterior axis was reduced from 165.4° to 173.5° on average, and the average total change was 8.1°. Between patients aged <1 year and those >1 year, there was a statistically significant difference in the postoperative endocranial angulation of the anteroposterior axis after 3 months ($p = 0.003$). The distraction techniques resulted in better correction of endocranial morphology. This indicates that the changes in the skull base axis after one-piece fronto-orbital advancement without bandeau are related to the remodelling capacity of the skull base in growing children based on the dura mater.

1. Introduction

Craniosynostotic plagiocephaly involves premature fusion of either the left or right side of the coronal suture. It can result in facial and skull deformities such as flattening of the forehead and frontoparietal region ipsilateral to the fused suture, compensatory bulging of the contralateral frontoparietal region, recession and elevation of the orbital rim, palpebral fissure widening, malar projection, and improper positioning of the ears (Hunter and Rudd, 1977; Pelo et al., 2011; Khorasani et al., 2013). Although many factors affect facial symmetry, the endocranial morphology of the skull base is one of the most notable, owing to the connection between the cranial vault and facial skeleton as well as its support of the anteroposterior expansion of the skull (Mooney et al., 1996, 2001; Dundulis et al., 2004).

We previously reported the effectiveness of one-piece fronto-orbital advancement by using the distraction technique for correcting the endocranial morphology (Choi et al., 2009). This has been confirmed by other studies (Tahiri et al., 2015a; Taylor et al., 2015). Surprisingly, our previous work showed the capability of external cranial distraction to correct the axis of the skull base (Choi et al., 2010; Jeong et al., 2016). We believe that correction of the skull base axis on the coronal plane is possible owing to the tension force of the cranial distraction based on the remodelling capability of the infant, as the frontal bone flap was not separated from the dura mater. Furthermore, as the capacity for cranial remodelling is known to be better in younger patients, we suspect that the time of cranioplasty could affect the skull base axis (Goldstein et al., 2014; Samra et al., 2015; Swanson et al., 2016). In the present study, we investigated whether the patient's age at the time of distraction is related to the correction of the endocranial morphology.

* Corresponding author. Department of Plastic and Reconstructive Surgery, University of Ulsan, College of Medicine, Seoul Asan Medical Center, 88, Olympic-ro 43-gil, Songpa-gu, Seoul 05505, South Korea. Fax: +82 2 476 7471.
E-mail address: pschoi@amc.seoul.kr (J.W. Choi).

http://dx.doi.org/10.1016/j.jcms.2017.06.010
1010-5182/

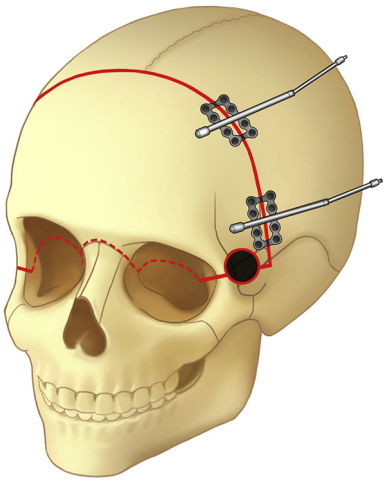

Fig. 1. After one-piece osteotomy along the designed nasofrontal, orbital roof, zygomatico-frontal, and sphenofrontal suture was made, distraction devices were fixed to the temporal or parietal area according to the specific deformity.

2. Materials and methods

In this retrospective study, we investigated the surgical outcome of patients with unilateral craniosynostosis. The patients had unilateral craniosynostotic plagiocephaly and underwent one-piece fronto-orbital advancements with distraction surgery between April 2005 and December 2015. Patients with multiple suture synostosis were excluded from the study. To analyse the effect of age, the patients were classified into two groups (i.e., <1-year-old and >1-year-old).

A bicoronal incision followed by subgaleal dissections was performed. Subperiosteal dissections were performed when the dissection was 2 cm above the supraorbital rim. A 1.0–1.5-cm hole was positioned at the point where the sphenofrontal, zygomatico-frontal, and temporal sutures met (i.e., the pterion). The size of the burr hole was slightly different for each patient (Choi and Kim, 2015). A coronal osteotomy line was made following the imaginary coronal suture fusion line, and a burr hole and coronal osteotomy were performed. A one-piece osteotomy along the designed nasofrontal, orbital roof, zygomatico-frontal, and sphenofrontal suture was made with a 5-mm guarded osteotome. A small malleable retractor was used to protect the dura from the osteotome, which may cause dural tearing. After the osteotomy, distraction devices (Leibinger Co. & Martin, Co., Tuttlingen, Germany) were fixed to the temporal or parietal area according to the specific deformity (Fig. 1). A typical distraction protocol was used; this includes a 7-day postoperative latent period followed by 1 mm of distraction per day. The consolidation period was 8–12 weeks; subsequently, the devices were removed and the osteogenesis and contour were assessed with computed tomography scanning at postoperative 3 months.

All statistical analyses were performed with SPSS software (SPSS Inc., Chicago, IL, USA). Mann–Whitney *U*-tests were used to

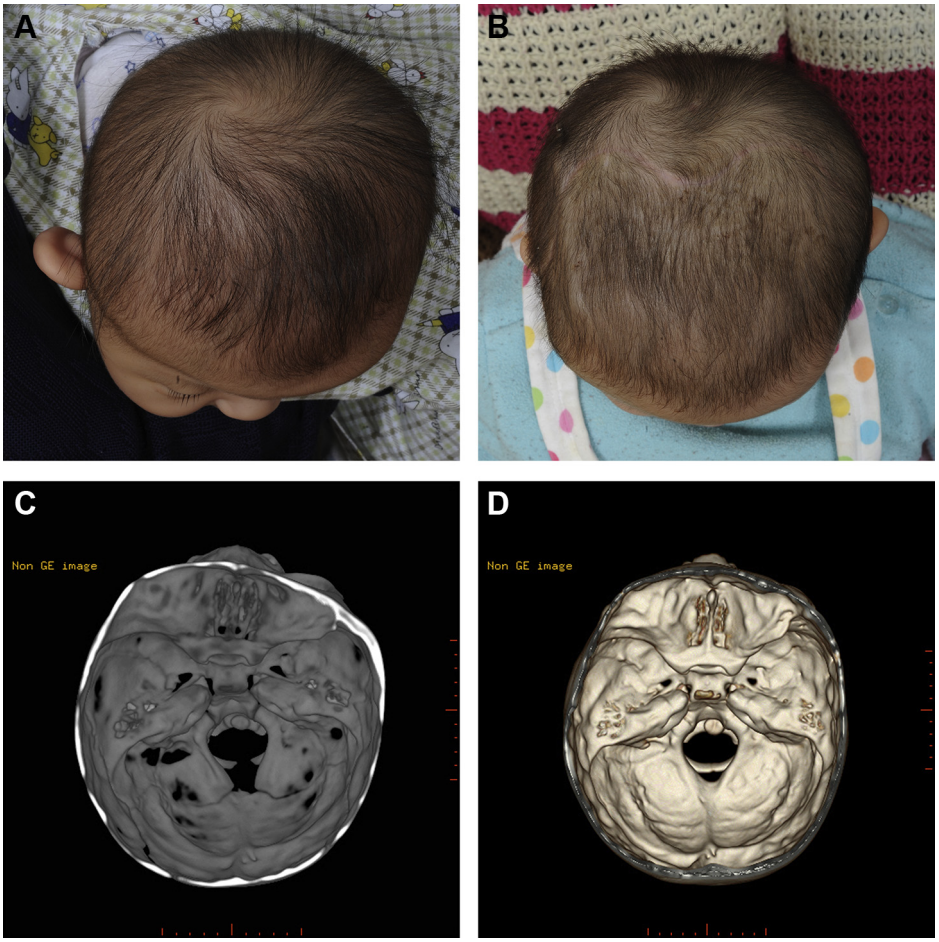

Fig. 2. The patient had right craniosynostotic plagiocephaly and underwent one-piece fronto-orbital advancements with distraction surgery at age 11 months. The endocranial angle of the skull base changed from 163.5° (A,C) to 178.1° (B,D) at 2.4 years after the operation.