

Co-occurrence of Deformational Plagiocephaly and Metopism in an Adult Sri Lankan Skull: A Case Report

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Abstract

Plagiocephaly is characterised by asymmetrical distortion of the skull. The co-occurrence of deformational (non-synostotic) plagiocephaly with a persistent metopic suture (metopism) in adulthood is rarely documented. A well-preserved dry adult skull of Sri Lankan origin was identified in the osteological collection of the Department of Anatomy, Faculty of Medicine, Wayamba University of Sri Lanka. Examination revealed a parallelogram-shaped cranial vault and significant occipito-parietal flattening consistent with deformational plagiocephaly. Unusually, a complete metopic suture (10.03 mm) was present, extending from the glabella to the bregma. All other cranial sutures were patent. This case highlights an anatomical variant in which a persistent metopic suture persists into adulthood despite the mechanical stresses typically associated with cranial deformation. It highlights the importance of distinguishing between deformational and synostotic plagiocephaly in skeletal remains.

Key words: Plagiocephaly; Nonsynostotic; Skull; Metopic suture; Osteology

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Introduction

Plagiocephaly is an asymmetry of the skull resulting from unilateral flattening of the skull (1). There are two types of this condition: deformational plagiocephaly and synostotic plagiocephaly (2, 3). Deformational plagiocephaly is characterised by morphological alterations of the skull, which can be attributed to the mechanical forces exerted during pregnancy, during birth, or after birth. It exhibits no craniosynostosis, and cranial sutures are usually open and normal. It is also referred to as positional plagiocephaly, posterolateral plagiocephaly, occipital plagiocephaly and non-synostotic plagiocephaly (4-7). This condition has become more common since the launch of the "Back to Sleep" campaign, which advocated sleeping healthy infants in the supine position (8). Apart from sleeping in a supine posture, other factors are linked to an increased risk of developing deformational plagiocephaly. These include male sex, multiple gestations, congenital and acquired torticollis, premature birth, and congenital skull flattening due to intrauterine constraints (9, 10).

Morphological characteristics of the skull affected by deformational plagiocephaly include occipito-parietal flattening, contralateral occipital bossing, ipsilateral frontal bossing, and forward ear displacement. Forehead triangulation and a prematurely fused metopic suture with the existence of a bony ridge are certain consistent characteristics of positional plagiocephaly, irrespective of its severity (11, 12). Some of the characteristic features of synostotic posterior plagiocephaly (lambdoid synostosis), such as ipsilateral occipital flattening with compensatory contralateral parietooccipital protrusion, ipsilateral bulging of the mastoid process, a downward shift of the ipsilateral ear, trapezoid shape vertex view, and a skull shape that

resembles a parallelogram in the posterior view, can be used to distinguish the type of plagiocephaly (13). However, physical findings of synostotic posterior plagiocephaly are not definitively distinguishable from those of deformational posterior plagiocephaly; thus, imaging is required to confirm the diagnosis in live individuals (14). Visible lambdoid suture on ultrasound scan or presence of inverted lambdoid suture on computed tomography scan is used to distinguish deformational plagiocephaly from synostotic posterior plagiocephaly in live individuals (13). The metopic suture, also known as the frontal suture, is a fibrous joint present in the midline of the frontal bone (15). The fusion of metopic sutures often starts at the glabella and ends at the anterior fontanelle (16). A study on three-dimensional (3D) computed tomographic (CT) scan evaluations showed that the physiological closure of the metopic suture was completed after 9 months of age (17). However, racial variations in complete fusion have been documented in the literature (18, 19, 20). In contrast to metopic suture synostosis, persistence of metopic suture (metopism) in adulthood is considered a normal variant (9). Paleoanthropological and comparative anatomical data indicate that the risk of dystocia brought on by closed pelvis morphology following bipedalism accounts for the postnatal metopic suture existence in human beings (9).

Usually, an abnormal skull shape is associated with metopic synostosis instead of metopism. Therefore, a persistent metopic suture in the plagiocephalic skull is an unusual finding. This case report presents an adult skull displaying plagiocephaly with a persistent metopic suture in an adult skull from the osteology collection of the Department of Anatomy, Faculty of Medicine, Wayamba University of Sri Lanka.

Case report

A well-preserved adult skull of Sri Lankan origin with unknown sex and age displaying plagiocephaly was discovered during routine examination of the osteology collection. The skull exhibited an evident metopic suture extending from the glabella to the bregma, dividing the frontal bone into two halves. The suture was well-defined and maintained continuity along its entire length. The sagittal suture, coronal suture, lambdoid suture, and even the lambda and bregma were well preserved, and there was no evidence of craniosynostosis.

A thorough examination of the exterior and interior of the skull was conducted, emphasising the cranial vault morphology, bony landmarks, and the presence of any associated abnormalities. An axis of symmetry was established for the posterior and central parts of the middle cranial fossa, and morphometric parameters of the skull were measured by a single investigator using a digital calliper. All measurements were taken three times, and the mean value was considered the final measurement. Photographic images and radiographs were obtained for documentation and reference. The morphometric analysis of the exterior of the skull revealed a metopic suture of 10.03mm (Figure 01), total length extending from the glabella to the bregma. The maximum and minimum widths of the metopic suture were 7.89 mm and 0.05 mm. The suture displayed no signs of abnormal bony growth or any associated dental or craniofacial anomalies. All other sutures appeared normal with no signs of early synostosis, and the occipitofrontal circumference was 490 mm.

Examination of morphological characteristics of the exterior of the skull revealed the presence of frontal bone asymmetry with flattening on the left side and bossing on the right side,

occipital-parietal flattening of the right side, and bossing to the left side (Figure 01), parallelogram-shaped vertex view (Figure 02), normal posterior view with no evidence of lambdoid synostosis (Figure 03), bulging of the mastoid process into the left side, slight anterior displacement of the left sternomastoid foramen, and symmetric temporomandibular joint position in the base of the skull (Figure 04).

Discussion

Over the past few decades, the documented prevalence of metopism has significantly declined. In a 1937 study, the prevalence rate was 16% (21), while it was 10% in a 2000 study (22) and declined to 2.6% in a recent 2017 study (23). This skull, prepared after 2017, suggests that it is more likely to belong to a person born after the 1930s. Therefore, the existing metopic suture reports a rare variant that is declining in prevalence among humans. This case showed forward displacement of the ipsilateral (left) sternomastoid foramen, aligning with the presence of forward ear displacement posterior to positional plagiocephaly, and a symmetric temporomandibular joint position. This suggests that the reported case is more likely to be deformational plagiocephaly than lambdoid synostosis, in which there is marked posterior displacement of the contralateral temporomandibular joint (15).

The presence of ipsilateral occipital-parietal flattening, contralateral occipital bossing, parallelogram-shaped vertex view, and normal posterior view is similar to the characteristics described for deformational plagiocephaly (11, 12). However, instead of prematurely fused metopic sutures, which is a consistent characteristic of positional plagiocephaly, we observed the existence of a metopic suture in the skull.

Furthermore, the presence of occipital-parietal flattening on the right side of the skull was also consistent with the findings of a study that showed occipito-parietal

flattening in deformational plagiocephaly is more common on the right side (24).

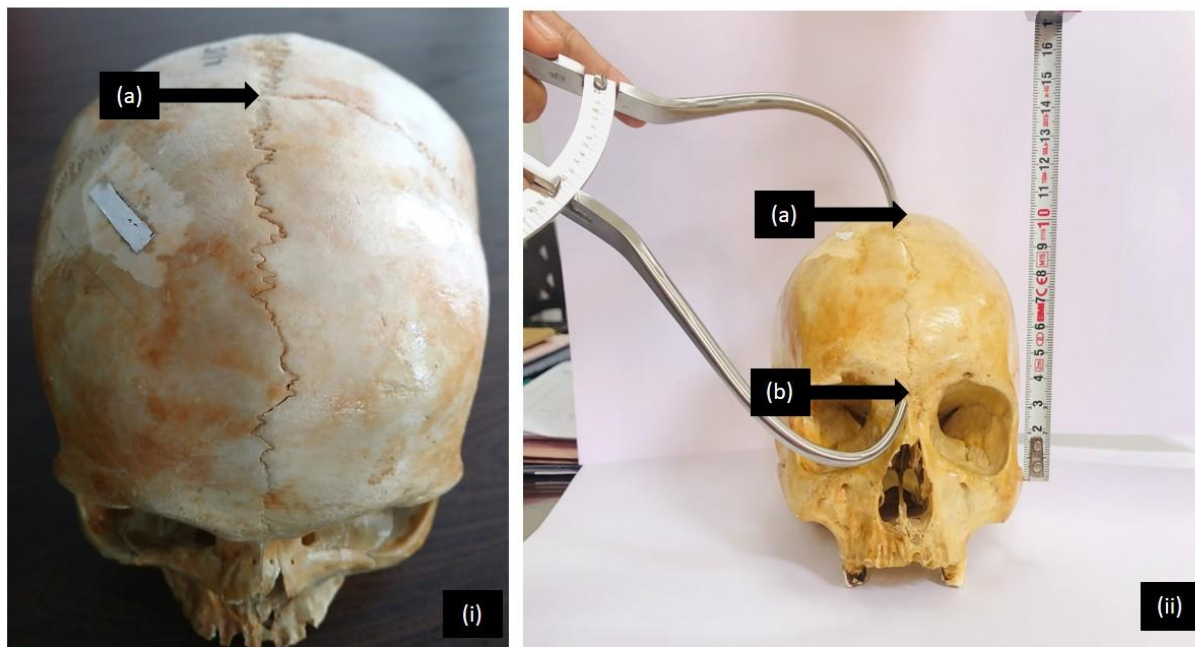


Figure 01: Anterior view of the reported Sri Lankan adult skull with persistent metopic suture and plagiocephaly. (a) metopic suture (b) glabella.

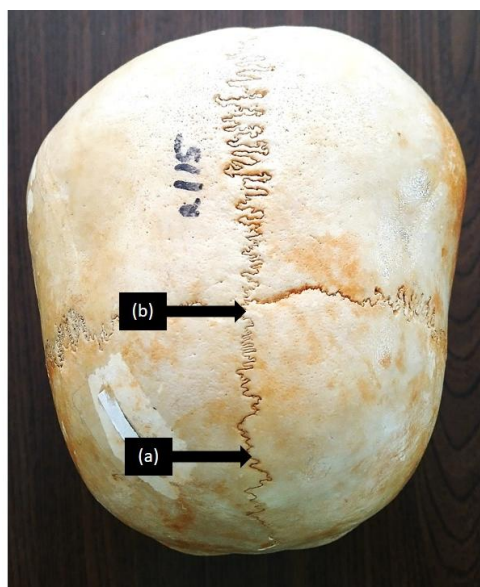


Figure 02: Vertex view of the reported Sri Lankan adult skull with persistent metopic suture and plagiocephaly. (a) metopic suture (b) bregma

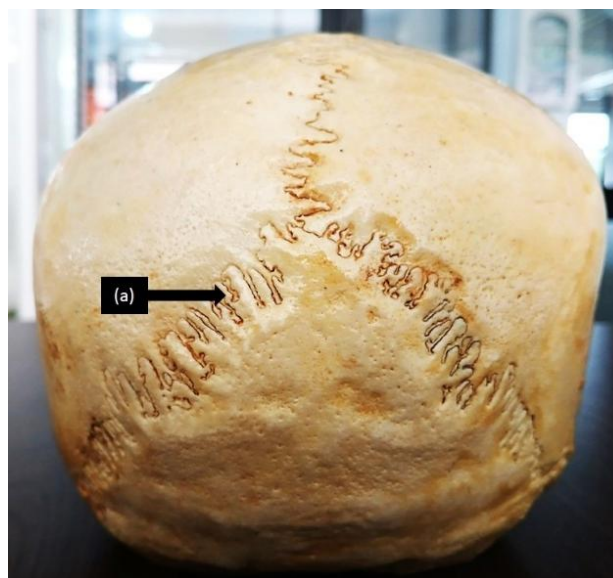


Figure 03: Normal posterior view with no evidence of lambdoid synostosis in the reported Sri Lankan adult skull, which exhibits metopic sutures and plagiocephaly. (a) lambdoid suture.

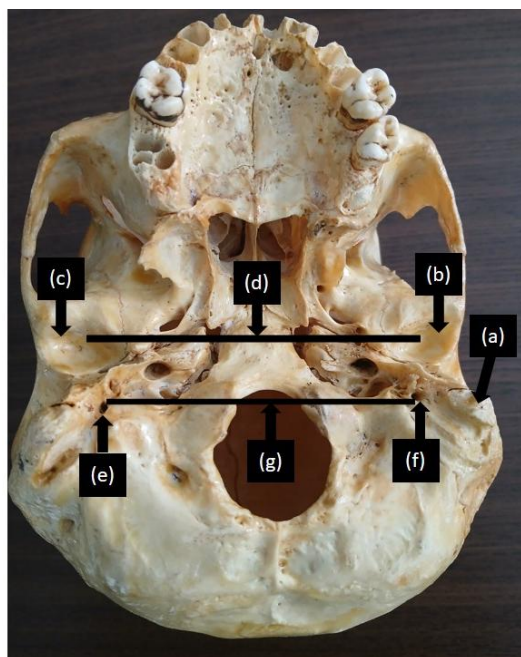


Figure 04: *The inferior view of the reported skull with (a) bulging of the mastoid process into the left side, (b) slight anterior displacement of the left sternomastoid foramen and symmetrical temporomandibular joint position (c).*

It is also evident that posterior positional plagiocephaly is more common than anterior positional plagiocephaly and lambdoid craniosynostosis (25). The absence of evidence of true lambdoid craniosynostosis in the skull also confirms that this is more likely to be a case of posterior positional plagiocephaly or deformational plagiocephaly.

The persistence of a metopic suture in adult skulls is often associated with frontal sinus abnormalities, such as absent and hypoplastic small sinuses. However, the presence of a metopic suture as seen in this plagiocephalic skull has not been previously reported, suggesting a possible correlation between these two cranial features.

The identification of a well-preserved metopic suture in an adult plagiocephalic skull within the osteology collection of the Department of Anatomy, Faculty of Medicine, Wayamba

University of Sri Lanka supports the association between persistent metopic sutures and cranial abnormalities. Further investigations, including larger sample sizes and detailed clinical studies, are required to establish a comprehensive understanding of the implications of metopic sutures in cranial pathologies and facilitate accurate diagnoses and interventions.

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