Several Facial Angles on the Mid-Sagittal Profile in Artificially Deformed Peruvian Skulls

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Abstract Three principal cranial dimensions and six angles on sagittal cranial profile related with facial prognathism, between artificially front-occipital deformed and undeformed Peruvian skulls were examined. The deformed skull group was characterized by a shorter and wider neurocranial vault. Angular analyses suggested that the skull deformation caused displacement of the basion-nasion line. However, the significant difference in the facial prognathism between the deformed and undeformed skulls could not be confirmed in this craniogeometric study.

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Key Words : Craniogeometry, Facial prognathism, Mid-sagittal profile, Artificial deformation, Peruvian skulls

Introduction

The practice of cranial vault deformation flourished as a custom at one time among the American Indians, Pacific islanders and various European stocks[3]. The artificial deformation of the neurocranial vault results in a series of compensatory changes in the cranial base and face[1),2),7),8)]. In particular, the flattening (platybasia) of the mid-sagittal cranial base would most likely affect changes in facial prognathism.

In the present study, the changes caused by artificial deformation in several angles relating to facial prognathism on cranial profile were craniogeometrically examined.

Materials and Methods

Samples consisted of 12 deformed and 12 undeformed skulls strictly selected from 90 male Peruvian skeletal remains of the pre-Columbian stage[4),5)]. The deformed samples were front-occipitally compressed with a relatively strong intensity (Fig. 1). Three cranial dimensions were measured according to Martin and Saller(1952)[6]. For each skull, the sagittal profile was drawn. Six angles on the profile were selected (Fig. 2), and were measured using image processing software (NIH-image) on a personal computer (Macintosh LC630). Student's t-test was used for inter-group comparisons.

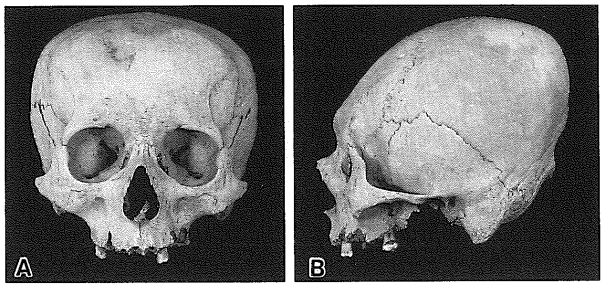

Fig. 1 Photographs of male Peruvian skull with front-occipital deformation.
A: Frontal view, B: Lateral view

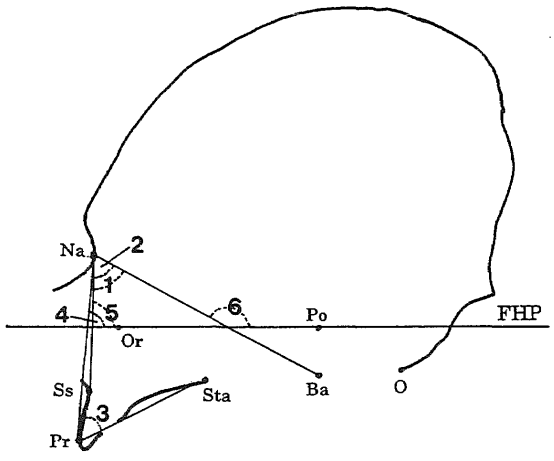

Fig. 2 Mid-sagittal cranial contour tracing with the line and angles for measuring.
Ba: Basion, O: Opisthion, Or: Orbitale, Po: Porion, Pr: Prosthion, Sta: Staphylion, Ss: Subspinale, FHP: Frankfurt horizontal plane
1: Ba-Na-Pr angle, 2: Ba-Na-Ss angle, 3: Sta-Pr-Ss angle, 4: Na-Pr (FHP) angle, 5: Na-Ss (FHP) angle, 6: Ba-Na (FHP) angle

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Results and Discussion

Main cranial dimensions are shown in Table 1. The deformed group was characterized by a shorter and wider neurocranial vault, indicating considerably large cranial index. However, the total cranial size, indirectly evaluated by cranial modulus, was almost identical to that of the undeformed group, as reported by Ogata (1976)[9].

Angular measurements are given in Table 2. The Ba-Na-Pr and Ba-Na-Ss angles with respect to basion-nasion line were significantly more acute in the deformed than in the undeformed group. Cheverud et al.(1992)[2] reported that widening of the cranial base results in a general anterior-posterior reduction in facial dimensions, particularly in the maxillary alveolus and nasal regions. On the other hand, the Sta-Pr-Ss, Na-Pr (FHP) and Pr-Ss (FHP) angles were not significantly different between the two groups. Also, the angle of the basion-nasion line with the Frankfurt horizontal plane (FHP) was significantly smaller in the deformed than in the undeformed group. It has been reported that artificial deformation modifies the position of the basion[1),8)]. The changes in the Ba-Na-Pr and Ba-Na-Ss angles, caused by front-occipital deformation, may be explained by displacement of the basion-nasion line. In conclusion, differences in facial prognathism between the artificially deformed and undeformed skulls could not be confirmed.

Table 1 Main cranial measurements in the deformed and undeformed cranial groups.

No.[1)]	Measurement	Deforemed			Undeformed			
		n	mean	s.d.	n	mean	s.d.	t-value
1	Max. Cr. Length	12	157.8	4.61	11	171.7	5.41	6.65 **
8	Max.Cr.Bradth	12	153.4	4.48	10	142.2	4.49	5.83 **
17	Ba-Br Height	12	131.1	5.43	11	130.6	6.53	0.20
8/1	Cranial Index	12	97.3	4.46	10	82.9	2.70	8.94 **
1+8+17/3	Cranial Modulus	12	146.6	3.44	10	148.4	4.38	0.96

1):Martin's Number, *:p<0.05, **:p<0.01
Student's t-test was used to analyze inter-group differences.

Table 2 Angular measurements in the deformed and undeformed cranial groups.

No.	Angle	Deformed			Undeformed			
		n	mean	s.d.	n	mean	s.d.	t-value
1	Ba-Na-Pr	11	65.2	3.16	12	67.7	2.13	2.24 *
2	Ba-Na-Ss	11	63.9	2.11	12	66.5	2.20	2.89 **
3	Sta-Pr-Ss	9	61.4	6.30	12	64.2	6.27	1.01
4	Na-Pr(FHP)	11	84.3	4.06	12	84.3	3.75	0.00
5	Pr-Ss(FHP)	10	82.4	12.53	12	81.5	9.66	0.19
6	Na-Ba(FHP)	12	149.9	2.25	12	152.3	2.43	2.51 *

FHP: Frankfurt horizontal plane, * :p<0.05, **:p<0.01
Student's t-test was used to analyze inter-group differences.

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ペルーの人工変形頭蓋正中矢状面輪郭における若干の顔面角について

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要　旨　ペルー人男性の前頭後頭型人工変形頭蓋における頭蓋型と，正中矢状面輪郭上の歯槽性突顎に関連する若干の角について調べた．変形頭蓋は非常に大きな頭蓋示数を有するが，頭蓋モズルスは非変形頭蓋との間に有意差がなかった．Basion(Ba)-Nasion(Na)-Prosthion(Pr) 角と Ba-Na-Subspinale(Ss) 角における両頭蓋間の差は有意であった．これに対し，Na-Pr 線，Na-Ss 線とフランクフルト面 (FHP) のなす角度の差は有意でなかった．また，Na-Ba 線と FHP とのなす角に有意差が認められた．これらの結果から人工変形は Na-Ba 線の位置変化をもたらすが，歯槽性突顎の形態には影響を与えないことが示唆される．

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