A CEPHALOMETRIC STUDY OF PARENTS AND THEIR CHILDREN

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INTRODUCTION

Several studies of families in recent years have demonstrated the contributions made by inheritance to skull growth (WYLIE, 1944; DE COSTER, 1951, 1952; SASSOUNI, 1955; STEIN et al, 1956; SARNAS, 1959; KRAUS et al, 1959). This paper is an attempt to add a few more facts by comparing selected bony features which are observable on lateral head radiographs. The comparisons were made for each of the selected features to find resemblances that might exist between the parents and their children and between the children of the same family. The similarities identified are based upon an appraisal of morphology and total size, and sometimes similarity is suggested by the child being, as it were, an increment of growth of one of its parents.

MATERIALS AND METHODS

Six families, three with six children and three with four children had lateral head radiographs taken with their heads positioned in the Frankfort plane; the position was maintained by using a cephalometer designed by ADAMS.

The ages of the children ranged from 2^ years to 17 years. There were 16 boys and 14 girls.

Comparisons were made of tracings of three aspects of the endocranial outline and the mandibular outline *(Fig. I).* The endocranial aspects are:

(1) The overall endocranial outline.

(2) The anterior endocranial outline.

(3) The posterior endocranial outline.

The anterior endocranial outline follows the mid-sagittal plane of the squamous part of the frontal bone and the laterally placed orbital plates of the frontal bone. The posterior endocranial outline follows the mid-sagittal plane of the parietal and occipital bones. The outline of the mandible is made up of the condyle, the posterior and lower borders and the mid-sagittal outline of the symphysis.

The endocranial outlines were chosen in preference to the more familiar exocranial outlines because of the large age differences that existed between the parents and their children. It has already been established by DE COSTER (1951) and confirmed by FORD (1958) that growth of the anterior cranial base ceases after 7 years, whereas STRAMRUD (1959) showed that the exocranium, and particularly the frontal bone thickness, increases from three years to adulthood.

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Orientation lines were constructed for the comparisons of the endo-cranial and mandibular outlines *(Fig. 1)*.

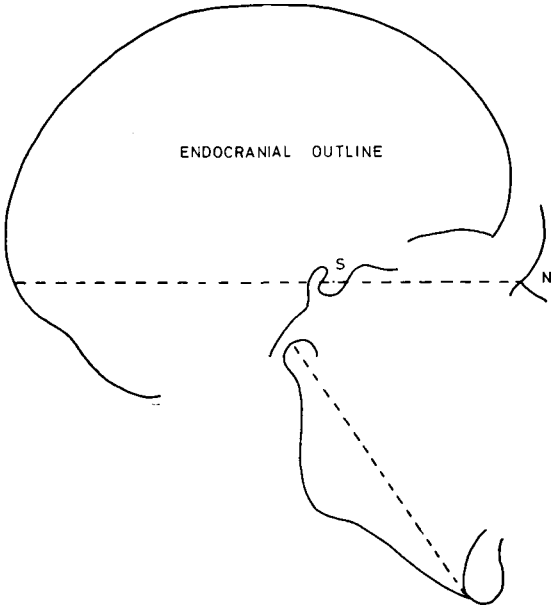


Fig. I The outlines and the orientation lines that were used for the comparisons.

(1) Orientation for the endocranial outlines:

This is a line joining S, the centre of sella turcica, and N, the junction of the frontal and nasal bones. The line was continued posteriorly to touch the occipital bone.

(2) Orientation for the mandible:

This is made up of a line joining the junction of the lingual surface of the symphysis and the lower border of the mandible to the centre of the condylar head.

Tracing were made for all the individuals, and on to each tracing the orientation lines were drawn. Comparisons were then made for the three endocranial outlines with the S points and the S-N lines coincident. Similarly comparisons were made for the mandible, the junctions between the lingual surface of the symphysis and the lower border of the mandible being superimposed and the lines to the condyle made coincident. Comparisons of the outlines for each family were made between the parents, between the parents and each child, and finally between children in the same family.

FINDINGS

Total Endocranial Outline

The endocranial outlines of the parents were first of all superimposed to determine any resemblances that might exist; it was thought that should they be very similar it would be impossible to judge from which parent a particular morphological feature of a child came. *Figure 2* demonstrates a very great likeness in outline of the parents of one family, while *Figure 3* shows parents of another family where the endocranial outline varies in both vertical and antero-posterior dimensions. It may be noted that in the sphenoid region there is very little resemblance in either of the compared parents.

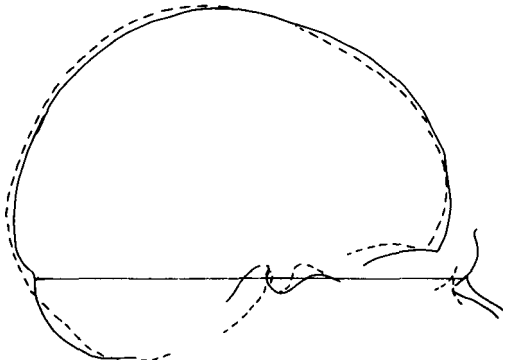


Fig. 2 Superimposed tracings of two parents with very similar endocranial outlines.

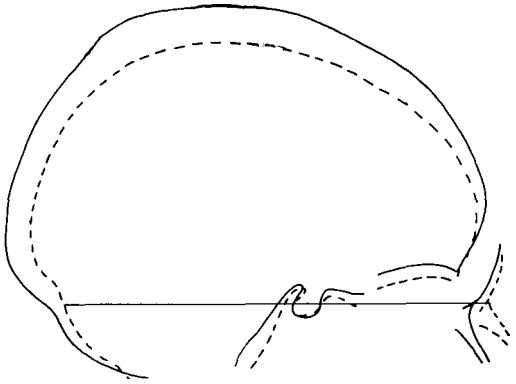


Fig. 3 Superimposed tracings of two parents with dissimilar endocranial outlines.

From the superimpositions of the tracings of the children on those of their parents, it was found that there was either resemblance with one of the parents or no obvious likeness at all. The tracing from daughter **D.B.,** aged 16 years, when compared with those other parents show she is more like her mother; their frontal, parietal and sphenoid bone outline are nearly coincident, and the distance S-N is practically identical *(Fig. 4);* **D.B.** is clearly less like her father *(Fig. 5).*

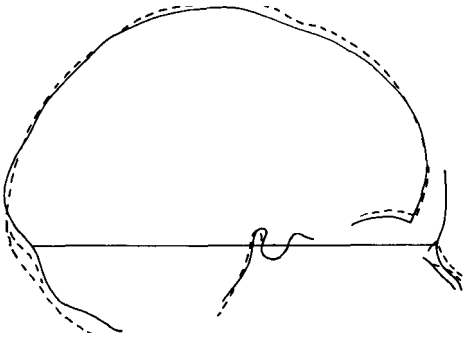


Fig. 4

Daughter **D. B.,** aged 16 years, compared with her mother.
Mother ———————— Daughter D. B. - - -

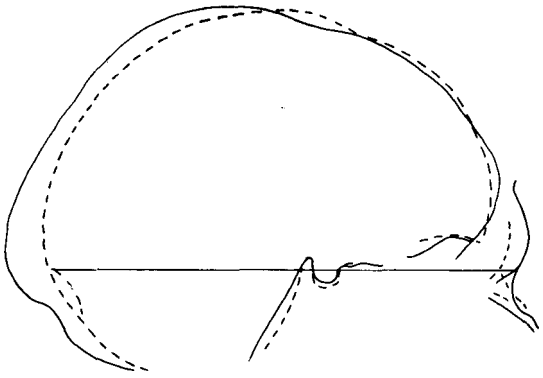


Fig. 5

Daughter D. B., aged 16 years, compared with her father. Father ———
——— Daughter D. B. --------

When children of the same family are compared with each other, there are sometimes very marked likenesses. The two sisters in *Figure 6* more nearly resemble each other than the two brothers shown in *Figure 7.* Again, because of the age differences, comparisons made in three years time may well show a different picture. However, in the case of the sisters

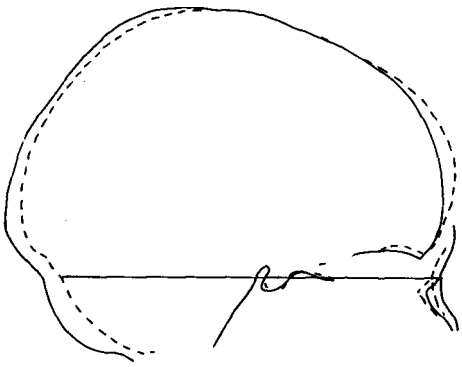


Fig. 6

Sister C M , aged 11 years, compared with her sister D. M., aged 8^ years. C. M. ———————— D. M. --------

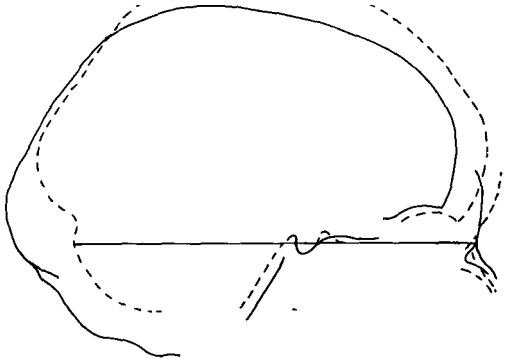


Fig. 7

Brother K. B., aged 15 years, compared with brother P. B., aged 13 years. K. B. ———————— P. B. --------

tlie growth that has yet to take place is likely to make the younger even more like her older sister. It is not easy to make a similar speculation for the two brothers.

The Anterior and Posterior Endocranial Outlines

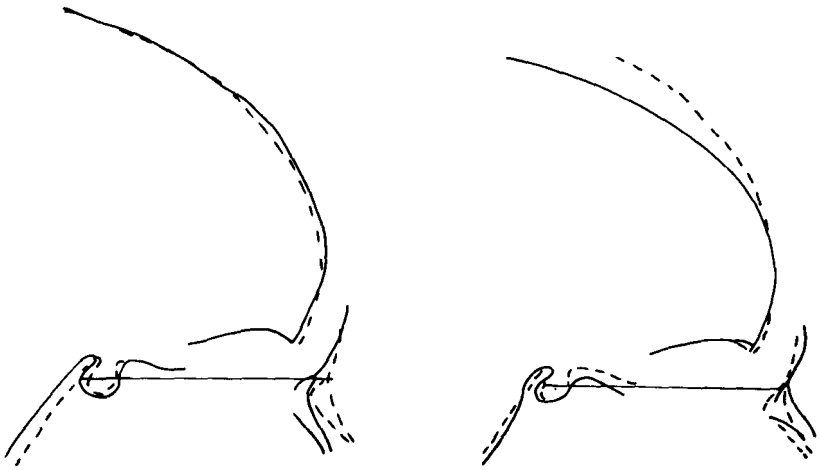
It has already been explained how the anterior endocranial outline lies in two planes. They were chosen because the cranial base line in the mid-sagittal plane that DE COSTER (1951) described cannot always be easily identified.

Of the six families analysed two sets of parents had such similar anterior outlines that no comparisons for likeness could be made for the children of these particular parents.

The anterior endocranial outline of daughter A.S., aged $15^{1/2}$ years, is very like her father, and the frontal bone is altogether larger than that of her mother *(Figs. 8a* and *8b)*.

Among the 22 children who were compared 17 children more resembled their father and only 4 were like their mothers, and only one the of children looked like neither parents.

The posterior endocranial outline was the least satisfactory morphological aspect to compare because posterior cranial growth was still in progress; however, it was possible to roughly categorise, and only subsequent follow-up will prove the validity of these comparisons.



a b

Fig. 8

Superimposed tracings of the anterior endocranial outlines. Daughter A. S., aged 16 years, compared

a. with her father.

Father ———————— *A.S.* --------

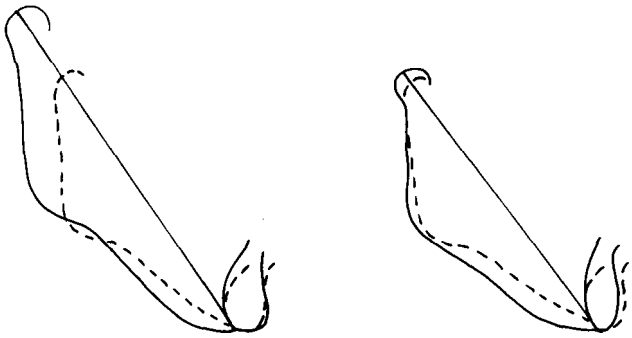
b. with her mother.

Mother ———————— *A.S.* .....

The Mandibular Outline

Again because of the age difference exact coincidence was not expected and was not found. As with the other outlines resemblance could be with either parent or non-existent. One set of parents had mandibles that were very similar in outline and size and, as before, comparisons with their children were not made.

The tracing of the mandible of daughter C.B., aged 10 years, suggests, if age is taken into account, that her mandible is more like father *(Fig. 9a)* than her mother *(Fig. 9b)*. The lower border of father and daughter are very alike in appearance; and with the growth still expected to take place, the daughter's mandible will become larger than her mother's and even more like the mandible of the father.



a *b*

Fig. 9 Superimposed tracings of the mandibular outlines. Daughter C. B., aged 10 years, compared

a. with her father.

Father ———————— C. B. --------

b. with her mother.

Mother———————— C. B. --------

Table I is a summery of family likenesses in the mandible for all the families analysed. The parents of family 4 had mandibles with nearly identical outline and so comparisons to identify from which parent a child of this family inherited its mandible could not be made. In families 2, 3 and 5 the mandibular outlines of five of the children were unlike either parent. It appears that either parent may contribute to transmitting mandibular family likeness to their children, which is of course only confirmation of a well known fact.

Mandibular Outlines						
	Families					
Child	1	2	3	4*	5	6
A	F	M	M		F	F
B	M	—	M		F	M
C	M	M	F		M	M
D	M	—			—	F
E	M	—	M			
F	F	F	F			

F = more like father. M = more like mother.

* Mother and Father have similar mandibles.

TABLE I

Table II is a summary for one family of the resemblances that may exist in the different bony features that have been described. The table shows how for four of these features a child may resemble completely either parent (Child A and Child C) or may be as it were a composite of both parents. Even from this small sample, it appears that a pattern of likeness is established at a very early age; Child F is only 6^ years old.

SUMMARY

Six families, three with six children and three with four children had lateral Head radiographs taken with their heads positioned in the Frankfort plane.

Comparisons were made of tracing of three aspects of the endocranial outline and the mandibular outlines *(Fig. 1)*. It was found that resemblances between parents and their children and between children of th-,b|l^icQ e same family may or may not exist when the different bony outlines are compared.

Endocranial and Mandibular Outlines

Family 3

Child	Age in Yrs.	Overall Endocranial Outline	Anterior Endocranial Outline	Posterior Endocranial Outline	Mandibular Outline
A	15	M	M	M	M
B	13		F	F	M
C	12	F	F	F	F
D	10½	F	M	F	
E	7¾	F	M	F	M
F	6¼		F	F	F

F = more like father. M = more like mother.

TABLE II

RÉSUMÉ

On prit des radiographies de tête latérales (la position étant celle de l'orientation de Frankfort) chez six familles, dont trois avaient chacune six enfants et trois quatre enfants.

On compara les décalques de trois aspects de la silhouette endocraniale

On compara les décalques de trois aspects de la silhouette endocraniale et de la silhouette mandibulaire *(Fig. 1).* On trouva que les ressemblances entre parents et enfants et entre les enfants d'une meme famille existent parfois lorsqu'on fait la comparaison entre les différents traits endocraniaux.

DISCUSSION

This study is in its early stages, and the sample suggests that the four features which have been analysed are as much under genetic control as the several contours described by KRAUS, WISE and FREI (1959). However, this is not to say that these bones grow entirely under genetic control;

it must always be remembered that environmental factors may be modifying the central inherited plan.

In course of the analysis several questions have arisen. Will the child who resembles his father today be anything like him in five years time? How can it be certain that the same criteria for comparisons are being used all the time? It was hinted in the introduction that there is an element of judgement. Further work with this material will aim to overcome some of these obvious objections; but it is believed that by an extension of this principle of comparing bony features it will be increasingly possible to predict possible trends of growth.

ACKNOWLEDGEMENTS

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