A Cephalometric Comparison Of Some Skeletal And Denture Pattern Components In Two Groups Of Children With Acceptable Occlusions

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No investigation has so far been reported involving a comparison of facial and dental parts in children of similar ethnic origin and living in different countries. The groups studied here were a North American (White) and a similar group of New Zealand (White) children.

The age distribution of the groups was as follows: six children at seven years, twenty-five at eight years and thirteen at nine years. The sex distribution of the groups was as follows: twenty-three males and twenty-one females. The two groups were matched exactly in respect to age and sex.

Prior to the taking of cephalometric radiographs the occlusion of each child of both groups had been classified as acceptable. Both groups consisted of individuals classified as being of European origin.

METHOD

Cephalometric radiographs, using the Broadbent-Bolton machine, from the files of the Department of Orthodontics in the University of Washington, were used for the North American group of children. Cephalometric radiographs, using the Margolis machine, from the files of the Orthodontic Department in the University of Otago Dental School, Dunedin, were used for the New Zealand group of children.

Angular measurements only were used in comparing the skeletal and denture patterns of the two groups of children. A comparison of absolute size of the various components of these patterns would involve the use of linear measurements. The fact that a different type of cephalometer was used for each group renders invalid any comparison of absolute size of parts.

Tracings were made from the cephalometric radiograph of each child, and a diagram showing the skeletal and

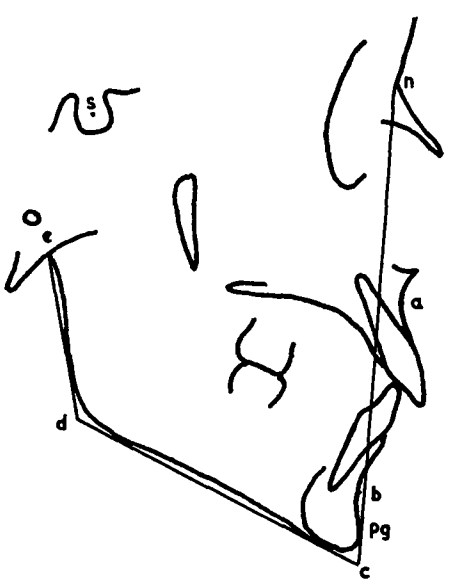

Fig. 1 Reference points.

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denture patterns of each child was constructed using the following points (Fig. 1): s, sella; n, nasion; pg, pogonion; c, chin angle; d, jaw angle; e, articulare; a, subspinale; and b, supramentale.

The skeletal pattern of each individual was measured by using the angles at: s, n, c, d and e in addition to Downs' angle of convexity and the sna-snb difference.

The denture pattern of each individual was measured by the following angles: maxillary incisor to sn; mandibular incisor to mandibular plane; and the upper and lower incisors to each other.

The results of the comparison of the skeletal pattern components are shown in Table I and those of the denture pattern in Table II.

Linear measurements in millimeters were made of the lines s-n, n-c, c-d, d-e, and e-s in the diagram constructed from the tracing of the cephalometric radiograph of each child in both groups. Linear measurements in millimeters were also made of the distances s-angle z and d-angle x (Figure 2) in the diagram constructed from the tracing of each individual.

Table III shows the results of the linear measurements.

A polygon for the New Zealand group was constructed using the mean figures for the angles at s, n, c, d, e, and the mean figures for the linear

TABLE I

Angle	Group	Means	S.D.	Diff. in means	St. error of diff.	't'	P
s	N.Z.	123.840	4.56	2.568	0.980	2.620	<0.02
	N.A.	121.272	4.61				
n	N.Z.	78.545	3.06	0.591	0.668	0.884	n.s.
	N.A.	79.136	3.21				
c	N.Z.	68.204	3.33	0.818	0.743	1.100	n.s.
	N.A.	69.022	3.63				
d	N.Z.	126.136	5.65	0.046	1.238	0.037	n.s.
	N.A.	126.090	5.96				
e	N.Z.	141.886	5.51	1.341	1.290	1.039	n.s.
	N.A.	143.227	6.58				
sna snb diff.	N.Z.	2.818	1.35	0.727	0.344	2.113	<0.05
	N.A.	3.545	1.84				
nagp	N.Z.	+4.204	+3.46	+1.182	0.880	1.040	n.s.
	N.A.	+5.386	+4.70				

TABLE II

Angle	Group	Means	S.D.	Diff. in means	St. error of diff.	't'	P
L-1 to mand. plane	N.Z.	92.568	5.52	4.477	1.108	4.041	<0.01
	N.A.	97.045	4.86				
U-1 to L-1	N.Z.	131.045	6.23	5.159	1.287	4.008	<0.01
	N.A.	125.886	5.84				
U-1 to s-n	N.Z.	76.772	4.74	1.636	0.970	1.686	n.s.
	N.A.	75.136	4.34				

TABLE III

Item	Group	Mean in mm.	Diff. in means, mm.
s-n	N.Z.	68.6	0.6
	N.A.	68.0	
n-c	N.Z.	112.4	4.5
	N.A.	107.9	
c-d	N.Z.	75.0	2.9
	N.A.	72.1	
d-e	N.Z.	43.0	2.0
	N.A.	41.0	
e-s	N.Z.	33.7	0.8
	N.A.	32.9	
s - angle z	N.Z.	42.3	nil
	N.A.	42.3	
d - angle x	N.Z.	60.7	4.1
	N.A.	56.6	

measurements s-n, n-c, c-d, d-e and e-s. A similar polygon for the North American group was constructed using the mean figures for the same angular and linear measurements in this group of children. The mean figures for the linear measurements s-angle z and d-angle x, and the angular measurements at x y and z (Figure 2) were used to locate the relationship of the incisor teeth to the polygon drawn for each group.

Figure 3 shows these two mean group polygons oriented on the horizontal cranial base line s-n, with points s coinciding.

Anterior facial height was also measured for each individual in both groups of children.

The Frankfort plane (F-P Figure 4) was located and a plane drawn at right angles to it. To this vertical plane were projected at right angles the points nasion (n), anterior nasal spine (ans) and gnathion (gn) to locate point f, point g, and point h (Figure 4).

Linear measurements of the distances f-g, g-h and f-h were made from the tracing of each child in both groups; they illustrate upper, lower and total facial heights respectively.

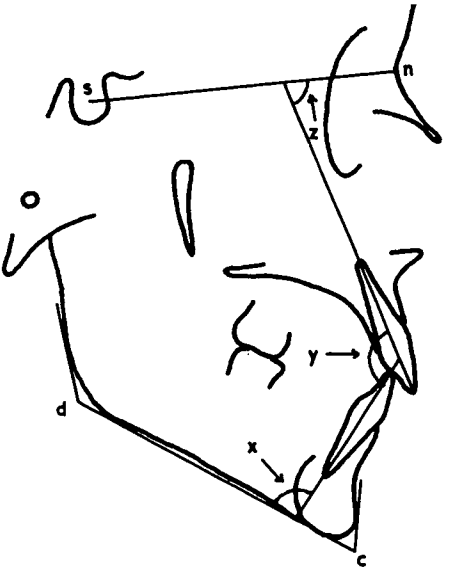

Fig. 2 Axial inclination of mandibular incisor to mandibular plane, angle x. Axial inclination of upper and lower incisors, angle y. Axial inclination of upper incisor to s-n plane, angle z.

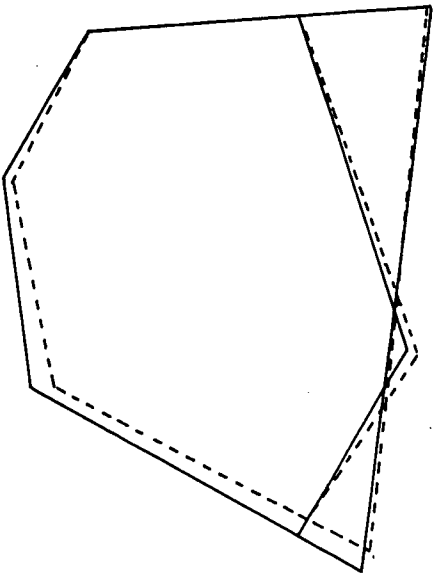

Fig. 3 Mean group polygons oriented on horizontal cranial base line, s-n. Points s coinciding. New Zealand, unbroken line; North American, dash line.

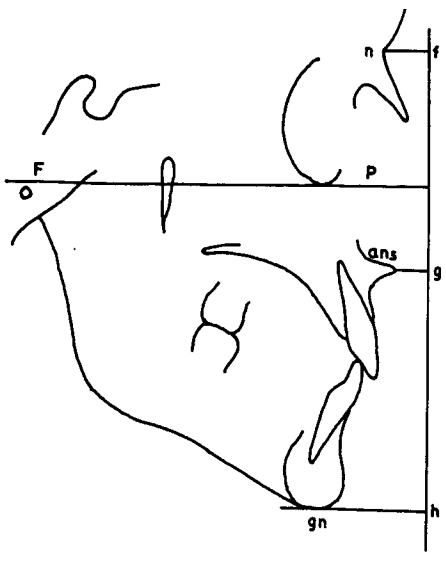

Fig. 4 Facial height.

The results of the comparison of these facial height components are shown in Table IV.

Discussion

The only angle of the basic facial polygon s-n-c-d-e which shows any significant difference when the skeletal patterns of the two groups of children are compared is the angle at point s, the saddle angle. Here there is a 't' value of 2.62 (Table I); thus, a reasonably high level of significance exists in the difference between the groups in this component. In the four remaining angular components the differences are not significant. With five component angles compared and only a significant difference evident in one, it is reasonable to state that the two groups of children are quite similar in their facial skeletal pattern.

In the N.Z. group the saddle angle is more obtuse; the difference between the mean figures is 2.568°. Other factors being equal, this would tend to have the effect of making the lower face more retrusive in the N.Z. child. If the lower face is more retrusive, we would expect the N.Z. group to show a greater apical base disparity, (i.e., a larger mean sna/snb angular difference) than the North American group. We find that the reverse is true when we examine the comparison of this component of the skeletal pattern; there is a significantly greater difference ('t' value 2.113, greater than 5%) between the maxillary and mandibular apical bases in the North American group (Table I). The more obtuse N.Z. saddle angle has not apparently caused any retrusion of mandibular apical base. Other factors must have exerted a cancelling-out effect.

The more obtuse N.Z. saddle angle might conceivably be expected to make the angle of convexity greater in the New Zealand group. Again, however, this is not the case. The North American mean group figure for this component is +1.182° more than the N.Z. mean (Table I). The angle of convexity is a measure of the protrusion

TABLE IV

Item	Group	Means in mm	S.D.	Diff. in means	St. error of diff.	't'	P
f-g	N.Z.	48.47	3.22	2.43	0.59	4.1	<0.01
	N.A.	46.04	2.23				
g-h	N.Z.	60.31	4.18	1.88	0.90	2.1	<0.05
	N.A.	58.43	4.26				
f-h	N.Z.	108.79	6.19	4.32	1.23	3.5	<0.01
	N.A.	104.47	5.35				

of the maxillary part of the face to the total profile. While there is no significant difference between the groups in this respect, it seems logical to postulate that other factors again must have played a part in causing the increased angle of convexity in the North American children.

It is in the results of the denture pattern comparisons that we find the greatest differences between the groups.

The axial inclination of the lower incisor to the mandibular plane has been the subject of numerous investigations. Broadly speaking, a figure of 90° ± 5° is considered the average and "normal range" for this component. It is surprising therefore to find a mean figure of 97.045° for the North American sample in this study. The mean figure for the New Zealand group is 92.568° which is within the so-called normal range. The difference between the mean figures for the two countries is 4.477°, a 't' value of 4.041, making the difference between the groups for this component a highly significant one (greater than 1%).

The axial inclination of the upper incisor to the horizontal cranial base line s-n was measured and compared; there was no significant difference found.

There was again a highly significant difference ('t' value of 4.008, greater than 1%) between the groups in the axial inclinations of the incisors to one another. Procumbency of the incisor teeth is more pronounced in this North American sample of children with acceptable occlusion than in the similar New Zealand group.

The point has been made earlier that any comparisons of absolute size based upon linear measurements are not valid. We can, however, make an assessment of the comparative size of some components from an examination of Table III and Figure 3. The difference between the means of the two groups for the component s-n is relatively small, viz., 0.6 mm. In Figure 3 the two polygons are oriented on this cranial base line s-n where the mean difference is relatively small.

When we compare the length of the mandibular body (c-d) in the two groups, the difference between the means is 2.9 mm. The body of the mandible in the New Zealand child of 7-9 years thus appears longer than that of the North American child of similar age. We found in the New Zealand child that, although the saddle angle was more obtuse, the lower face was not more retrusive. It can be postulated that the greater mandibular body length has exerted a cancelling-out effect in this respect.

The mean linear measurement d-angle x (Figure 2) is 4.1 mm greater in the New Zealand child; however, when this is correlated with the longer New Zealand mandibular body, the lower incisors in each group are in the same relative relationship to the chin point. The mean linear measurement s-angle z is identical in both groups. The greater North American incisor procumbency is thus due to the greater axial inclination of the maxillary and mandibular incisors to the cranial base and the mandibular body respectively.

Comparing the facial height components in each group, the upper facial height of the North American child is quite significantly less than in the New Zealand child ('t' value 4.1, greater than 1%). The total facial height of the North American child is likewise quite significantly less ('t' value 3.5, greater than 1%). The difference between the groups is less marked in respect to the height of the lower face ('t' value 2.1, greater than 5%).

Summary and Conclusions

Certain components of the skeletal and denture patterns in two groups of

children in different countries have been studied. The individuals in each group were of similar age, sex, occlusion and ethnic origin.

Quite a marked over-all similarity was found in the basic skeletal pattern.

The New Zealand child tends to have a more obtuse saddle angle, but the effect of this upon the facial pattern as a whole is cancelled out by the relatively longer New Zealand mandibular body. The general relationship to the cranial base, of the chin and the facial plane, is thus practically identical in the two groups.

Facial height is significantly less in North America than in New Zealand.

The mandibular incisors are likely to be inclined farther labially in the North American child. The over-all procumbency of the incisor teeth is also somewhat greater in these children.

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