Incisor Relationships in Different Skeletofacial Patterns

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We have known for a long time that different incisor relationships exist in similar facial types. This is often an important factor in determining the prognosis of orthodontic treatment.[5,8,9] The reverse of this also occurs where similar incisor relationships are found in different skeletal facial patterns. From this observation stems the idea that there must be some form of change occurring in the dentofacial skeleton that allows the accommodation of normal incisor relationships in different skeletal patterns. This paper concerns itself with a study of incisor accommodation.

Logically, any alteration or adjustment of one part of the dentofacial complex will require a like adjustment by another part of the complex for its own accommodation and so on. The idea is summed up by Coben[3] when he states, "The significance of any one variant lies in its integration in the total facial morphology and therefore it is not sufficient to consider any single variant alone." The reasons for a normal incisor relationship being able to accommodate itself in different skeletal patterns may be subject to individual variation. This study was undertaken in an attempt to show how the incisors are accommodated and whether there is any consistent pattern operating. The incisor relationships studied were normal according to a classification devised for this investigation.

Review of the Literature

In 1956 Holdaway discussed[5] a compensatory mechanism which allows a good occlusion to be achieved in a subject with an acceptable facial balance related to a skeletal Class II apical base. This relationship is achieved by the relative tipping of upper and lower incisors.

Goldman[4] studied faces of above-average appearance and suggested that a compensatory or balancing property exists within the dentofacial complex which preserves the overall harmony and proportions of the facial pattern. This compensation is such that when one facial dimension shows an obvious discrepancy one or more of the others will be altered to minimize the effects of the dimension displaying the obvious discrepancy.

Coben[3] illustrates this compensation by showing that severe flexure of the cranial base without a corresponding reduction in the size of the mandible leads to mandibular prognathism. An obtuse cranial base, on the other hand, may increase the anteroposterior length of the upper face and result in mandibular retrusion. Therefore the mandibular increment must keep pace with the growth of the cranial base if there is to be an harmonious relation in the dentofacial complex.

There is a need to study the aesthetic and functional compensation which results from incisor repositioning. This is particularly so since a number of cephalometric analyses rely upon incisor compensation, Steiner[8] and Tweed.[9]

Materials and Methods

Lateral cephalometric radiographs were used for this study. The selection of these radiographs was based on the following criteria:

1) A normal incisor relationship

TABLE I

Class I		Class II		Class III	
M	F	M	F	M	F
50	50	45	51	49	23

was a special requirement of the study since the idea of incisor adjustment was being investigated. The definition of "normal" had to allow for compensation and the incisor relationships were thus classed as normal when there was an overbite present and the overjet was in the range of +1 - +4 mm.

2) The second permanent molars and the canines were erupted and in occlusion.

3) No permanent teeth were missing.

4) No deciduous teeth were retained.

5) The incisors had not been crowned.

6) No orthodontic treatment had been performed.

Two hundred sixty-eight radiographs were selected and classified according to sex and skeletal pattern. Since the incisors were being studied, the ANB difference was used for the skeletal classification according to Holdaway.[5] Thus skeletal Class I had an ANB difference in the range of 0° - +4°, Class II had an ANB difference in the range >+4° and Class III had an ANB difference in the range <0°. An attempt was made to balance the sample to give equal numbers of radiographs in each subgroup; however, this was not possible due to difficulty in finding suitable radiographs. (Table I).

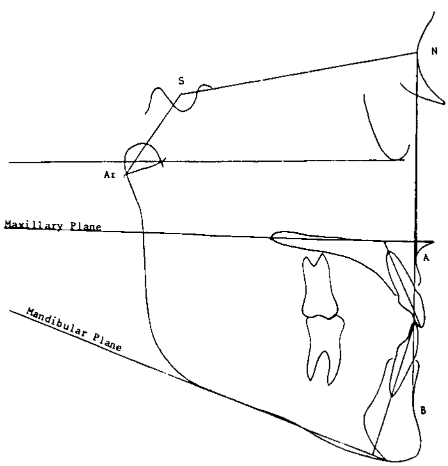

Fig. 1 Typical tracing.

The following points and planes were located on the selected radiographs: sella, nasion, articulare, points A and B, anterior and posterior nasal spines, maxillary and mandibular planes, and the inclinations of the upper and lower incisors (Fig. 1).

The variables measured were compared in males and females and between the three skeletal classes using a modified analysis of variance.

Results and Discussion

Cephalometric study of this nature requires a reliable reference plane. The anterior cranial base was chosen for this purpose and is represented by sella-nasion. The length and flexion of the cranial base were measured and tested for variation between sexes and skeletal classes (Table II). There was no significant variation in length or flexion of the cranial base at the 1% level of significance between skeletal classes, therefore it is concluded that

TABLE II

	F-values	
Variable	*Sex*	*Class*
S-N	18.63*	1.21
N-S-Ar	0.39	1.02
SNA	1.77	8.3*
SNB	2.9	5.4*
L-I to mand. plane	2.2	9.46*
U-1 to max. plane	0.58	5.29*

* — variation significant at 1%

the anterior cranial base is a very constant structure in this sample and as such provides a very acceptable reference plane.

The variation of SN between sexes is expected and in keeping with the findings of Ingerslev and Solow[6] and Bibby.[2] This was the only variable in this study to show a sex difference (Table II).

To investigate the mechanism of incisor accommodation two possibilities arise, first, the cranial structure could produce this effect and second, it could be due to the incisors. Adjustment or alteration in the former must be evident in the maxilla or the mandible for it to affect the teeth. Using the reference plane mentioned earlier, the relative positions of the apical bases were compared in the three skeletal classes. This could be done directly by comparison of SNA for maxillary apical base adjustments and SNB for mandibular adjustments.

On analysis these results reveal that the position of A point relative to the cranial base is the same or at least very similar in skeletal Classes I and II with Class III showing a significant difference from both other skeletal classes (Table III).

The position of B point in Classes I and III is shown to be similar relative to the cranial base while Class II shows a significant difference from the other classes. Therefore, it is seen that the more protrusive jaws in skeletal Classes II and III have the same relation to the cranial base as they have in a skeletal Class I. In both instances the less protrusive jaw is in a retruded position relative to the same jaw in skeletal Class I.

From this evidence there appears to be no mechanism acting to reduce the anteroposterior discrepancy between the upper and lower jaws in this sample and it is concluded that the cranial structures offer no adjustments which allow the incisors to relate normally.

At this stage the positions of the incisors were investigated relative to their respective jaw planes, i.e., maxillary and mandibular planes. To do this the inclinations of the incisors were compared between skeletal classes.

The results show that the proclination of the lower incisors is similar in skeletal Classes I and II whereas in Class III they are very upright or retroclined relative to the other classes.

The upper incisor inclination is significantly different between all three skeletal classes, Class II having relatively retroclined upper incisors and Class III having relatively proclined upper incisors.

A method of compensatory adjustment can be seen in the incisors which acts to reduce the anteroposterior discrepancy between the upper

TABLE III

Variable	*Class I*		*Class II*		*Class III*	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
S-N	71.91	4.07	71.72	4.3	72.92	3.96
N-S-Ar	124.34	5.19	125.02	5.27	123.46	4.91
SNA	82.81	5.19	82.68	3.65	79.56	3.93
SNB	80.16	5.08	76.87	3.49	80.74	3.89
L-1 to mand. plane	94.45	7.3	97.14	7.39	89.28	6.9
U-1 to maxi. plane	110.18	6.28	105.16	7.35	114.01	6.58

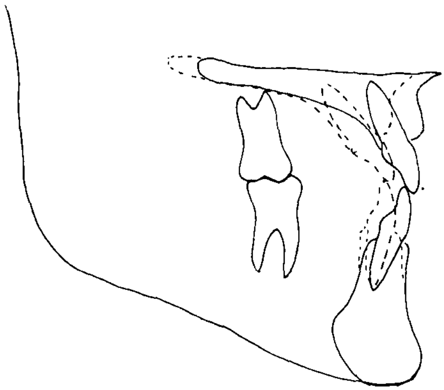

Fig. 2 Incisor compensation in skeletal Class III.

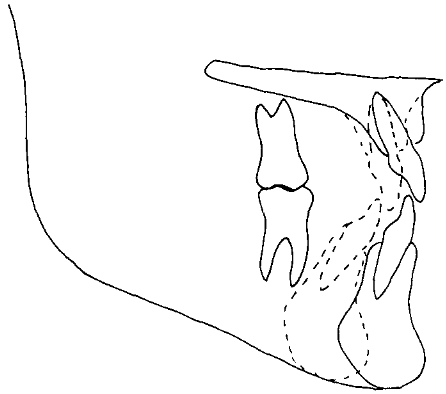

Fig. 3 Incisor compensation in skeletal Class II.

and lower apical bases and which allows the establishment of the normal incisor relationship. A consistent pattern appears to be operating which retroclines the lower incisors in the protrusive mandible of Class III types while at the same time the upper incisors are proclined to meet them (Fig. 2). This pattern is also seen in Class II types but with one difference, the upper incisors are relatively retroclined in the protrusive upper jaw as expected, whereas the lower incisors have a similar and only slightly more anterior inclination than those in Class I (Fig. 3). Since a normal incisor relation is established in skeletal Class II types the majority of the compensation appears to be effected by the upper incisors.

Conclusions

1) Sella-nasion is a stable reference plane for this sample.

2) Skeletal classification based on the relative prognathism of A and B points to the cranial base indicates that Class II skeletal types are produced due to a relatively retruded mandible. Similarly, skeletal Class III types are due to a relatively retruded maxilla.

3) A compensation mechanism exists which allows upper and lower incisors to be accommodated in a normal relationship regardless of skeletal class.

This compensation is effected by both upper and lower incisors in skeletal Class III types and mainly by the upper incisors in skeletal Class II types.

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