The Early Developmental Position of the Lower Third Molar Relative to Certain Jaw Dimensions

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The mandibular third molar develops in the ramus of the mandible; its occlusal surface faces upwards and forwards, and as space becomes available for it by growth of the mandible, it rotates into a more upright position.[10] Development may begin between the ages of seven and fourteen years with the peak formation period at eight years[1,5] or nine years.[6]

In the early stages of its development the lower third molar crypt lies on the surface of the bone, submerging as it calcifies.[7,9] The eruption age is very variable ranging from 16 years onwards with an average of 20.5 years.[8]

The lower third molar frequently becomes impacted, supposedly due to lack of growth of the mandible resulting in insufficient space to permit eruption. Björk established an association between lack of space for the lower third molar and its impaction.[2] He investigated how this lack of space occurred and found it to be a combination of three skeletal factors, the most important of which was a vertical direction of condylar growth, followed by short jaw length, and reduced alveolar prognathy. A fourth factor which contributed to third molar impaction was retarded maturation of the tooth.

Lower third molars are important to the orthodontist. Diagnosis and treatment planning cannot be undertaken without determining their presence and position, and no orthodontic case should be considered complete until these teeth have erupted or have been removed.

The development of lower incisor crowding is a common problem in orthodontics, and one which is frequently associated with development and eruption of third molars. Alternatively this secondary crowding may be considered as part of the process of maturation unrelated to the third molar. Cryer, in the discussion of his paper stated[3] ". . . the third molar eruption was prevented by the same arch shortness which aggravated the lower incisor crowding. . . . However, the degree of crowding might be influenced by the presence of third molars." In other words lower incisor crowding and third molar impaction are simply manifestations of a general lack of space or unfavorable tooth to bone ratio.

The premise is then suggested that the mesially tilted developmental position of the lower third molar is dictated by the inherent crowding, or shortage of space. It is also suggested, in view of the frequency of the mesioangular type of impaction of the lower third molar, that the developmental angulation might be an indication of future impaction. Examination of radiographs of developing lower third molars reveals that there is considerable variation in the degree of angulation of this tooth from one individual to another and even between right and left sides of the same individual.

The following investigation was undertaken to determine the relationship between the angulation of the developing mandibular third molar and various dimensions of the teeth and jaws.

MATERIAL

A group of 162 children was selected

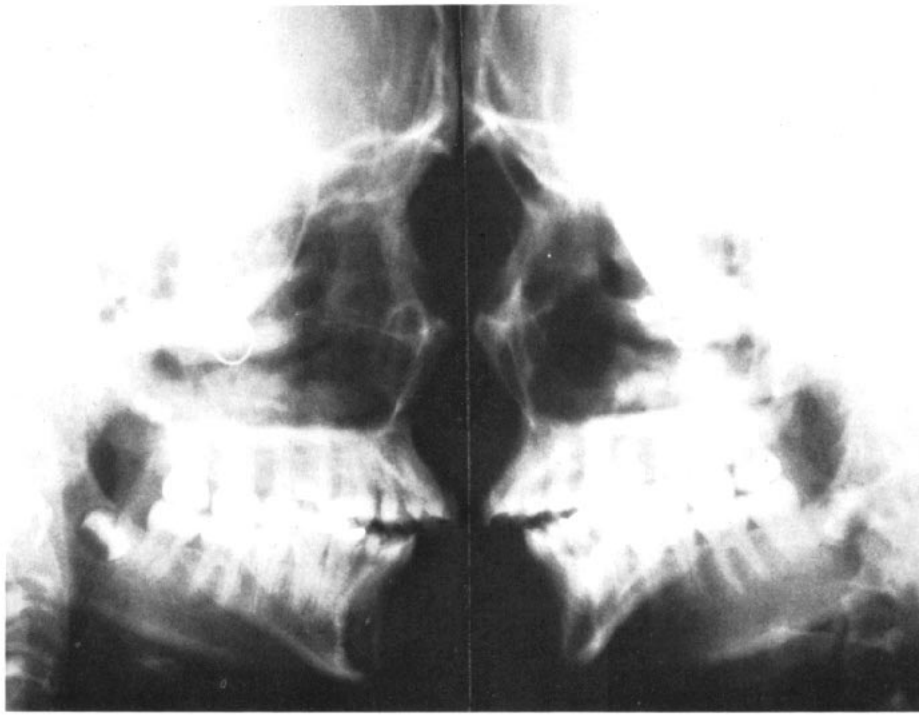

Fig. 1 60° left and right cephalometric radiographs showing the lower third molars without superimposition.

from the records of a longitudinal study of third molar development. Selection was made, firstly because it was possible to measure space condition on the models, and secondly, because there was sufficient calcification of at least one lower third molar to enable a measurement of its angulation to be made. Age at the time of the set of records used ranged from 8 years - 13.7 years with an average of 11.1 years.

The records available for each child included a set of plaster models of the dentition and 60° rotated left and right cephalometric radiographs; these were taken to give a clear picture of the third molar on each side of the jaw, without superimposition (Fig. 1).

Measurements

1. *Radiographs:* The following measurements were made on the 60° rotated left and right cephalometric films (Fig. 2).

(a) The angle formed by the occlusal surface of the lower third molar and the mandibular plane (Y_1).

(b) The angle formed by the occlusal surface of the lower third

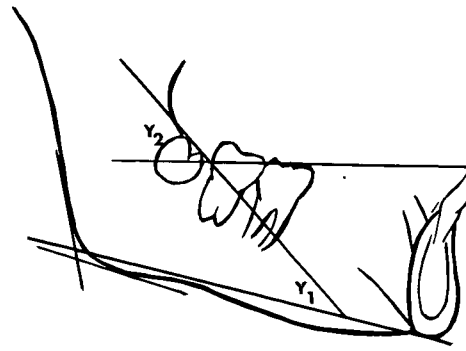

Fig. 2 Illustrating the measurements made on radiographs.

molar and the occlusal plane (Y_2).

(c) The length of the mandible as measured from gonion to pogonion (X_2).

(d) The gonial angle as measured by the angle formed between tangents to the lower part of the distal border of the ramus, and the distal part of the lower border of the body (X_3).

(e) The space between second and third molars as measured by the shortest distance between the distal surface of the second molar and the adjacent surface of the third molar (X_4).

(f) The size of the lower third molar at its widest mesiodistal dimension (X_5).

2. *Models:* Space condition was measured on the models as arch length, minus total tooth size (X_1).

In a well-aligned arch with all the teeth in contact, the arch length was taken to be the same as the total tooth size. Where spaces occurred they were added to the total tooth size to give the arch length. If a tooth was crowded or rotated, the space available for it in the arch was measured and substituted for it in calculation of the arch length.

The space condition was measured for each side of the arch from the midline to the distal surface of the first permanent molar. Where a midline space occurred it was divided equally between right and left sides.

Thus there were two sets of measurements for each subject except for twenty-six who had lower third molars on one side only.

Statistical Analysis

The mean and range for each of the above measurements was calculated and the figures are shown in Table 1.

Reproducibility of the radiographic measurements was tested by making double determinations on a random sample of ten films according to the method of Dalberg.[4] The results are shown in Table 2.

Correlation analyses of all the variables were carried out for the left and right sides separately. Zero order correlation coefficients significant at the five per cent level are shown in Table 3.

There was a weak positive correlation between the inclination of the lower third molar to the mandibular plane, and the space between second and third molars, (right side, $r = .24$: left $r = .22$).

Similar correlations occurred between inclination of lower third molar to the occlusal plane and the space between second and third molars, (right side, $r = .25$: left, $r = .23$).

On the right side there was a weak

TABLE 1 Showing the mean and range for each of the variables measured

Variable	Mean	Range
∠—8/M.P.	38°	11 to 83
∠—8/OCC.P.	55°	22 to 100
Gonial Angle	122°	103 to 148
Go./Pog.	84 mm	74 to 99
Space ∠—8 - ∠—7	1.2 mm	7 to 0
Size ∠—8	10.7 mm	13 to 7
Space Condition	—1.4 mm	—8.4 to 3.4

TABLE 2 Standard errors derived from double determinations of measurements made on ten radiographs

Variable	Standard Error
∠—8/M.P.	2.5°
∠—8/OCC.P.	2.2°
Gonial Angle	0.9°
Go./Pog.	1.1 mm
Space ∠—8 - ∠—7	0.2 mm
Size ∠—8	0.3 mm

TABLE 3: Significant correlation coefficients

Right side (n = 147)

	Y_1	Y_2	X_1	X_2	X_3	X_4	X_5
Y_2	0.94				—0.18	0.25	
X_1				0.25			
X_2			0.25		—0.18		0.20
X_3	—0.24	—0.19		—0.18			
X_4	0.24	0.25					—0.33
X_5				0.20		—0.33	

Left side (n = 151)

	Y_1	Y_2	X_1	X_2	X_3	X_4	X_5
Y_2	0.95					0.23	
X_1							
X_2							
X_3							
X_4	0.22	0.22					—0.40
X_5	—0.22					—0.40	

negative correlation between the angulation of the lower third molar to the mandibular plane, and the gonial angle ($r = —.24$), and also between the latter and the degree of angulation of the lower third molar to the occlusal plane, ($r = —.19$).

On the left side there was a weak negative correlation between the degree of angulation of the lower third molar to the mandibular plane, and the size of the third molar, ($r = —.22$).

The remaining two variables, space condition (X_1) and the length of mandible (X_2) were not significantly correlated with the angulation of the third molar.

Multiple linear regression analyses were carried out firstly with the degree of angulation of the lower third molar to the mandibular plane (Y_1) as the dependent variable and secondly, with the degree of angulation of the lower third molar to the occlusal plane (Y_2) as the dependent variable. In both cases all the remaining variables (X_1 X_2 X_3 X_4 and X_5) were used as independent variables. In both these regression analyses, on the right side it was found that the gonial angle (X_3) and the space between second and third molars (X_4) contributed significantly to the regression equation. The multible correlations including only these two variables were ($R = .32$ and $R = .30$).

On the left side, only the size of the third molar (X_5) contributed to the regression equation when Y_1 was the dependent variable ($R = —.22$), and the space between second and third molars (X_4) when Y_2 was the dependent variable ($R = .23$).

Discussion

Although the correlation coefficients discussed above were statistically significant, none of them were of sufficiently high magnitude to demonstrate any strong relationship between the angulation of the developing lower third molar and the other variables under consideration. It must be concluded therefore, that although the lower third molar develops in a mesioangularly

tilted position which may vary from 11° to 83° to the mandibular plane, the degree of angulation at this early developmental stage is virtually independent of the size and shape of the jaws and teeth.

This does not exclude the possibility that the degree of angulation of the developing mandibular third molar may be related to its final position or to secondary crowding which may appear in the middle or late teens.

Since this is a longitudinal investigation it will be possible to observe the changes in angulation which occur during the development and eruption of the lower third molar, whether these changes differ with regard to rate and amount, and whether any differences in these changes are related to any of the dimensions of teeth and jaws considered in this study, or to any other dimensions of the dentofacial complex which may be suggested.

Conclusions

1. In the early stages of calcification the developing lower third molar is tilted mesially forming an angle with the mandibular plane of 38° on average with a range from 11° to 83°.

2. In 82% of cases the lower third molar is spaced from the second molar a mean of 1.2 mm with a range of 7 mm — 0 mm.

3. There is no definite relationship between this early developmental position of the lower third molar, and other dimensions of teeth and jaws.

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