Lower Third Molar Space

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Increase in lower third molar space in the five years following complete replacement of the deciduous dentition finds the contributions from ramus resorption and mesial movement of the first molar about equal on average, but highly variable.

KEY WORDS: • ARCH LENGTH • GROWTH • SPACE • THIRD MOLAR •

Mandibular third molar development starts in the ramus at about the age of seven years (BANKS 1954). At this stage, there is no space for it in the dental arch. RICHARDSON (1985) found space still deficient at age 13 by an average of 8mm.

Various factors have been suggested as contributors to the development of space for the third molar prior to its eruption. Among these are resorption of bone from the anterior border of the ramus (BRASH 1924), the backward slope of the anterior border of the ramus in relation to the alveolar border (BRASH 1934), forward movement of the dentition (BRASH 1953, SCOTT 1953), growth in length of the mandible (BJÖRK 1956), sagittal direction of mandibular growth (BJÖRK 1956), and sagittal direction of eruption of the dentition (BJÖRK 1956).

The objective of the present investigation is to examine the change in lower molar space over the five-year period immediately following establishment of the permanent dentition anterior to the first permanent molar, and to relate this change to the factors mentioned above.

— Material and Methods —

A group of 22 males and 29 females, with intact lower arches, was selected from the records of a longitudinal study of third molar development (RICHARDSON 1977). Third molars were present on both sides in all cases. There was no orthodontic treatment in the lower arch.

The first set of records used for this investigation was the earliest set showing a complete permanent dentition anterior to the first molars. The average age at these first records was 13 years. The second set of records was made five years later.

The records included 60° left and right cephalometric radiographs and conventionally oriented 90° lateral cephalometric radiographs.

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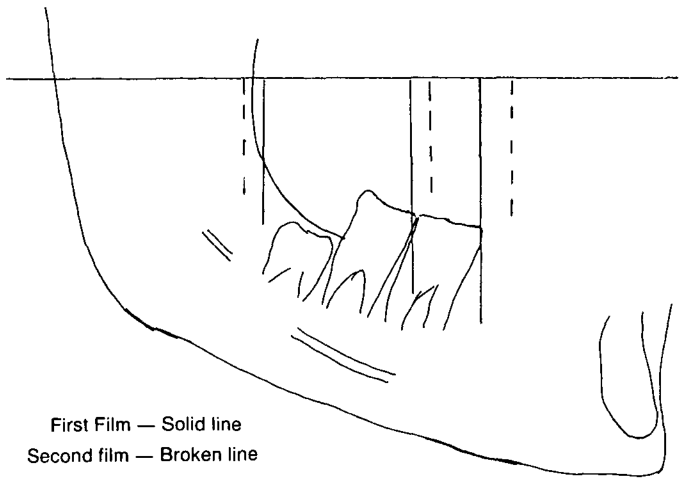

Fig. 1 The method of measuring the total increase in molar space, posterior increase in molar space and forward movement of the first molar on a tracing of 60° rotated cephalometric radiograph.

60° Cephalometric Radiographs

Total Increase in Molar Space

On a tracing of the first film, the distal contact point of the first molar and the junction of the anterior border of the ramus with the body of the mandible were projected onto a horizontal drawn through the maxillary plane (ANS–PNS). The distance between these projected points gives a measure of the original molar space.

The tracing of the first film is then superimposed on the second with mandibular structures in register, and the two corresponding points are projected onto the horizontal to give a second measurement of molar space. The difference between these two measurements of molar space represents the increase in molar space over the five-year interim between films (Fig. 1).

Posterior Increase in Molar Space

With the tracings again superimposed on anterior internal mandibular structures, the posterior space increase is measured as the distance between the two projections of the junction of the anterior border of the ramus with the body of the mandible onto the maxillary horizontal.

Change in Position of the Lower First Molar

This is measured in a similar way, as the distance between projections of the mesial contact point of the first molar onto the maxillary horizontal (Fig. 1).

The Ramal Occlusal Angle

This is measured on the first film, as the angle formed by the anterior border of the ramus and the occlusal plane (Fig. 2).

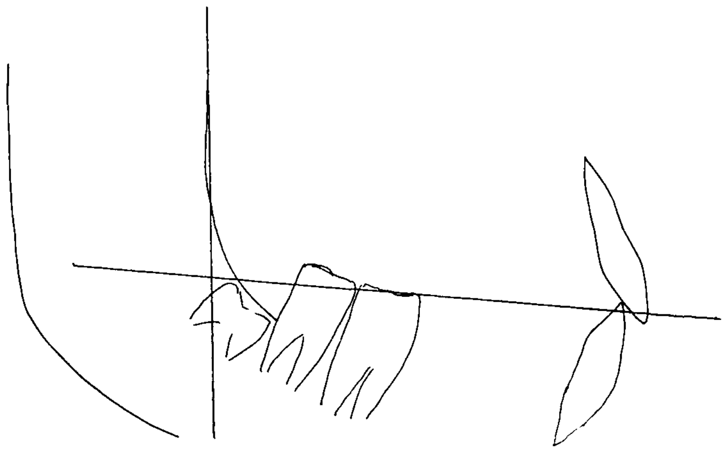

Fig. 2 The method of measuring the ramal/occlusal angle on a tracing of a 60° rotated cephalometric radiograph.

90° Lateral Cephalometric Radiograph

Growth in Length of the Mandible

Mandibular length is measured from condyle to symphysis, using the points identified on Fig. 2 as Ar and Pog. Growth is calculated as the difference between this measurement on the first and second films.

Direction of Mandibular Growth

The angle formed by the mandibular plane (Go–Me) and the Ar–Pog line used to measure length is measured on the first film to define direction of mandibular growth (Fig. 3). This is similar to the method used by Björk (1956).

Direction of Eruption of the Dentition

Measured as the angle formed between the mandibular plane and a line joining incision inferius (Ii) with pogonion on the first film(Fig. 3). This is a modification of the method used by Björk (1956).

Statistical Analysis

All measurements were made twice by one observer to an accuracy of 0.5mm or 0.5°. Means and standard deviations were calculated for all the variables, for left and right sides where appropriate (Table 1).

Correlation coefficients between the total increase in molar space (Table 2) and the posterior increase in molar space (Table 3), and all the other variables were calculated for left and right sides. The .05 probability level was used as the minimum level of significance throughout.

— Results —

During the five-year observation period, the molar space increased by an average of 4mm. The posterior increase in molar space averaged about 2mm, and the lower first molar moved forward by about 2mm. During that same period, the overall mandibular length increased by an average of almost 10mm.

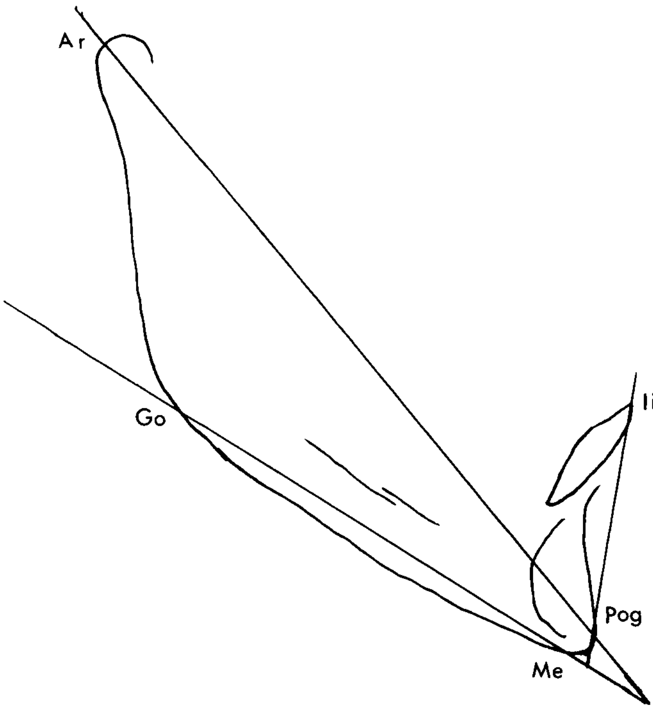

Fig. 3 **The method of measuring the angles Ar–Pog/MP and Ii–Pog/MP on a tracing of a 90° lateral cephalometric radiograph.**

Significant positive correlations were found between the total increase in molar space and the change in position of the first molar, the overall increase in mandibular length, and the angle Ii–Pog/Go-Me on both sides.

Significant negative correlations were found between the posterior increase in molar space and the change in position of the first molar on both sides.

A significant positive correlation was found between the posterior increase in molar space and the angle Ii–Pog/Go-Me on the right side.

— Discussion —

This method of measurement of the change in molar space by superimposition on mandibular structures shows that space increases partly at the front and partly at the back.

The posterior increase in space can probably best be accounted for by resorption of bone in the region of the anterior border of the ramus. Bone resorption at this site was described by HUNTER as early as 1837, and since then by others including HUMPHRY (1871), BRASH (1924) and ROBINSON AND SARNAT (1955).

Table 1

Means and Standard Deviations for all Variables (N = 51)

		Mean±SD
Total increase in molar space (mm)	L	4.1±1.8mm
	R	4.1±1.7mm
Posterior increase in molar space (mm)	L	1.9±1.8mm
	R	2.2±1.6mm
Change in position of first molar (mm)	L	2.2±1.5mm
	R	2.0±1.4mm
Ramal/Occlusal Angle (°)	L	101.9±5.6°
	R	107.1±6.7°
Increase Ar→Pog (mm)		9.6±4.3mm
Angle Ar–Pog/Go–Me (°)		15.2±2.3°
Angle Ii–Pog/Go–Me (°)		72.7±5.4°

Table 2

Correlation Coefficients Between Total Increase in Molar Space and the Other Variables

		R
Change in position of first molar	L	+0.4***
	R	+0.4***
Ramus/occlusal angle	L	+0.1
	R	−0.1
Increase in Ar→Pog	L	+0.4***
	R	+0.3*
Angle Ar–Pog/Go–Me	L	+0.2
	R	+0.1
Angle Ii–Pog/Go–Me	L	+0.3*
	R	+0.4**

* $P<0.05$
** $P<0.01$
*** $P<0.001$

Scott (1958) claimed that resorption of bone from the anterior border of the ramus was not necessary to make space for the developing third molar, since the alveolar process extends distally on the inner side of the ramus. He believed that such resorption as occurs at this site is associated with maintenance of the correct relationship between the origin and insertion of the temporalis muscle.

On the 60° angulated unilateral cephalometric radiographs, the posterior extension of the alveolar process is thrown more forward in relation to the anterior border of the ramus. This gives a more true representation as well as a better view of the retromolar area and the amount of space for second and third molars than is seen in a 90° view.

On average, the increase in molar space posteriorly was 2mm, ranging from zero up to 6mm.

Significant negative correlations between posterior increase in molar space and change in position of the first molar

Table 3

Correlation Coefficients Between Posterior Increase in Molar Space and the Other Variables

		R
Change in position of first molar	L	−0.3*
	R	−0.3*
Ramus/occlusal angle	L	+0.1
	R	+0.2
Increase Ar→Pog	L	—
	R	—
Angle Ar–Pog/Go–Me	L	−0.1
	R	—
Angle Ii–Pog/Go–Me	L	+0.1
	R	+0.3*

* $P<0.05$

suggests that when there is a large increase in molar space posteriorly, there is less forward movement of the dentition. This also suggests that in some cases space at the back of the arch is made by resorption of bone (related to growth of the mandible), and in others by forward movement of teeth.

The lack of significant correlations between posterior increase in molar space and the other variables suggests that it is not possible to predict, from these dimensions, which cases will show the most resorption or mesial tooth movement.

Significant positive correlations between total increase in molar space and change in position of the first molar suggest that forward movement of the dentition is quite an important factor in the creation of space in the molar region. This supports the theories of mesial migration of teeth postulated by Brash (1953) and Scott (1953), among others.

Absence of significant correlations between total increase in molar space and the angle between the anterior border of the ramus and the occlusal plane indicate that the size of this angle is not an important factor in provision of space for the molars. Brash (1934), from his bone growth studies on pigs, believed that the backward slope of the anterior border of the ramus helped to make space for the molars as they erupted.

Significant correlations between total increase in molar space and increase in the measurement Ar→Pog suggest that more space is created in the molar region when overall growth in length of the mandible is large. This is in agreement with the findings of Björk (1956). Björk also found that the direction of mandibular growth was an important factor in provision of molar space; more space for molars was made when the growth direction was mainly horizontal, rather than vertical. Lack of significant correlations between total increase in molar space and the angle between Ar–Pog and the mandibular plane in the present study do not support this conclusion.

Björk (1956), found that a backward direction of eruption was one of the factors contributing to lack of space for the third molar. This is supported by the findings in this study showing significant correlations between total increase in molar space and the angle between Ii–Pog and the mandibular plane on both sides, and between posterior increase in molar space and this same angle on the right side, indicating that more space is created in the molar region when the direction of eruption is forward.

— Conclusions —

- Space for the third molar is made partly by forward movement of the dentition and partly by resorption of bone at the back of the dental arch.
- When the amount of bone resorption at the back of the arch is large, there is less forward movement of the dentition.
- It is not possible, from the parameters examined in this study, to predict the direction from which molar space will increase.
- The biggest increase in molar space occurs in the presence of a large amount of overall mandibular growth and a forward direction of eruption of the dentition.

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