# Lower Molar Crowding in the Early Permanent Dentition

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**Statistical evaluations finding a tendency for early molar crowding to decrease, with forward molar movement and an increase in anterior crowding.**

Key Words: • Crowding • Growth • Molar space •

Crowding has been classified by VAN DER LINDEN (1974) as primary, secondary and tertiary. An alternative approach is to describe crowding according to the site at which it is found.

Crowding of incisors, cuspids and bicuspids is immediately obvious on clinical examination of the early permanent dentition. On the other hand, crowding in the molar region can only be detected radiographically. Molar crowding may be present with or without crowding farther forward in the arch, and in severe cases may persist following treatment of anterior crowding with bicuspid extraction.

When molar crowding is apparent in the early permanent dentition, it is doubtful that future growth will create enough space to accommodate all of the teeth in good alignment.

The object of the present investigation was to examine lower molar crowding in the early permanent dentition, and its relationship with various dimensions of the mandible, over a five-year observation period.

## — Material and Method —

The study sample consisted of 51 subjects, 22 male and 29 female, with untreated lower arches and third molars present on both sides. This group was selected from the records of a longitudinal study of third molar development, and has been analyzed previously (RICHARDSON 1979, 1982). Some of the earlier measurements have been incorporated into the present investigation.

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## — Measurements —

Measurements were made on dental casts and 90° and 60° cephalometric radiographs taken in the early permanent dentition soon after all permanent teeth anterior to the first molar had erupted, and five years later.

All measurements on radiographs and casts were made twice by the same observer to a precision of 0.5mm or 0.5°. Measurements for left and right sides were made separately.

### *60° Cephalometric Films*

- **Original molar space** was measured on a tracing of the first film as the distance between the distal surface of the first molar and the junction of the ramus and body of the mandible projected onto a horizontal through the maxillary plane (Fig. 1).
- **Size of second and third molars** was measured directly on the film at their maximum mesiodistal widths.
- **Original molar space condition** was calculated as the difference between the original molar space and the size of the second and third molars.
- **Change in molar space condition** was calculated after measurement of molar space condition with the tracing of the first film superimposed on the second exposed five years later, registering on mandibular structures. Positive values indicate a decrease in molar crowding.
- **Angulation of the lower third molar** was measured on a tracing of the first film as the angle between the occlusal surface of the third molar and a perpendicular to the maxillary plane through the mesial contact point of the first molar (Fig. 2).
- **Change in angulation of the lower third molar** was calculated from measurement of the new angulation of the lower third molar to the same perpendicular, superimposing on mandibular structures.
- **Space between second and third molars** was measured directly on the first film as the shortest distance between the distal surface of the second molar and the adjacent surface of the third molar.
- **Change in position of the first molar** was measured as the difference between the projections of the mesial surfaces of the first molar onto the maxillary plane, with the tracings of first and second films registered on mandibular structures. Positive values indicate forward movement of the first molar (Fig. 1).

### *90° Cephalometric Films*

- **Change in angulation of lower incisors** was measured to a horizontal through the maxillary plane with a tracing of the first film superimposed on the second, registering on mandibular structures. Positive changes indicate retroclination of lower incisors (Fig. 3).

### *Casts*

- **Original space condition** was measured as the arch length minus tooth size (Richardson 1970).
- **Change in space condition** during the five-year period was calculated from measurements of space condition made on the first and second sets of casts. Positive changes in space condition indicate an increase in crowding.

### *Statistical Analyses*

Statistical analyses included a zero-order correlation analysis of all the variables and a multiple regression analysis with change in space condition as the dependent variable.

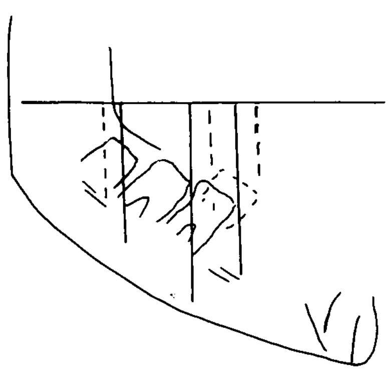

**Fig. 1** Measurement of molar space and change in position of the first molar
Solid line – first film
Broken line – second film

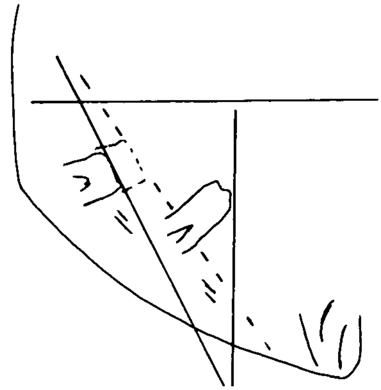

**Fig. 2** Measurement of third molar angulation
Solid line – first film
Broken line – second film

## — Results —

Table 1 shows means, standard deviations and ranges for all of the variables. Significant zero-order correlation coefficients are shown in Table 2. The level of significance used was $P<.05$.

The multiple regression analysis with the change in space condition as the dependent variable and all the others as independent variables gave a multiple correlation coefficient below the designated level of significance on the right side, but on the left side it was 0.60 ($P<0.05$). The original space condition, original molar space, original molar space condition, angulation of the third molar, space between second and third molars, change in position of the first molar and change in angulation of the lower incisors all contributed to the regression equation. On the left side almost 40% of the change in space condition can be related to these variables.

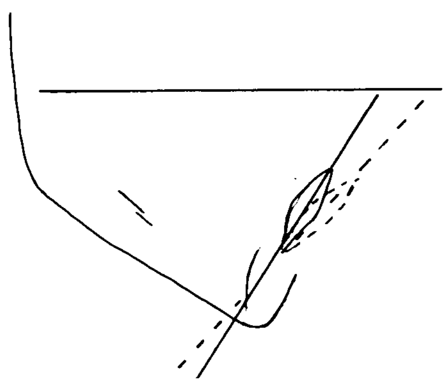

**Fig. 3** Measurement of change in incisor angulation
Solid line – first film
Broken line – second film

## — Discussion —

The original molar space condition or degree of molar crowding was measured in this investigation as the difference between the size of the second and third molars and the space between the distal surface of the first molar and the junction of the ramus and body of the mandible, projected onto a horizontal through the maxillary plane.

Other features which might reflect the original molar space condition and the change in molar space condition are the angulation of the third molar, the change in angulation of the third molar, and the space between second and third molars.

In an earlier investigation (Richardson 1970) no definite relationship was found between the developmental angulation of the third molar and either the shape and size of the mandible or the space condition of the lower arch. In the present investigation, significant positive correlations were found between the angulation of the lower third molar and the original molar space (0.27) and the original molar space condition (0.32).

These correlations suggest that very steep third molar angulation in the early permanent dentition is associated to some extent with shortage of space in the molar region.

The change in third molar angulation during the five-year observation period was positively correlated with the original molar space condition on the right side (0.42). This suggests that less uprighting of the third molar took place during the five-year observation period when molar crowding was present in the early permanent dentition.

A space between the developing third molar and the second molar might be considered a sign of adequate space in the molar region. If this were so, it might be expected that the space between second

Table 1

Means, Standard Deviations and Ranges

N = 51

| | Side | Min | Mean | Max | S. D. |
|---|---|---|---|---|---|
| Original Molar Space (mm) | L | 7.50 | 14.97 | 21.25 | 2.66 |
| | R | 11.00 | 15.24 | 20.75 | 2.28 |
| Width L7+L8 (mm) | L | 20.75 | 23.13 | 25.50 | 1.23 |
| | R | 19.50 | 22.98 | 25.75 | 1.43 |
| Original Molar Space Condition (mm) | L | −15.00 | −8.16 | −1.75 | 3.02 |
| | R | −12.50 | −7.74 | −2.25 | 2.73 |
| Change in Molar Space Condition (mm) | L | 0.50 | 4.07 | 8.00 | 1.81 |
| | R | 0.75 | 4.08 | 7.50 | 1.74 |
| Angulation L8 (deg) | L | 7.00 | 32.55 | 56.00 | 10.20 |
| | R | 11.00 | 30.56 | 54.00 | 9.02 |
| Change in Angulation L8 (deg) | L | −22.50 | 8.56 | 45.00 | 11.55 |
| | R | −8.50 | 10.10 | 38.00 | 10.99 |
| Space L7 to L8 (mm) | L | 0.00 | 1.04 | 5.00 | 1.04 |
| | R | 0.00 | 0.98 | 4.00 | 0.95 |
| Change in L6 Position (mm) | L | 0.00 | 2.20 | 7.50 | 1.51 |
| | R | 0.00 | 1.99 | 4.50 | 1.35 |
| Change in L1 Angulation (deg) | | −8.50 | −1.08 | 8.75 | 3.49 |
| Original Space Condition (mm) | L | −1.90 | 0.02 | 2.60 | 1.00 |
| | R | −3.16 | −0.11 | 3.44 | 1.27 |
| Change in Space Condition (mm) | L | −0.30 | 1.12 | 4.10 | 1.01 |
| | R | −0.42 | 1.20 | 4.06 | 0.97 |

Table 2

Statistically Significant Zero Order Correlation Coefficients

N = 51

• P<0.05 ■ P<0.01 ▲ P<0.001

| Dimension | | 4 L | 4 R | 5 L | 6 R | 7 R | 8 L | 8 R | 9 L | 9 R | 10 L | 11 L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Original Molar Space | L | −0.66▲ | | 0.27• | | | | | | | | −.31• |
| | R | | −0.38▲ | | | | | −0.32• | | | | |
| 2 Width L7+L8 | L | | | | | | | | | | | |
| | R | | | | | −0.31• | | 0.34• | | | | |
| 3 Original Molar Space Condition | L | −0.67▲ | | 0.32• | | | | | | | | −.33• |
| | R | | −0.37▲ | | 0.42■ | | | −0.46▲ | | | | |
| 4 Change in Molar Space Condition | L | | | | | | 0.40■ | | | | 0.27• | 0.34• |
| | R | | | | | | | 0.42■ | | | | |
| 5 Angulation L8 | L | | | | | | | | | | | |
| | R | | | | | −0.38■ | | | | | | |
| 6 Change in Angulation L8 | L | | | | | | | | | | | |
| | R | | | | | | | | | | | |
| 7 Space L7 to L8 | L | | | | | | | | | | | |
| | R | | | | | | | | | | | |
| 8 Change in L6 Position | L | | | | | | | | −0.32• | | | 0.47▲ |
| | R | | | | | | | | | −0.47▲ | | |
| 9 Change in L1 Angulation | | | | | | | | | | | | −0.29• |
| 10 Original Space Condition | L | | | | | | | | | | | |
| | R | | | | | | | | | | | |
| 11 Change in Space Condition | L | | | | | | | | | | | |
| | R | | | | | | | | | | | |

Table 2

and third molars would be positively correlated with the original molar space and the original molar space condition. No such correlations were found. On the right side there was a significant negative correlation (−0.31) between the size of the second and third molars and the space between second and third molars, indicating a tendency for such spaces to be associated with smaller teeth.

A significant negative correlation was also found between the second-to-third molar space and the angulation of the third molar on the right side (−0.38). This supports an earlier finding (Richardson 1970), and implies that large spaces between second and third molars may be associated with steeply tilted third molars.

The absence of significant correlations between second-to-third molar spacing and either original molar space or original molar space condition suggests that presence or absence of spacing between second and third molars in the early permanent dentition should not be construed as an indicator of molar crowding.

This is consistent with the earlier finding of Richardson (1977) that such spaces between second and third molars commonly occurred in the early stages of third molar development, tended to close quite soon, and the third molars might later become impacted.

Measurement of these spaces on earlier radiographs of the subjects used in the present investigation showed that closure of the spaces did not always progress uniformly. They could close a little and open up again, although they eventually closed completely in all cases.

The original molar space and space condition were negatively correlated with the change in anteroposterior position of the lower first molar on the right side (−0.32, −0.46), with the change in space condition on the left side (−0.31, −0.33) and with the change in molar space condition on both sides (−0.66 left, −0.38 right and −0.67 left, −0.37 right).

These correlations suggest that molar crowding in the early permanent dentition is associated with large forward movements of the first molars, an increase in lower arch crowding, and a decrease in molar crowding in the ensuing five-year period.

The change in molar space condition was positively correlated with the change in first molar position on both sides (0.40 left, 0.42 right), with the original space condition (0.27), and with the change in space condition on the left (0.34). There was also a positive correlation between the change in first molar position and the change in space condition on the left side (0.47).

These correlations also indicate that space is created in the molar region to some extent by forward movement of the dentition, with a consequent increase in lower arch crowding. This seems to be slightly more likely to occur when the lower arch is originally uncrowded.

A positive correlation between change in first molar position and the size of second and third molar (0.34 on the right side) indicates a slight tendency for more forward movement of the first molar when the second and third molars are large.

The change in angulation of the lower incisors was negatively correlated with the change in first molar position on both sides (−0.32 left, −0.47 right), and on the left side with the change in space condition (−0.29).

This suggests that as the first molars move forward and lower arch crowding increases, the lower incisors tend to procline.

No new etiological factors of any importance have come to light in the present investigation. The multiple correlation coefficient of the change in space condition on the other variables (0.60) was not appreciably larger than the 0.53 found for the group as a whole in an earlier investigation (RICHARDSON 1979). Nevertheless, the present findings do throw some light on the role of molar crowding in the development of late lower arch crowding.

Although the variables considered here can explain less than half the variation in the change in space condition, the role of molar crowding in the etiology of late lower arch crowding should not be ignored.

It is apparent that when molar crowding is present in the early permanent dentition, especially when the lower arch is relatively uncrowded, there is likely to be some forward movement of the dentition with an increase in anterior crowding. In such circumstances interceptive extraction of second molars, bicuspids, or third molars, as may be appropriate, should be considered.

## — Conclusions —

- A steeply inclined lower third molar in the early permanent dentition which does not upright much in the ensuing five years is associated to some extent with molar crowding.
- When molar crowding is present in the early permanent dentition, a decrease in molar crowding in the following five years does not necessarily mean that sufficient space will be gained for eruption of the third molar.
- When molar crowding is present in the early permanent dentition, there is likely to be forward movement of the buccal dentition with an increase in lower arch crowding in the ensuing five-year period.
- Diagnosis of molar crowding in the early permanent dentition is an indication that interceptive measures to prevent the development of late lower arch crowding should be considered.
- A space between a second molar and the developing third molar in the early permanent dentition is not necessarily a sign that there is adequate space in the molar region; this is also associated with small second and third molars and with a steeply tilted third molar.

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