REVIEW ARTICLE

The role of the third molar in the cause of late lower arch crowding: A review

Margaret E. Richardson, M. Dent. Sc., D. Orth.*
Belfast, Northern Ireland

There are various reasons for the development of or increase in crowding in the untreated lower arch during the postadolescent period. The purpose of this article is to review the evidence in support of the theory that the presence of a third molar is one of the causes of such crowding. (AM J ORTHOD DENTOFAC ORTHOP 1989;95:79-83.)

Lower arch crowding that develops or increases after establishment of the permanent dentition during the teenage period, best described as postadolescent crowding, is a common orthodontic problem. It has been documented by various authors including Humerfelt and Slagsvold.[1] It usually occurs in the incisor region but any contact may be affected.[2]

The cause of this kind of crowding is controversial and often confused with the causes of posttreatment relapse, which may be quite different.

There is some evidence to support the theory that late lower arch crowding is caused by pressure from the back of the arch. Whether this pressure results from a developing third molar, physiologic mesial drift, or the anterior component of force derived from the forces of occlusion on mesially inclined teeth is not clear. There is also a school of thought[3-5] holding the view that in the absence of the third molar, the dentition has room to settle distally under anterior pressures caused by late growth or soft-tissue changes. Thus the third molar plays, at the very least, a passive role in the development of late lower arch crowding.

Bergström and Jensen[6] examined 30 dental students with unilateral aplasia of lower third molars and found that there was more crowding on the side with the third molar present as compared with the side in which it was missing.

Vego[7] compared 40 cases with and 25 cases without third molars (ages between 12 and 17 years) and found that more crowding developed in the group with third molars present. Total tooth size in the absent-third-molar group was slightly smaller, but the difference was not significant.

Schwarze[8] compared a group of 56 patients with third molar germectomy to 49 subjects whose third molars were allowed to develop. He found a significantly greater forward movement of first molars associated with increased lower arch crowding in the nonextraction group.

Lindquist and Thilander[9] extracted third molars unilaterally in 52 patients and found more stable space conditions (less increase in crowding) on the extraction side compared with the control side in 70% of cases.

On the other hand Shanley,[16] in a small cross-sectional study, compared lower incisor crowding and procumbency in three groups of subjects (a total of 44) with bilaterally impacted, erupted, or congenitally absent third molars. He found no significant differences and concluded that mandibular third molars have little influence on crowding or procumbency of lower incisors.

The Belfast third molar study produced further evidence in support of the "pressure from behind" theory.[10-14] A group of 51 subjects (22 females, 29 males) with intact lower arches and bilateral third molars present were examined at ages 13 and 18 years. On average these cases had an increase in lower arch crowding of slightly more than 1 mm on each side during the 5-year observation period. In some quadrants the crowding increased by as much as 4 mm and only 16% of quadrants demonstrated no change in crowding.

The mesial contact point of the first molar was used to measure the change in position of the first molar, according to the method used by Schwarze[8] except that 60°-rotated cephalometric radiographs were used. This point was projected onto a horizontal drawn through the maxillary plane and by superimposing the first and second films on mandibular structures, the inner outline of the mandibular symphysis, and inferior dental canal, in the manner of Björk,[15] the amount of change

*Orthodontic Department, School of Dentistry, Belfast.

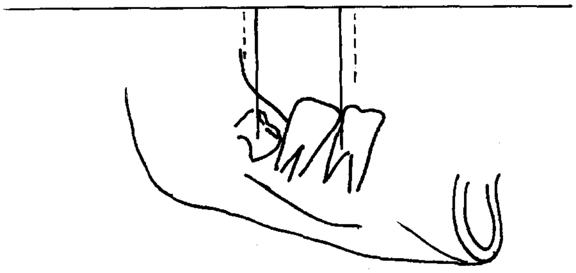

Fig. 1. Measurement of original molar space, change in molar space, and change in first molar position. *Solid lines,* First cephalometric film; *broken lines,* second cephalometric film.

in position of the first molars could be measured (Fig. 1). This change averaged 2 mm in a forward direction on each side throughout the 5-year period. In some cases it was as much as 7 mm. It was positively correlated with the increase in crowding, although the correlation coefficient was significant only on the left side (0.5*).

Another variable at the back of the arch examined in this material was the molar space measured along the maxillary horizontal as the distance between the distal contact point of the first molar and the junction of the ramus with the body of the mandible. Changes in this space were measured by superimposing on mandibular structures as before (Fig. 1). Molar space condition—that is, molar crowding—and change in molar space condition were calculated by subtracting the size of the second and third molars from the measurements of molar space.

There was a significant correlation on the left side between the increase in anterior crowding and the initial degree of molar crowding (−0.3*). This suggests that a person who lacks adequate space in the molar region in the early permanent dentition is likely to show an increase in crowding anterior to the first molar in subsequent years.

There was also a significant correlation on the left side between the change in molar crowding and the change in anterior crowding (0.3*), suggesting that as molar crowding decreased, anterior crowding increased.

The change in molar space was significantly correlated on both sides with the change in position of the first molar (left, 0.4***; right 0.4***), which indicates that space for the third molar is made, at least to some extent, by forward movement of the dentition, which may jeopardize alignment of teeth anterior to the first molar. The significant correlation coefficients found in these studies were low and in some cases reached the level of significance only unilaterally; therefore it is apparent that conditions in the molar region were only partly responsible for increased crowding and that other factors must have been involved.

The method of measurement of the change in molar space by superimposition on internal mandibular structures showed that the space increased 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. It was negatively correlated on both sides with the change in first molar position (left, −0.3*; right, −0.3*), so that if there is a small posterior increase in molar space, there is likely to be a greater forward movement of the dentition. It was not possible to predict in which cases the molar space would increase by posterior resorption or by forward movement of teeth.

Apparently if there is lack of space in the molar region at the age of 13 years, there is a possibility that space for the molars will be gained by forward movement of the buccal teeth, which may lead to anterior crowding. Fig. 2 shows models and radiographs of a 13-year-old boy with no crowding on the left side and a 10.3 mm space deficiency in the molar region. Five years later anterior crowding on the left side had increased by 2.1 mm, molar crowding had decreased by 6.0 mm, and the first molar had moved forward 4.8 mm.

In contrast, Fig. 3 shows models and radiographs of a girl who at the age of 13 years had only 2.5 mm of molar crowding on the right side and 0.5 mm of anterior crowding. Five years later the molar crowding had decreased by 3.0 mm with no forward movement of the first molar and an increase of only 0.5 mm in anterior crowding.

Mesial inclination of a lower canine usually is considered to be a sign that the buccal segment has moved forward. Fig. 4 shows three cases in which lower canines, which were quite upright at the age of 12 years, have a distinct mesial inclination 6 years later. In all these cases, the incisors had become more crowded.

Another investigation carried out in the Belfast material was a small pilot study into the effects of second molar extraction on the development of late lower arch crowding. Seventeen lower second molars were extracted in 10 subjects. These were matched with non-

*Denotes significance $p < 0.05$; ***denotes significance $p < 0.001$.

*Denotes significance $p < 0.05$; ***denotes significance $p < 0.001$.

Fig. 2. A, Model. **B,** Left cephalogram (60°) showing no anterior crowding and marked molar crowding on the left side at 13 years. **C** and **D,** Five years later anterior crowding has increased and molar crowding decreased. (From Richardson ME. Angle Orthod 1982;52:300-12.)

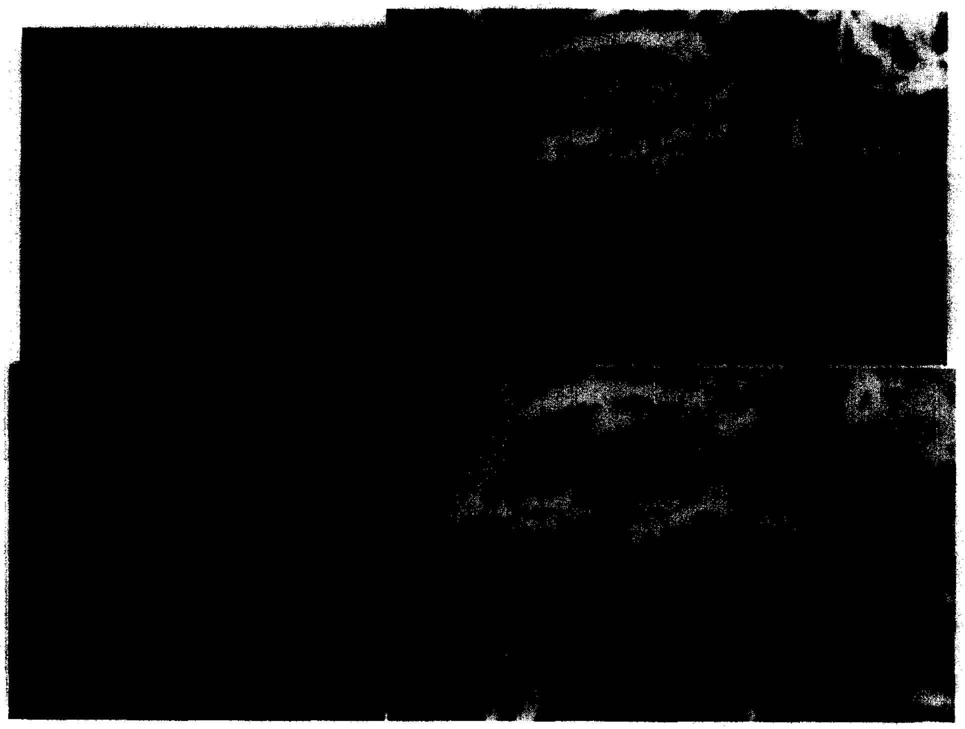

Fig. 3. A, Model. **B,** Right cephalogram (60°) showing minimal anterior crowding and molar crowding on the right side at 13 years. **C** and **D,** Five years later showing little change in anterior or molar crowding. (From Richardson ME. Angle Orthod 1982;52:300-12.)

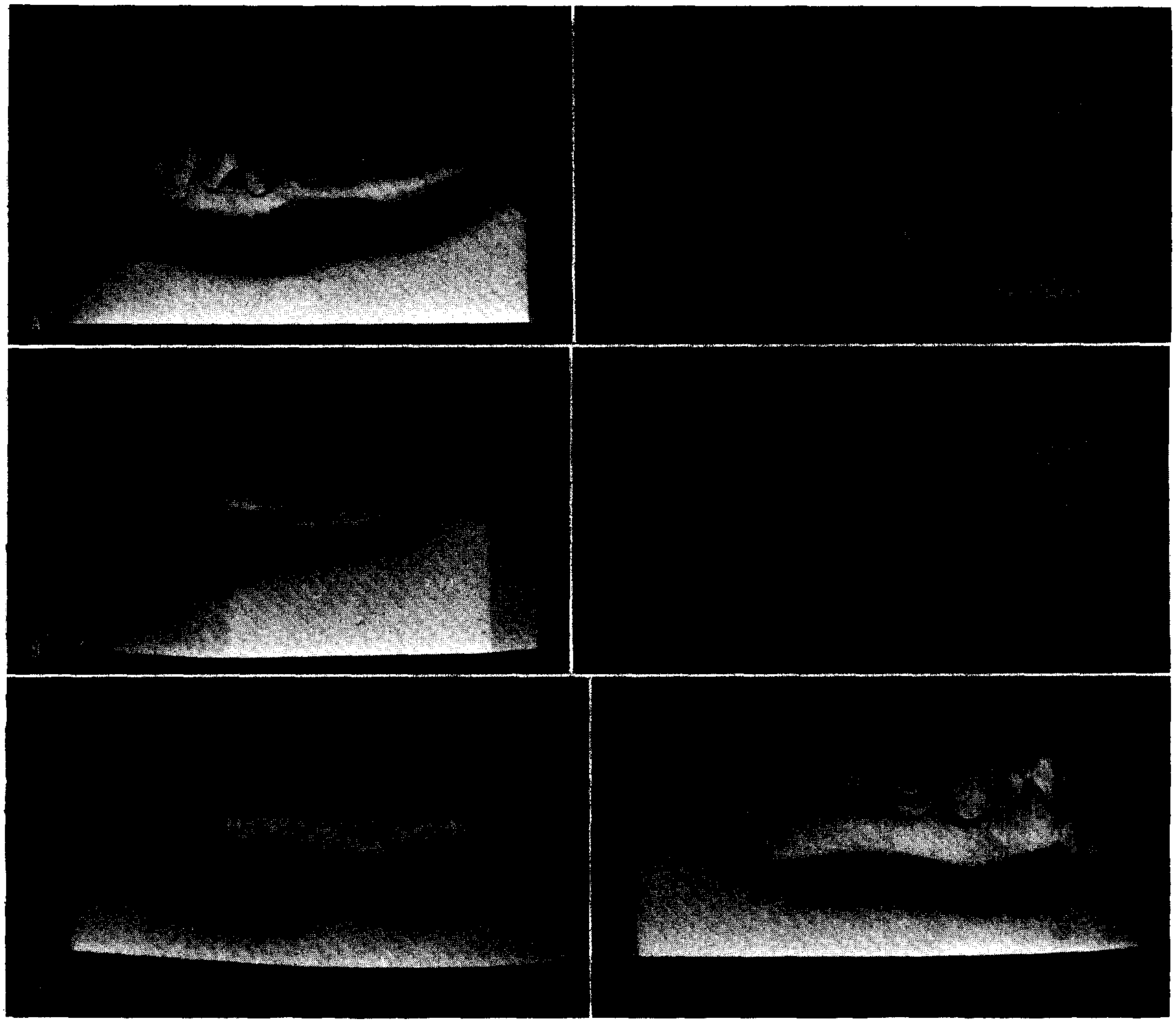

Fig. 4. A through **C**, Three upright lower canines that have become mesially inclined between the ages of 13 and 18 years.

extraction quadrants as closely as possible in terms of age, sex, and space condition. The change in crowding was measured on models and change in position of the lower first molar on 60°-rotated radiographs throughout a 5-year period following extractions by the method already described.

Significant differences for both these measurements were found between the two groups. In the nonextraction group, there was an average increase in crowding of slightly more than 1 mm with an average forward movement of the first molar of 2.5 mm. In the extraction group, there was a slight decrease in the crowding (−1.5 mm) and a slight distal movement of the first molar (−1.3 mm).

These results complement the findings of Schwarze[8] and Lindquist and Thilander[9] on third molar extractions. The numbers in the investigation were very small and the collection of a larger sample of second molar extraction cases is ongoing to determine whether the results can be confirmed.

The evidence outlined in this article implicates pressure from the back of the arch and presence of a third molar in the cause of late lower arch crowding. This does not preclude the involvement of other causative factors. The cause of late crowding may differ from one subject to another or there may be more than one factor contributing to the development of late crowding in any one individual.

I am very grateful to Mrs. Wendy James for preparation of the typescript, to Mrs. Marlene Boe for the illustrations, and to Dr. Raymond Thurow, Editor, *Angle Orthodontist*, for permission to reproduce Figs. 2 and 3.

REFERENCES

1. Humerfelt A, Slagsvold O. Changes in occlusion and craniofacial pattern between 11 and 25 years of age. Trans Eur Orthod Soc 1972:113-22.
2. Sakuda M, Kuroda Y, Wada K, Matsumoto M. Changes in crowding of the teeth during adolescence and their relation to growth of the facial skeleton. Trans Eur Orthod Soc 1976:93-104.
3. Selmer-Olsen R. The normal development of the mandibular teeth and the crowding of the incisors as a result of growth and function. Dent Rec 1937;57:465-77.
4. Woodside DG. Extraoral force [round-table]. J Clin Orthod 1970;14:554-77.
5. Graber TM, Kaineg TE. The mandibular third molar—its predictive status and role in lower incisor crowding. Proc Finn Dent Soc 1981;77:37-44.
6. Bergström K, Jensen R. The significance of third molars in the aetiology of crowding. Trans Eur Orthod Soc 1960:84-96.
7. Vego L. A longitudinal study of mandibular arch perimeter. Angle Orthod 1962;32:187-92.
8. Schwarze CW. The influence of third molar germectomy—a comparative long-term study. London: Transactions of the Third International Orthodontic Congress, 1975:551-62.
9. Lindquist B, Thilander B. Extraction of third molars in cases of anticipated crowding in the lower jaw. AM J ORTHOD 1982; 81:130-9.
10. Richardson ME. Late lower arch crowding: facial growth or forward drift? Eur J Orthod 1979;1:219-25.
11. Richardson ME. Late lower arch crowding in relation to primary crowding. Angle Orthod 1982;52:300-12.
12. Richardson ME. The effect of lower second molar extraction on late lower arch crowding. Angle Orthod 1983;53:25-8.
13. Richardson ME. Lower molar crowding in the early permanent dentition. Angle Orthod 1985;55:51-7.
14. Richardson ME. Lower third molar space. Angle Orthod 1987;57:155-61.
15. Björk A. Prediction of mandibular growth rotation. AM J ORTHOD 1969;55:585-99.
16. Shanley LS. The influence of mandibular third molars on mandibular anterior teeth. AM J ORTHOD 1962;48:786-7.

Reprint requests to:
Dr. Margaret E. Richardson
Orthodontic Department
School of Dentistry
Grosvenor Road
Belfast, BT12 6Ba
Northern Ireland