An Investigation of the Mandibular Third Molars in Orthodontic Cases

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For the orthodontist to feel that he has done the best orthodontic treatment he can for a particular patient, he should be aware of the relationship of the mandibular third molars to the remaining teeth in the dental arch.

The purpose of this study has been to evaluate the mandibular third molars with respect to what are the changes that occur in the position of the developing mandibular third molar during extraction and nonextraction orthodontic treatment; also will the mandibular third molar ever be a useful tooth?

In a review of the literature Salzmann[1] describes the beginning of the mandibular third molar development between the ages of seven and fifteen years. The mandibular third molar is formed within the ramus of the mandible; the occlusal surfaces are tilted slightly forward and somewhat lingually. As the mandible increases in length, the roots shift forward permitting a normal eruption. The eruption usually occurs between fifteen to twenty-one years or later.

Björk[2] in a detailed study of mandibular third molars showed a relationship of the impaction of these teeth to the lack of space in the alveolar arch between the second molar and the ascending ramus. Three skeletal factors contributed to this insufficient space for the third molar: 1) vertical direction of condylar growth resulting in little resorption of the anterior border of the ramus, 2) small mandibular growth in length, 3) a backward-directed trend of eruption of the dentition. Retarded maturation of the third molar also was related to its impaction.

Broadbent[3] found that information from the Bolton study showed that third molar impactions were associated with retarded facial skeletal development.

Shanley[4] evaluated three groups of patients to determine the influence of mandibular third molars on mandibular anterior teeth. One group had normally erupted third molars; a second group had impacted third molars; and a third group had congenitally missing third molars. He found that there were no significant differences in arch length discrepancies or in the angles of the mandibular incisors to the mandibular planes in the three groups.

Garn[5] et al. in a study of 140 children investigated calcification and movement of the mandibular third molar. Throughout its formation the mandibular third molar evidenced no significant sex difference in timing, being unique among the teeth. Interrelationships with somatic growth and sexual maturation were low and rarely significant, thus emphasizing the developmental autonomy of the third molar.

Richardson[6] found no definite relationship between the mesial angulation of the developing mandibular third molar and the size and shape of the jaws and teeth.

Perlow[7] presented four case histories to support his observations that with proper treatment the third molars will move forward and upright themselves. He believes that the removal of lower second premolars rather than first premolars will improve the position of 95 per cent of the unerupted third molars.

Faubion[8] in comparing twenty first premolar extraction orthodontic cases with twenty nonextraction orthodontic

cases found that 55 per cent of the mandibular third molars of the extraction group were retained in good position and only 15 per cent of the mandibular third molars were retained in the nonextraction group. It was concluded that removal of first premolars in arch length discrepancy cases helps provide space for eruption of mandibular third molars in a significant number of patients.

Ricketts[9] described his concept of arcial growth of the mandible permitting the possibility of prognosis of impacted third molars as early as the bud stage. In the early stages of development the mandibular third molar bud lies on the surface of the ramus; Ricketts discussed a technique that the impaction of the lower third molar can be prevented by simple encleation of the bud at age 6 to 8 years.

Laskin[10] emphasized the prophylactic removal of unerupted and impacted mandibular third molars as soon as it is evident that they are not in position to erupt normally. By age 16 to 17 years this can be determined radiographically. Similar removal of these teeth in an older patient would be much more difficult. Complications that can arise from mandibular third molars are the development of periocoronitis, periodontal involvement, pathologic resorption, caries, dentigerous cyst formation, and neoplasms such as ameloblastomas and carcinomas arising from the dentigerous cysts.

He also discussed indications for retention of unerupted third molars, one indication being that of a possibility of losing the second molar due to a large restoration, periodontal disease, or extensive caries. Another indication for retention is in orthodontic patients whose four premolars have been removed and for whom extraction of the third molars would reduce the dentition by a total of eight teeth. Too, the orthodontist may want the third molars for anchorage during treatment.

Shira[11] stated the importance of removing unerupted asymptomatic third molars is because 33 per cent of ameloblastomas are from follicular cysts that are formed from epithelial cells of the follicular sac. These cells can remain dormant until later in life.

When retention of the mandibular third molars is desired as mentioned previously, but their angulation does not allow normal eruption into the dental arch, Peskin and Graber[12] describe correcting the situation by surgically repositioning these teeth.

Material and Methods

This study was undertaken on sixty treated patients from the files of the author. The study consisted of thirty-two males and twenty-eight females ranging in age from 9.0 years to 16.0 years with a mean age of 12.1 at the start of treatment. There were three groups of patients of twenty each: lower first bicuspid extraction group, lower second bicuspid extraction group, and the nonextraction group. Only patients who had both mandibular third molars were selected. The patients had three sets of lateral cephalometric radiographs and dental x-rays at the start of the active treatment (A), at the end of active treatment (B), and two years after the end of active treatment (C). A long cone radiographic technique[13] was used for radiographs taken two years after the end of active treatment.

A tracing (Fig. 1) of the mandible from the lateral cephalometric radiograph was used showing the outline of the mandible, the inferior dental canal, the lower incisor, and the lower left first and third molars. The mandibular plane (GoM) was drawn joining gonion to menton; the long axis of the left third molar was drawn perpendic-

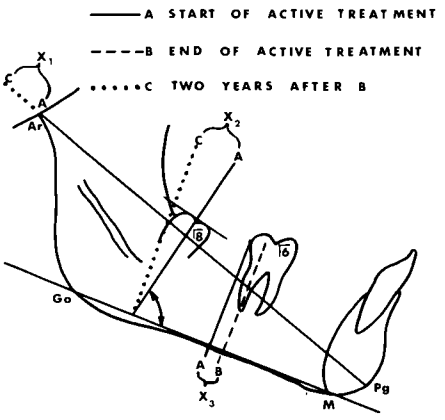

Fig. 1 Illustrating the reference points and measurements made from the lateral cephalometric radiograph.

ular to the occlusal surface. The angle ($\overline{|8}$ to GoM) formed by these two lines was measured. A line from the distal contact of the lower first molar was drawn perpendicular to the mandibular plane to measure the mesial movement of the first molar before and after treatment. The growth of the length of the mandible was measured by comparing the increase in length of the line from articulare to pogonion (ArPg). The tracing was superimposed on succeeding headfilms and registered on the posterior and inferior portion of the symphysis and the inferior dental canal as used by Björk.[14]

The following were used to evaluate the changes that occurred to see if there were any significant relationships to the change in axial inclination of the mandibular third molar during orthodontic treatment:

X_1—Mandibular growth as measured in millimeters by the increase of the line articulare to pogonion (ArPg) from the start of treatment (A) to two years after the end of active treatment (C).

X_2—The change in angulation of the long axis of the mandibular left third molar to the mandibular plane (GoM) from (A) to (C).

X_3—The mesial movement of the lower first molar as measured in millimeters from (A) to (B).

Using the periapical radiographs, the mandibular third molars, two years after the end of active treatment, were evaluated for their angulation and available space. The angulation of the tooth was made by measuring its long axis to a perpendicular to the long axis of the mandibular second molar. The angulations (Fig. 2) were grouped using the rating of 0° to 29° as severe angulation, 30° to 59° as moderate, 60° to 89° as slight, and 90° as good angulation to erupt. The space available for

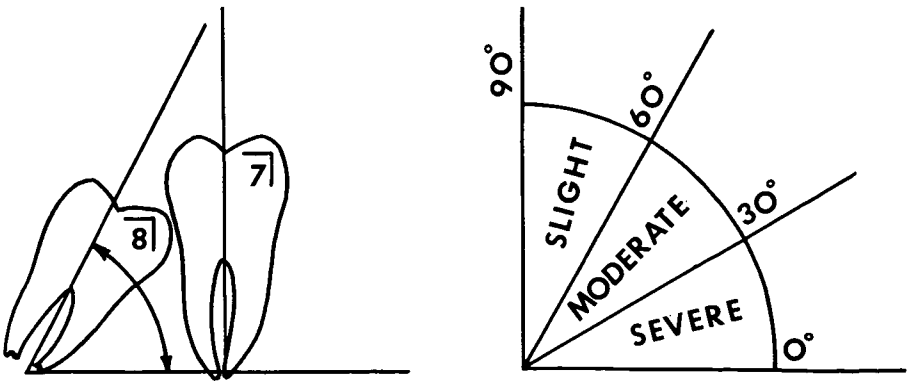

Fig. 2 Shows measuring the angulation of the long axis of the mandibular third molar to a perpendicular to the long axis of the mandibular second molar.

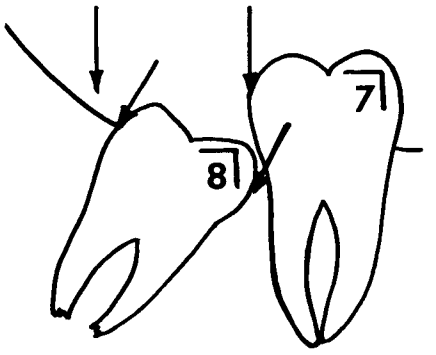

Fig. 3 Measuring space available for the mandibular third molar as the distance distal of the mandibular second molar in line with the occlusal plane to the ramus.

the tooth to erupt was judged as sufficient or insufficient by using dividers adjusted to the width of the third molar and measuring the distance distal to the second molar in line with the occlusal plane to the ramus (Fig. 3).

Results and Discussion

The increase of the line articulare to pogonion indicating mandibular growth (X_1) from the start of treatment to two years after the end of active treatment in the lower first bicuspid group was a mean of 8.45 mm with a standard deviation of 5.10. The mean increase in the lower second bicuspid group was 9.8 mm (±5.38) and the nonextraction group 9.9 mm (±5.38) indicating all three groups to be somewhat similar in growth of the mandible.

The angular change (X_2) of the long axis of the lower third molar to the mandibular plane from the start of treatment to two years after the end of active treatment was 7.7° (±16.19) in the lower first bicuspid group. In the lower second bicuspid group the mean change was 12.9° (±13.79) similar to the nonextraction group mean of 11.3° (±11.46).

The mesial movement of the lower first molar (X_3) from the start of treatment to the end of active treatment was slightly more in the lower second bicuspid group with a mean of 4.42 mm (±1.33) compared with the mean of 4.05 (±1.02) in the first bicuspid group.

In all three groups there was no significant statistical correlation of the change in inclination of the lower third molar to the mandibular plane from the start of treatment to two years after treatment as related to the increase in size of the mandible measured from articulare to pogonion or as related to the mesial movement of the lower first molar.

Even though in the lower first and second bicuspid groups there was an increase of the distance from the distal of the second molar to the ramus as measured by the mesial movement of the first permanent molar, this did not produce a consistent uprighting change in the axial inclination of the third molar. The axial inclination of the lower third molar would decrease, remain the same, or increase with similar amounts of growth of the mandible in all three groups, and similar amounts of mesial movement of the first molar in the two extraction groups. This irregular performance appears to be responsible for the very low correlation coefficients.

An evaluation of the mandibular third molars was made using periapical radiographs taken with a long cone radiographic technique to study the angulation and space available two years after the end of active orthodontic treatment in all the groups. As only patients having both lower third molars were used in this study, there were a total of 40 third molars in each group.

In the first bicuspid group, 40 per cent of the third molars were retained as they had good angulation (Fig. 2) and sufficient space (Fig. 3) to erupt; the other molars were removed. Of the

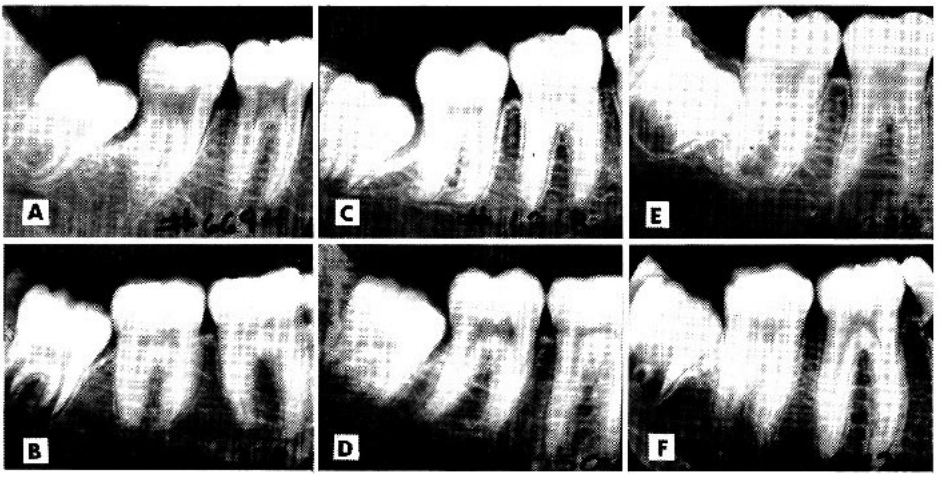

Fig. 4 Periapical radiographs of the lower third molars in the three groups studied. (A,B) Lower first bicuspid group with slight angulation and sufficient space. (C,D) Lower second bicuspid group with slight angulation and sufficient space. (E,F) Nonextraction group with slight angulation and insufficient space.

teeth that were removed, a significant number (11) were evaluated as having slight angulation or impaction and sufficient space to erupt (Fig. 4 A,B). There were four molars removed that had moderate angulation and sufficient space to erupt.

In the second bicuspid group 32.5 per cent of the third molars were retained with good angulation and sufficient space to erupt. Of the third molars removed, a significant number (16) had slight angulation and sufficient space to erupt as was also found in the first bicuspid group (Fig. 4 C,D). There were three teeth removed that had moderate angulation and sufficient space.

In the nonextraction group 15 per cent of the third molars were retained with good angulation and sufficient space to erupt; the others were removed. Of the extracted teeth only one had slight angulation and sufficient space to erupt, but there were a considerable number, twenty-seven, that had slight angulation but insufficient space to erupt (Fig. 4 E,F).

As in the Faubion[8] study, which used lower first premolars and a control group, this study showed the removal of the first or second lower bicuspids helped to provide more space for eruption of the mandibular third molars than in the nonextraction group.

It was concluded by the author that consideration and further evaluation should be given to what Peskin and Graber[12] described in surgically repositioning lower third molars for bicuspid extraction patients who have lower third molars with slight angulation and sufficient space to retain as many teeth as possible.

If the eleven third molars, with slight angulation and sufficient space, which were removed in the first bicuspid group could be repositioned to erupt normally, this would increase the total to twenty-seven or 67.5 per cent of the third molars to be retained instead of the 40 per cent. Similarly, if in the second bicuspid group the sixteen third molars having slight angulation and sufficient space that were removed could be repositioned to erupt normally, the total would be changed to 72.5 per cent of the teeth.

Summary and Conclusions

An investigation was made of the mandibular third molars in sixty orthodontically treated individuals using lateral cephalometric radiographs and periapical radiographs. There were three groups of twenty patients each: a lower first bicuspid extraction group, a lower second bicuspid extraction group, and a nonextraction group. The position of the third molar was evaluated two years after active orthodontic treatment.

The following conclusions were made from this investigation:

1. There was no significant statistical correlation of the change in inclination of the lower third molar to the mandibular plane from the start of treatment to two years after active treatment as related to the increase in length of the mandible as measured from articulare to pogonion or as related to the mesial movement of the first molar in the three groups of individuals studied.

2. This study showed that the removal of the first or second lower bicuspids helps to provide more space for eruption of the third molars than in the nonextraction group.

3. There was a significant number of third molars in the first and second bicuspid extraction groups that had sufficient space to erupt, but they were only slightly impacted and could not erupt.

4. Further study and consideration should be undertaken to possibly allow more mandibular third molars which have sufficient space and are slightly angulated to erupt and become useful teeth by surgically repositioning them.

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