The Impacted Mandibular Molar

THEODORE A. WILLIS, M.D.*
San Mateo, California

The most frequent of dental aberrations is impaction of a third molar tooth. Mead[8] defines an impacted tooth as "one that is prevented from erupting into position due to malposition, lack of space or other impediment." He found that of 581 impacted teeth, 561 were molars; of these, 248 were in the mandible and 213 in the maxilla. Hellman[5] found impacted teeth in 9.5% of males, 23.8% of females.

In a survey of 3,874 routine full-mouth roentgenographs, Dachi and Howell[3] reported that among Oregon students 21.9% of the 3rd mandibular molars were impacted, 17.5% of maxillary 3rd molars; more in females than males.

Björk, et al.,[1] basing their statistics on a roentgenological study of Danish males, 243 at the age of 12 years and 337 dental students, found that one of four or five adults had impacted teeth. They attributed impaction to insufficient space between the second molars and the ascending ramus of the mandible, to faults in growth in length of the mandible, and in direction of growth of the condyles, and direction of tooth eruption.

An impacted third molar may erupt medially, laterally, forward or be completely inverted. Aberrant teeth have been found in the coronoid process and in the neck of the condyle. These, however, are atavistic anomalies not related to impaction. In lower vertebrates the teeth are smaller, more numerous, and more widely distributed than in mammalian jaws.

The mandible is the second bone to appear in the human embryo. Patten[9] illustrates it in a 6-8 week embryo. Gardner, Gray and O'Rahilly[4] state that the mandible begins to ossify during the fifth postovulatory week.

Keith[6] divides the development of the jaw into three stages; first, as in fishes, Meckel's cartilage forms the primitive bone. Its upper end is formed by the otic malleolus. In the second stage, also in fishes, there is formation of a dermal bone that strengthens the cartilaginous rod and forms support for the teeth, the alveolar shelf. The third stage is the formation of the ascending ramus and the squamosal part of the temporal bone. In fish, amphibians and reptiles and in birds, the primitive temporomandibular joint persists. In mammals, since the permanent teeth erupt behind the milk teeth, additional space is required. This is obtained, according to Keith, by deposit of new bone along the posterior border of the ramus and resorption along its anterior border. Growth of the ramus in height is accomplished by deposit of new bone along its upper border. After the teeth are gone, the alveolar margins absorb and the angle of the ramus with the body of the mandible reverts to its infantile form.

Temporomandibular joints of carnivores are of a hinge type. A transverse half-cylinder condyle fits into a deep mandibular fossa permitting no lateral movement. The molar teeth erupt in line with the rami.

In ruminants the condyles and fossae are practically flat permitting a lateral grinding movement. There is a fibrous disc between the bones. Vertical movement occurs between the condyles and the discs, lateral movement between the

* Department of Anatomy, Stanford University.

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discs and the fossae. The last molars are well separated from the rami.

In omniverous Man the condyles are less cylindrical than those of the carnivores, the fossae shallower. The condyles are slightly convex posteriorly and slant forward laterally. The arrangement of an interosseous meniscus is similar to that of the ruminant.

If impaction of the lower third molar is due to lack of space into which it may erupt between the ramus and the second molar, what factors determine the extent of this space? Why has the ramus not moved backward by bone deposition and bone absorption as described by Keith? What factors determine the point of angulation of the jaw?

Julius Wolff[10] did not originate the theory that bone is a living tissue and develops according to the mechanical forces to which it is habitually subjected, but his meticulous experiments gave rise to his "Law" to that effect. This has been demonstrated many times.

Broadbent,[2] in studying the influence of the eruption of molar teeth on the development of the jaws and face, superimposed x-ray tracings made at successive stages of growth of more than 1000 individuals. These illustrate forward and downward movement of the teeth within the jaws as the latter continue to enlarge. He states that "If the developmental growth of the face has not been retarded in progress toward its destined size for its age, then and only then will there be sufficient room in the jaws for all teeth to occupy their normal positions whether they have erupted or not."

In frontal views of individuals at four and ten years of age Broadbent shows the changes in relative positions of the molars as the face expands in width. The first and second, and later the third molars appear first in the base of the ramus then migrate to the alveolar ledge medial to the ramus. It is during these years that a child's diet changes from pap to more substantial foods that require grinding mastication and the need for molar teeth is intensified.

Garn, Lewis, Vicinus and Bonne, in their several publications, report that the long term calcification and movement of the third molars is not well correlated with general skeletal maturation or with sex development. They found agenesis of the third molar to be a frequent aberration and that, when present, incidence of other missing teeth rises thirteen-fold.

Do teeth actually migrate in the bone or is the apparent change in position due to deposit and absorption of adjacent bone? This could be investigated by placing markers in the bone in definite relation to the teeth and to the angle of the jaw.

The primary mechanical forces affecting development of the jaw are eruption of the molar teeth and mastication. The critical time of growth is during the eruption of the molars and their movement forward and medially away from the base of the ramus, perhaps better stated, when the base of the ramus is building laterally from the alveolar shelf. It is possible that the type of food masticated during this period has an important influence on such movement.

The temporal muscles pull the coronoid processes upward and backward. The masseters pull the jaw upward and forward. The pterygoids parallel these and, when acting unilaterally, account for lateral grinding movement of the jaw.

Among the mandibles in the bone collection of the Department of Anatomy at Stanford University, School of Medicine, are a number that show impaction of the third mandibular molars. There are also the mandibles of

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Fig. 1 Vertical view of an Indian's mandible. Note the wide buccinator grooves between the rami and the molar teeth. The right third molar impinges slightly on the second.

Fig. 2 Vertical view of an Indian's mandible. Note abrasion of the molar teeth. Note the wide grooves and the broad alveolar shelves.

fifteen California Indians.* These show no impactions and but little caries. In several of them the molar crowns are worn completely through to the dentine. The alveolar shelves are broad and the buccinator grooves wide, separating the molars well from the bases of the rami, some of which are anterior to the posterior borders of the last molars, Figures 1 and 2.

The insertions of the pterygoids are well marked on the bones and, with the worn crowns, suggest strenuous grinding mastication of tough material.** These mandibles closely resemble the jaw of the Heidelberg Man, Figure 3.

The mandibles with impacted third molars have narrow and poorly developed alveolar shelves and buccinator grooves. The sockets of the impacted teeth are in the bases of the rami, not on the shelves Figures 4, 5 and 6. The significant difference between the jaws with and without impaction is in the development of the alveolar shelves and buccinator grooves. The better shelves are associated with well-marked areas of pterygoid insertion. The angles of mandibles that retain their molar teeth, whether or not they are impacted, approximate 115 degrees.

Estimation of space for eruption of the third molars based only on lateral roentgenographs is unreliable, as a second molar that appears too close to the ramus to allow eruption of a third may well be separated from the ramus by a wide groove with adequate room on the shelf for the third.

Summary

In the material at hand, mandibles with good alveolar shelves had no impactions. Those with impactions had no alveolar shelves.

Failure of the molars to migrate mesially from the bases of the rami onto the shelves is even more significant in impactions than failure of the rami to move backward from the body of the mandible.

It is possible that such lack of migration and growth are due to deficiency of dietetic factors that require forward and back and lateral grinding move-

* Gift of Professor of Mining Engineering, Theodore J. Hoover. Unearthed in the vicinity of Santa Cruz, California.

** The California Indians raised grain which they ground in stone mortars with stone pestles. Powdered stone from these was an excellent abrasive.

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Fig. 3 Vertical view of a cast of the jaw of the Heidelberg Man. Note its close resemblance to Figs. 1 and 2.

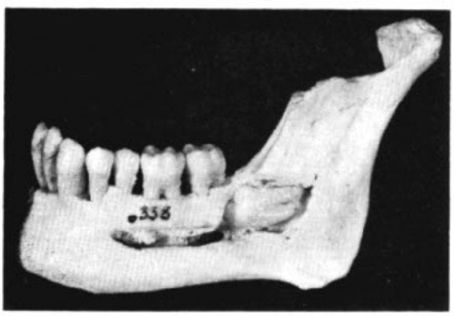

Fig. 4 Left lateral view of a mandible showing a cut out section of an impacted third molar tooth. Note that its roots are posterior to the 110 degree angle of the jaw and in the base of the ramus.

ments of the jaw during the eruption of the molar teeth.

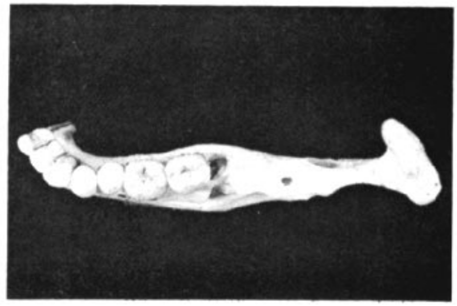

Fig. 5 Vertical view of Fig. 4. Note the lack of a buccinator groove and alveolar shelf. The impacted molar's socket is in the base of the ramus.

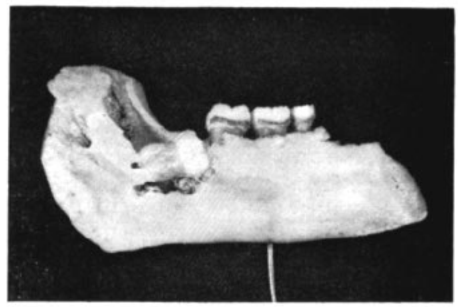

Fig. 6 A lingual view of an impacted third molar. Note the absence of buccinator groove and alveolar shelf. Its roots are posterior to the angle of the jaw.

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