牙體形態學 Dental morphology

# Permanent molars

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## 學習目標

能辨識及敘述牙齒之形態、特徵與功能意義，並能應用於臨床診斷與治療

1. 牙齒形態相關名辭術語之定義與敘述
2. 牙齒號碼系統之介紹
3. 牙齒之顎間關係與生理功能形態之考慮
4. 恒齒形態之辨識與差異之比較
5. 乳齒形態之辨識與差異之比較
6. 恒齒與乳齒之比較
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8. 牙齒之萌出、排列與咬合
9. 牙體形態學與各牙科臨床科目之相關
10. 牙科人類學與演化發育之探討

## 參考資料

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2. Jordan, R.E. and Abrams, L.: Kraus' Dental Anatomy and Occlusion, ed. 2, Mosby Year Book, St. Louis,1992.
3. Ash, M.M.and Nelson, S.J.: Wheeler's Dental Anatomy, Physiology and Occlusion, ed. 8, W.B. Saunders Co., 2003.

## Summary

The course of Dental Morphology provides the student with knowledge in the morphological characteristics of the teeth and related oral structures upon which a functional concept of intra-arch relationships may be based for the clinical application to patient assessment, diagnosis, treatment planning, and oral rehabilitation.

## Topics covered within the four sections of this chapter include the following:

**I. Overview of molars**

A. General description of molars
B. Functions of molars
C. Class traits of all molars
D. Arch traits that differentiate maxillary from mandibular molars

**II. Type traits that differentiate mandibular second molars from mandibular first molars**

A. Type traits of mandibular molars from the buccal view
B. Type traits of mandibular molars from the lingual view
C. Type traits of mandibular molars from the proximal views
D. Type traits of mandibular molars from the occlusal view

**III. Type traits that differentiate maxillary second molars from maxillary first molars**

A. Type traits of the maxillary first and second molars from the buccal view
B. Type traits of maxillary molars from the lingual view
C. Type traits of first and second maxillary molars from the proximal views
D. Type traits of maxillary molars from the occlusal view

**IV. Maxillary and mandibular third molar type traits**

A. Type traits of all third molars (different from first and second molars)
B. Size and shape of third molars
C. Similarities and differences of third molar crowns compared with first and second molars in the same arch
D. Similarities and differences of third molar roots compared with first and second molars in the same arch

## A. GENERAL DESCRIPTION OF MOLARS

Use a cast of all permanent teeth or Figure 7-1 while learning the position of molars in the arch. There are 12 permanent molars--six maxillary and six mandibular. The six permanent molars in each arch are the first, second, and third molars on either side of the arch. They are the sixth, seventh, and eighth teeth from the midline. Using the Universal Numbering System, the maxillary molars are numbers 1, 2, and 3 for the fight third, second, and first molars, and numbers 14, 15, and 16 for the left first, second, and third molars, respectively. The mandibular molars are numbers 17, 18, and 19 for the left third, second, and first molars, and numbers 30, 31, and 32 for the fight first, second, and third molars, respectively.

## A. GENERAL DESCRIPTION OF MOLARS

In the adult dentition, first molars are distal to second premolars. The permanent first molars are located near the center of each arch, anteroposteriorly. This is one reason that their loss is so devastating to arch continuity (allowing movement and tipping of the teeth on either side). They are the largest and strongest teeth in each arch. The second molars are distal to the first molars, and the third molars are distal to the second molars. Said another way, in the complete adult dentition the mesial surface of the first molar contacts the distal surface of the second premolar, the mesial surface of the second molar contacts the distal of the first molar, and the mesial surface of the third molar contacts the distal of the second molar.

## A. GENERAL DESCRIPTION OF MOLARS

The third molar is the last tooth in the arch, and its distal surface is not in contact with any other tooth. Unfortunately, this tooth's nickname is "wisdom tooth." It also has unfairly been given a bad reputation for having soft enamel, not serving any function, readily decaying, and causing crowding of the anterior teeth and other dental problems. The reason for this bad reputation is probably its posterior location that makes it difficult to keep clean. Frequently, one or more of the third molars are congenitally missing (never develop); this occurs in nearly 20% of the population. The combined mesiodistal width of the three mandibular molars on one side makes up over half (51%) of the mesiodistal dimension of their quadrant. The maxillary molars constitute 44% of their quadrant's mesiodistal dimension, still a significant portion.

## B. FUNCTIONS OF MOLARS

The permanent molars, like the premolars, (a) play a major role in the mastication of food (chewing and grinding to pulverize) and (b) are most important in maintaining the vertical dimension of the face (preventing a closing of the bite or vertical dimension, a protruding chin, and a prematurely aged appearance). They are also (c) important in maintaining continuity within the dental arches, thus keeping other teeth in proper alignment. You may have seen someone who has lost all 12 molars (six upper and six lower) and has sunken cheeks. The molars therefore have (d) at least a minor role in esthetics or keeping the cheeks normally full or supported, as well as keeping the chin a proper distance from the nose. The loss of a first molar is really noticed and missed by most people when it has been extracted. More than 80 $mm^2$ of efficient chewing surface is gone; the tongue feels the huge space between the remaining teeth; and during mastication of coarse or brittle foods, the attached gingiva in the region of the missing molar often becomes abraded and uncomfortable. Loss of six or more molars would also predispose to problems in the temporomandibular joints.

## C. CLASS TRAITS OF ALL MOLARS

Refer to Appendix page 7 while reading about the following class traits of all molars.

1. CROWN SIZE FORALL MOLARS

Molars have an occlusal (chewing) surface with three to five cusps, and their chewing surfaces are larger than the other teeth in their respective arches. (Refer to Tables 7-1 and 7-2 for the average and range in size of maxillary and mandibular molars in all dimensions.) They have broader occlusal surfaces than other posterior teeth (i.e., the premolars) both faciolingually and mesiodistally [averaging 2.2 mm and 3.0 mm, respectively, in maxillary molars and 2.1 mm and 3.2 mm, respectively, in mandibular molars]. However, molar crowns are shorter cervico-occlusally than all other crowns. The crowns of both the mandibular and maxillary molars are wider mesiodistally than long cervico-occlusally (Appendix 7a).

## C. CLASS TRAITS OF ALL MOLARS

2. TAPER FROM BUCCAL TO LINGUAL FOR ALL MOLARS

From the occlusal view, molar crowns taper (get narrower) from the buccal to the lingual. That is, the mesiodistal width on the buccal half is wider than on the lingual half (Appendix 7b), EXCEPT on maxillary first molars with large distolingual cusps, where crowns actually taper narrower from lingual toward the buccal.

## C. CLASS TRAITS OF ALL MOLARS

3. TAPER TO THE DISTAL FOR ALL MOLARS

For both arches, molar crowns from the occlusal view tend to taper distally, so that the distal side is narrower buccolingually than the mesial side (Appendix 7c). Also, from the buccal (or lingual) views, all molar occlusal surfaces slope toward the cervix (get shorter) from mesial to distal (Appendix 7d). This, along with the more cervical placement of the distal marginal ridge, makes more of the occlusal surface visible from the distal aspect than from the mesial aspect (compare mesial to distal views in Appendix page 7).

## C. CLASS TRAITS OF ALL MOLARS

4. HEIGHT (CREST) OF CONTOUR FOR ALL MOLARS

As with premolars, the height of contour on the buccal of molars viewed from the proximal is in the cervical third; on the lingual, it is in the middle third (Appendix 7e).

## C. CLASS TRAITS OF ALL MOLARS

S. CONTACT AREAS FOR ALL MOLARS

The contact areas of all molars viewed from the buccal (or lingual) views are at or near the junction of the occlusal and middle thirds mesially and are more cervical on the distal, near the middle of the tooth (Appendix 7f).

## D. ARCH TRAITS THAT DIFFERENTIATE MAXILLARY FROM MANDIBULAR MOLARS

Compare extracted maxillary and mandibular molars and/or tooth models while reading about these differentiating arch traits. Also refer to page 8 in the Appendix.

## D. ARCH TRAITS THAT DIFFERENTIATE MAXILLARY FROM MANDIBULAR MOLARS

1. CROWN OUTLINE TO DISTINGUISH MAXILLARY FROM MANDIBULAR MOLARS

From the occlusal view, the crowns of mandibular molars are oblong: they are characteristically much wider mesiodistally than faciolingually [by 1.2 mm on 839 teeth]. This is just the opposite of the maxillary molars, which have their greater dimension faciolingually [by 1.2 mm on 920 teeth]. From the occlusal view, maxillary molars have a more square or twisted parallelogram shape; mandibular molars have a somewhat rectangular shape (or even a pentagon shape on mandibular first molars). Compare the outline shapes in Appendix 8a (somewhat rectangular outline of mandibular molars) and 8k (a parallelogram outline for maxillary molars and a rectangular or pentagon outline for mandibular molars). Also, refer to a summary of geometric outlines of molars later in this chapter in Figure 7-27.

## D. ARCH TRAITS THAT DIFFERENTIATE MAXILLARY FROM MANDIBULAR MOLARS

2. NUMBER AND RELATIVE SIZE OF CUSPS (AND NUMBER OF LOBES)

Mandibular molar crowns have four relatively large cusps: two buccal (mesiobuccal and distobuccal) and two lingual (mesiolingual and distobuccal). On most mandibular first molars and some third molars, there is often an additional fifth, smaller cusp called a distal cusp, located on the buccal surface just distal to the distobuccal cusp. The two mandibular lingual cusps are of nearly equal size (much different from the maxillary molars). The crowns of maxillary molars have three larger cusps (mesiobuccal, distobuccal, and mesiolingual) with a fourth cusp of lesser size (distolingual). The longest and largest mesiolingual cusp is connected by an oblique ridge to the distobuccal cusp (unique to maxillary molars) (Appendix 8d). A fifth, much smaller cusp (cusp of Carabelli) is often found on the lingual surface of the mesiolingual cusp of maxillary first molars (Appendix 8i). The number of lobes forming molars is one per cusp. See Table 7-3 for a summary of the number of lobes forming first and second molars.

## D. ARCH TRAITS THAT DIFFERENTIATE MAXILLARY FROM MANDIBULAR MOLARS

3. LINGUALAND DISTALTILTTHAT DISTINGUISHES MAXILLARY FROM MANDIBULAR MOLARS

When examined from the mesial or distal views, mandibular molar crowns appear to be tilted lingually (true for all mandibular posterior teeth), whereas the crowns of maxillary molars are centered over their roots (Appendix 8b). Mandibular molar crowns also appear to tip distally relative to the long axis of the root due in part to the increased taper from the distal contact to the cervical line (see Appendix 8g where the distal crown bulge beyond the root can be seen).

## D. ARCH TRAITS THAT DIFFERENTIATE MAXILLARY FROM MANDIBULAR MOLARS

4. ROOTS TO DISTINGUISH MAXILLARY FROM MANDIBULAR MOLARS

Perhaps the most obvious trait to differentiate extracted maxillary from mandibular molars is the number of roots. Maxillary molars have three relatively long roots: mesiobuccal, distobuccal, and lingual (palatal). [The average root-to-crown ratio is 1.72 and 1.70 for the maxillary first and second molars, respectively.] The lingual root is usually the longest; the distobuccal root the shortest. The roots converge into a broad cervical root trunk. Mandibular molars have only two roots: a long mesial root and a slightly shorter distal root [mesial roots averaged 1 mm longer than the distal roots for 839 mandibular molars]. [The average root-to-crown ratio for mandibular molars is the greatest of all teeth: 1.83 and 1.82 for the first and second molars, respectively. ] The root furcation on lower molars is usually close to the cervical line (especially on first molars), making the root trunk shorter than on the maxillary molars (see Appendix 8c). Table 7-4 includes a summary of arch traits that can be used to differentiate maxillary from mandibular molars.

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

Refer to Figure 7-2 for similarities and differences of mandibular first and second molars.

1. CROWN PROPORTIONS FROM THE BUCCALVIEW

For both types of mandibular molars, the crowns are wider mesiodistally than high cervico-occlusally, but more so on the larger first molars [3.7 mm larger on first molars versus 3.1 mm for second molars].

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

2. RELATIVE NUMBER AND SIZE OF MANDIBULAR MOLAR CUSPS (AND GROOVES THAT SEPARATE THEM) FROM THE BUCCAL VIEW

The crown of the mandibular first molar is usually larger than the crown of the second molar in the same mouth, from one study, second mandibular molars were larger than first molars in only 10% of Ohio Caucasians and in 19% of Pima Indians.23 In contrast, Dr. Woelfel examined more than 600 sets of complete dentition casts of young dental hygienists' mouths and found only a few where mandibular second molars were slightly larger than the first molars. There were a few more in which the mandibular third molar crowns were as large as the first molars and larger than the mandibular second molars.

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

3. PROXIMAL CONTACTS OF MANDIBULAR MOLARS FROM THE BUCCAL VIEW

Both types of mandibular molars (in fact, all molars) have their mesial contact located more occlusally than the distal, close to the junction of middle and occlusal thirds of the crown. The distal contact is located more cervically, in the middle third (near the middle of the tooth cervico-occlusally). This difference in proximal contact height can be seen in most mandibular molars in Figure 7-2.

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

4. CERVICAL LINES OF MANDIBULAR MOLARS FROM THE BUCCAL VIEW

The cervical lines of both mandibular first and second molars are often nearly straight across the buccal surface. On mandibular first molars, there is often a ridge of cementum crossing the space in the root bifurcation in a mesiodistal direction,6 but sometimes there is a point of enamel that dips down nearly into the root bifurcation (Fig. 7-4) [This point of enamel is reported to occur in 90% of Mongoloid peoples studied.1] Sometimes there is dipping down of enamel on both the buccal and the lingual surfaces, and these extensions may meet in the root bifurcation, (Fig. 7-2, leftmost mandibular second molar). Such enamel extensions may cause periodontal problems because of the deep gingival sulcus in these regions.

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

5. TAPER OF MANDIBULAR MOLARS FROM THE BUCCAL VIEW

There is proportionally more tapering of the crown from the contact areas to the cervical line on mandibular first molars than on second molars because of the bulge of the distal cusp (Appendix 8g). The crown of the second molar appears to be wider at the cervix than the first molar because of the absence of a distal cusp (less taper toward the cervix below the contact points). The mesial sides of mandibular molar crowns are nearly straight, or slightly concave, from the cervical line to the convex contact area (Fig. 7-2). The distal sides are straight, or slightly convex, from the cervical line to the contact areas.
Also, the occlusal surface of both types of mandibular molars slopes cervically (gets shorter) from mesial to distal, giving the appearance that the crown is tipped distally on its two roots (somewhat less so on first molars, again due partly to the presence of the distal cusp).

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

6. VARIATIONS IN MANDIBULAR MOLAR CROWNS FROM THE BUCCAL VIEW

The distal cusp of mandibular first molars is absent about a fifth of the time (Fig. 7-5). [Among 874 dental hygiene students at the Ohio State University College of Dentistry (1971-1983), dental stone casts revealed that 81% of 1327 first molars without restorations had five cusps and 19% had only four cusps. Seventy-seven percent of the females had five-cusp first molars on both sides, 16% had four-cusp first molars on both sides, and 3% had one four-cusp and one five-cusp mandibular first molar.] Consequently, not all four-cusp molars are second molars. Almost one-fifth may be mandibular first molars. The mandibular first molar sometimes has an extra cusp on the buccal surface of the mesiobuccal cusp, about in the middle third of the crown. Studies have shown this to occur frequently in the Pima Indians of Arizona and in Indian (Asian) populations.4,5 An extra cusp in the same location has also been found on second and, most frequently, on third molars (see Fig. 7-6).

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

7. ROOTS OF MANDIBULAR MOLARS FROM THE BUCCAL VIEW

Both mandibular first and second molars have two roots, one slightly longer mesial root and one distal root (Appendix 8c). [The mesial root averaged only 1 mm longer than the distal root on 281 first molars and 0.9 mm longer on 296 second molars.] Both roots are nearly twice as long as the crown. [Root-to-crown ratio for first molars is 1.83:1, the highest ratio of any tooth.]

## A. TYPETRAITS OF MANDIBULAR MOLARS FROM THE BUCCALVIEW

8. VARIATIONS IN MANDIBULAR MOLAR ROOTS FROM THE BUCCAL VIEW

Observe the wide variation from the normal in the roots with extreme distal root curvature seen in Figure 7-7, lower row. This condition is called flexion [FLEK shen]. Occasionally, the mesial root is divided into a mesiobuccal and a mesiolingual root, making three roots on the mandibular first molar. It is reported that this condition is found in 10-20% of the mandibular first permanent molars in Eskimos. In Mongoloid people, there is usually a longer root trunk. Ten percent of their mandibular first molars have an additional distolingual root, and sometimes the mesial root is bifurcated, resulting in a four-rooted first molar.8 It is reported that in both deciduous and permanent dentitions, three-rooted mandibular molars occur frequently in Mongoloid (Chinese) people but rarely in European groupsJ'9 A small, third root can be seen in Figure 7-8A. This peduncles-shaped extra root is approximately 6 mm long. Also, in Figure 7-8B, a right and left bitewing radiograph from a Caucasian male revealed an unusual long third root bilaterally between normal mesial and distal roots.

## B. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE LINGUAL VIEW

Refer to Figure 7-9 for similarities and differences of mandibular molars from the lingual view.

1. CROWN TAPER OF MANDIBULAR MOLARS FROM THE LINGUAL VIEW

As with most teeth, mandibular first and second molar crowns taper from buccal to lingual and thus are narrower on the lingual side; this is more so on first molars where much of the taper is on the distal surface lingual to the distal cusp.

## B. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE LINGUAL VIEW

2. RELATIVE SIZE OF MANDIBULAR CUSPS (AND THEIR ASSOCIATED GROOVE) FROM THE LINGUAL VIEW

Since the lingual cusps of both types of mandibular molars are both slightly longer and more pointed or conical than the buccal cusps, the buccal cusps are hidden behind them. Therefore, in most cases, only the mesiolingual and distolingual cusps of mandibular molars are visible from the lingual aspect (not true in Fig. 7-9, because of the camera angle). The mesiolingual cusp is often the slightly wider and longer of the two (noticeably wider on first molars). [On mandibular first molars, the mesiolingual cusp was wider on 58% of 256 teeth, while on 33% the distolingual cusp was wider. On mandibular second molars, the mesiolingual cusp was wider on 65% of 263 of these teeth, compared to only 30% with a wider distolingual cusp.] On cusp sharpness, the lingual cusps were rated about even. [On first molars, 48% of the mesiolingual cusps were more pointed versus 47% distolingual cusps; on second molars, it was 44% versus 51%, respectively.] The lingual groove separates the mesiolingual from the distolingual cusp. It may extend onto the lingual surface but is unlikely to be fissured and form decay on the lingual surface.

## B. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE LINGUAL VIEW

3. CERVICAL LINE OF MANDIBULAR MOLARS FROM THE LINGUALVIEW

The cervical line on the lingual surface is relatively straight (mesiodistally) or irregular but may dip cervically between the roots over the bifurcation as is also sometimes seen on the buccal side of the crown.

## B. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE LINGUAL VIEW

4. ROOTS OF MANDIBULAR MOLARS FROM THE LINGUALVIEW

On mandibular first molars, the root trunk appears longer on the lingual than on the buccal side because the cervical line is more occlusal in position on the lingual than on the buccal surface. The roots are narrower on the lingual side than they are on the buccal side. From the lingual aspect, it is often possible to see the mesial surface of the mesial root owing to the way it is twisted on the trunk (seen on five mandibular first molars in Fig. 7-9). One can also see the distal side of the distal root because of its taper toward the lingual. On first and second molars, the short root trunk has a depression between the cervical line and the bifurcation.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

For proper orientation, as you study each trait, hold the crown so that the root axis line is in a vertical position as seen in Figure 7-10. Recall that both types of mandibular molar crowns are relatively shorter cervico-occlusally compared to faciolingually, and that the crowns of both types of mandibular molars are tilted lingually from the root base. Remember that this slant is an arch trait characteristic of all mandibular posterior teeth and is nature's way of shaping them to fit beneath and lingual to the maxillary buccal cusps. The buccal outline is convex in the cervical third (over its height of contour), then slightly curved and tapered occlusally in the middle and occlusal thirds.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

1. HEIGHT (CREST) OF CONTOUR OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

As with all molars (and premolars), the height of contour or bulge of the buccal surface is in the cervical third. It is close to the cervical line on second molars. The buccal crest of curvature is actually a ridge running mesiodistally near the cervical line and is called the buccal cervical ridge (or buccal cingulum). It is more prominent on mandibular second molars than on first molars (actually seen better from the occlusal view in Fig. 7-13). The lingual outline of the crown of both molars appears nearly straight in the cervical third with its height of contour in the middle third. This trait is useful to tell buccal from lingual surfaces.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

2. CUSP HEIGHT AND ASSOCIATED DISTAL TILT OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

In general, the lingual cusps of both mandibular first and second molars are more conical or pointed than the buccal. In review, the cusp length for mandibular molars is, from longest to shortest, mesiolingual, distolingual, mesiobuccal, distobuccal, and, when present, the smallest cusp found on 81% of first molars is the distal cusp. Due to the distal tilt to the crown and the sloping of the occlusal surface, much of the occlusal surface and all cusps can be seen from the distal aspect (as seen on the distal surfaces of all teeth in Fig. 7-10). Subsequently, on both first and second molars, from the distal aspect the tips of the mesiobuccal and mesiolingual cusps can be seen behind the distobuccal and distolingual cusps. On the first molar, the distobuccal cusp is seen above and somewhat buccal to the smaller, shorter distal cusp.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

3. TAPERTO DISTAL OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

On both types of molars, the crown is more narrow on the distal side than on the mesial side. Therefore, from the distal aspect, some of the lingual and the buccal surfaces can be seen (noted especially on the distal views of mandibular second molars in Fig. 7-10). The distal contact is centered on the distal surface cervical to the distal cusp on mandibular first molars. There may be a wear facet here from proximal wear due to functional movements within the arch.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

4. CERVICAL LINES OF THE MANDIBULAR MOLARS WHEN COMPARING PROXIMAL VIEWS

The mesial cervical line on both first and second molars slopes occlusally from buccal to lingual and curves very slightly toward the occlusal surface [0.5 mm on first molars, 0.2 mm on second molars]. The distal cervical line is nearly straight but slants occlusally from buccal to lingual.

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

5. MARGINAL RIDGES OF MANDIBULAR MOLARS WHEN COMPARING PROXIMAL VIEWS

Differences in mesial and distal marginal ridge heights are apparent on handheld teeth when viewing from the lingual but rotating the tooth first just enough in one direction to see the mesial marginal ridge height, and then enough in the opposite direction to compare it to the height of the distal marginal ridge. For mandibular molars, as with all posterior teeth (EXCEPT the mandibular first premolar), the distal marginal ridges are more cervically located than the mesial marginal ridges. The mesial marginal ridge is concave buccolingually, usually longer on the mandibular first molar, and often sharply V-shaped on the second molar. It is occlusally positioned so that not much of the triangular ridges are visible from the mesial aspect. The distal marginal ridge of the first molar is short and V-shaped, located just lingual and distal to the distal cusp. The mesial marginal ridges of mandibular molars are often crossed by a marginal ridge groove [68% of 209 first molars and 57~/0 of 233 second molars]. The distal marginal ridges of mandibular molars are less likely to have a mesial ridge groove [48% of 215 first molars and 35% of 233 second molars].

## C. TYPE TRAITS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

6. ROOTS AND ROOT DEPRESSIONS OF MANDIBULAR MOLARS FROM THE PROXIMAL VIEWS

From the mesial aspect, the mesial root of the mandibular first molar is broad buccolingually, hiding the distal root. It has a blunt and wide apex (Fig. 7-10, mesial views). It is less broad buccolingually on mandibular second molars, narrower in the cervical third, and more pointed at the apex. There is usually a deep depression on the mesial surface of the mesial root on both mandibular first and second molars extending from the cervical line to the apex, indicating the likelihood of two root canals in this broad root, one buccal and one lingual [as seen in cross-section views in Fig. 7-11). Sometimes this root is even divided into a buccal and lingual part8 (seen in the partially divided mesial root of two mandibular first molars in Fig. 7-10). The depressions on the inner surfaces of the mesial and distal roots (that is, the surfaces between the mesial and distal roots) are often deeper than the depressions on the outer surfaces.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

Refer to Figure 7-12 for similarities and differences of mandibular molars from the occlusal view.

1. LINGUAL INCLINATION OF MANDIBULAR MOLAR CROWNS FROM THE OCCLUSAL VIEW

To follow this description the tooth should be held in such a position that the observer is looking exactly along the root axis line. Because of the inclination lingually of the crown, more of the buccal surface should be visible than the lingual surface when the tooth is properly held in this position, similar to mandibular premolars.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

2. OUTLINE SHAPE AND TAPER OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

As stated previously, both types of mandibular molars are wider mesiodistally than faciolingually [by 1.2 mm for 281 first molars and by 0.9 mm for 296 second molars]. The mandibular second molar shape is roughly a four-sided rectangle, whereas the first molar, with the prominent buccal bulge of the distobuccal cusp and smaller distal cusp, is shaped more like a five-sided pentagon (Appendix 8k). The two major mesial cusps (mesiobuccal and mesiolingual) are larger than the two major distal cusps (see Fig. 7-13). Recall that the first molar also has a minor distal cusp. There are a couple of exceptions to this among the 10 mandibular first molars in Figure 7-12. Can you locate them?

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

3. RIDGES OF MANDIBULAR MOLARS FROM THE OCCLUSALVIEW

On both first and second mandibular molars, the triangular ridges of the mesiobuccal and mesiolingual cusps meet to form a transverse ridge, and the triangular ridges of the distobuccal and distolingual cusps form a second transverse ridge (seen on the mandibular first molar in Fig. 7-15). Since lingual cusps are higher, the triangular ridges of the lingual cusps of first molars are longer than the triangular ridges of the buccal cusps.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

4. FOSSAE OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

There are three fossae on both types of mandibular molars: the large central fossa (approximately in the center of the tooth), a smaller mesial triangular fossa (just inside the mesial marginal ridge), and the smallest distal triangular fossa (just inside the distal marginal ridge; it is very small on second molars). These fossae are shaded red in Figs. 7-13 (on a second molar) and 7-14 (on a first molar). There may be a pit at the junction of grooves in the deepest portion of any of these fossae.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

5. GROOVES OF MANDIBULAR MOLARS FROM THE OCCLUSALVIEW

The typical groove pattern on mandibular second molars is simpler than that on first molars. It is made up of three major grooves: a central groove running mesiodistally, plus a buccal and a lingual groove. The buccal and lingual grooves line up to form an almost continuous groove running from buccal to lingual that intersects with the central groove in the central fossa (Fig. 7-13). The resultant groove pattern resembles a cross (or +) (Appendix 8, occlusal view of the mandibular second molar). The central groove passes through the central fossa as it extends from the mesial triangular fossa to the distal triangular fossa. Its mesiodistal course is straighter than on mandibular first molars. The buccal groove separates the mesiobuccal and distobuccal cusps (often extending onto the buccal surface and ending in a buccal pit) and is usually continuous with the lingual groove, which separates the mesiolingual and the distolingual cusps, but does not usually extend onto the lingual surface.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

6. PROXIMAL CONTACT AREAS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

The mesial and distal contact areas of mandibular first and second molars is normally slightly to the buccal from the middle of the tooth. The mesial contact area of the mandibular first molar is close to the center buccolingually, whereas on the mandibular second molar it is slightly more buccal, near the junction of the middle and buccal thirds (second molar contacts are labeled in Fig. 7-13). The distal contact of the mandibular first molar is just lingual to the distal cusp, whereas on the second molar, it is more centered buccolingually.

## D. TYPETRAITS OF MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

7. VARIATIONS IN MANDIBULAR MOLARS FROM THE OCCLUSAL VIEW

As mentioned, on 874 casts of dental hygienists' dentitions at Ohio State University, 19% of the 1327 mandibular first molars had only four cusps (no distal cusp), so they had only one buccal groove. This four-cusp type of mandibular first molar does not taper as much from buccal to lingual as a four-cusp mandibular second molar (occlusal aspect), but it often tapers from distal to mesial, which is unusual (recall Fig. 7-5). Some mandibular first molars have a sixth cusp, which is named tuberculum sextum [too BUR kyoolum SEKS tum] when located on the distal marginal ridge between the distal cusp and distolingual cusp; it is named tuberculum intermedium [too BUR kyoo lum in ter MEE di um] (Fig. 7-16) when located between the two lingual cusps. A sixth cusp on the lingual aspect (and a third root) are common among the Chinese people.

## A. TYPE TRAITS OF THE MAXILLARY FIRST AND SECOND MOLARS FROM THE BUCCAL VIEW

Examine a maxillary first and second molar as you read. Hold the roots up and the crowns down, with the two somewhat parallel roots toward you.

1. RELATIVE CROWN SIZE AND SHAPE FROM THE BUCCAL VIEW

Refer to Figure 7-19 for similarities and differences of maxillary molars from the buccal view. Maxillary first molars are the largest upper teeth (especially mesiodistally), followed closely by the second molars in the same mouth. (Third molars are generally the smallest molar.) [Studies on the variability in the relative size of molars revealed that maxillary second molars were larger than first maxillary molars in only 33% of a sample of an Ohio Caucasian population, and in 36% of a Pima Indian population. In contrast, Dr. Woelfel found only two casts of young dental hygienists' mouths, from more than 600 sets of complete dentition casts, in which maxillary second molars were larger than the first molars.]

## A. TYPE TRAITS OF THE MAXILLARY FIRST AND SECOND MOLARS FROM THE BUCCAL VIEW

2. NUMBER AND SIZE OF CUSPS ON MAXILLARY MOLARS (AND ASSOCIATED GROOVE) FROM THE BUCCAL VIEW

Both the first and second maxillary molars have four major cusps (seen best on an occlusal view in Fig. 7-20), but only two are prominently visible from the buccal view: the mesiobuccal cusp and the distobuccal cusp. The relative heights of the four major cusps of maxillary molars are the longest mesiolingual, followed by the mesiobuccal, distobuccal, and the shortest distolingual (if present). The two lingual cusp tips (mesiolingual and distolingual) may show slightly from the buccal view since the mesiolingual is longest, and both lingual cusps are positioned slightly to the distal of the buccal cusp tips.

## A. TYPE TRAITS OF THE MAXILLARY FIRST AND SECOND MOLARS FROM THE BUCCAL VIEW

3. PROXIMAL CONTACTS OF MAXILLARY MOLARS FROM THE BUCCAL VIEW (SAME FOR ALL MOLARS)

For all maxillary (and mandibular) first and second molars, the mesial contact is located at the junction of occlusal and middle thirds. The distal contact is located more cervically in the middle third of the tooth, near the middle. Sometimes you can observe a slightly worn spot (facet) in this location proximally where it contacted the adjacent molar. A summary of the location of the proximal contacts of maxillary and mandibular molars is found in Table 7-5, and a review for all teeth discussed so far is presented in Table 7-6.

## A. TYPE TRAITS OF THE MAXILLARY FIRST AND SECOND MOLARS FROM THE BUCCAL VIEW

4. ROOTS OF MAXILLARY MOLARS FROM THE BUCCAL VIEW

At the cervical line the crown is attached to a broad, undivided base called the root trunk. Apical to the root trunk, the root separates into three parts (three roots): the mesiobuccal root, the distobuccal root, and the lingual root. The area of furcation is often near the junction of the cervical and middle thirds of the roots (seen in most molars in Fig. 7-19). This furcation is called a trifurcation since three roots come off the trunk. The furcation between the two buccal roots is a greater distance from the cervical line on second molars than on the first molars since the root trunks of the second molars are longer. [In Mongoloid people, the maxillary first molars often have a long root trunk; sometimes there is no furcation at all.1 See the last maxillary first molar on the upper row, right side, in Fig. 7-19.] The three roots are nearly the same length [within 1.5 mm], with the palatal (lingual) root the longest, followed by the mesiobuccal root, then the shortest distobuccal root.

## B. TYPE TRAITS OF MAXILLARY MOLARS FROM THE LINGUAL VIEW

Refer to Figure 7-21 for similarities and differences.

1. RELATIVE SIZE AND TAPER OF MAXILLARY MOLARS FROM THE LINGUAL VIEW

Little or no mesial or distal surfaces of maxillary first molar crowns are visible from the lingual view (except in the cervical third) since these teeth may be as wide or wider on the lingual half than on the buccal half due to a relatively wide distolingual cusp. This is an EXCEPTION, along with the three-cusp mandibular second premolar, to the normal taper towards the lingual for all other posterior teeth. Second molars are narrower in the lingual half due to the relatively smaller or nonexistent distolingual cusp. The lingual surface of both types of maxillary molars is narrower in the cervical third than in the middle third, since the crown tapers to join the single palatal root (seen clearly in the maxillary molars in Fig. 7-21).

## B. TYPE TRAITS OF MAXILLARY MOLARS FROM THE LINGUAL VIEW

2. NUMBER AND DESCRIPTION OF LINGUAL CUSPS ON A MAXILLARY MOLAR FROM THE LINGUAL VIEW

On the maxillary first molar, there are two well-defined cusps on the lingual surface, the larger mesiolingual cusp and the smaller, but still sizeable, distolingual cusp. The mesiolingual cusp is almost always the largest and highest cusp on any maxillary molar (Appendix 8, lingual view of the maxillary molar, and 8i for the cusp of Carabelli). Additionally, on the first molar, there is often a small fifth cusp (or groove or depression) on the lingual surface of the mesiolingual cusp 70% of the time. An actual cusp is evident over 46% of the time. [As data shows in Table 7-7, 46.5% of 1558 maxillary first molars had some form of Carabelli cusp (large or small), 24% had a depression in this location, and 29.5% were without any type of Carabelli formation.] This cusp is called the cusp (or tubercle) of Carabelli, after the Austrian dentist Georg von Carabelli (1787-1842), who described it. It is a nonfunctioning cusp, even when large, because it is located about 2 mm short of the mesiolingual cusp tip.

## B. TYPE TRAITS OF MAXILLARY MOLARS FROM THE LINGUAL VIEW

3. MAXILLARY MOLAR ROOTS FROM THE LINGUAL VIEW

On the maxillary first molar, the longest lingual root [averaging 13.7 mm on 308 maxillary first molars] is the third longest root on any maxillary tooth, after the maxillary canine and second premolar roots. The lingual root is not curved when seen from the lingual view, but it does taper apically to a blunt or rounded apex. There is usually a longitudinal depression on the lingual side of the lingual root of the first molar (seen in many lingual roots of maxillary first molars in Fig. 7-21). The characteristically wide mesiodistal spread of the curved buccal roots on the first molar is visible from this view. The lingual root on the maxillary second molar is as long as, and resembles, the lingual root of the first molar. However, the buccal roots in the background bend somewhat more distally and are closer together and more parallel than on first molars.

## C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS

Refer to Figure 7-22 for similarities and differences of maxillary molars from the proximal views.

1. MAXILLARY MOLAR CUSPS FROM THE PROXIMAL VIEWS

Like the crowns of a mandibular molar, maxillary first molar crowns appear short occlusocervically and broad faciolingually from the proximal view. Recall that the cusps of the first molar, in the usual order of their length occlusocervically, longest to shortest, are mesiolingual, mesiobuccal, distobuccal, and distolingual (if present), followed by the functionless fifth cusp (cusp of Carabelli) when present. Since the mesial two cusps are longer than the distal, four cusps are visible from the distal view: the distobuccal cusp and smallest distolingual cusp in the foreground, and the cusp tips of the mesiobuccal and largest mesiolingual cusp behind them. When present on first molars, the Carabelli's cusp can also usually be seen on the lingual surface from this view.

**C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS**

2. HEIGHT OF CONTOUR FOR MAXILLARY MOLARS FROM THE PROXIMAL VIEWS (SAME FOR ALL POSTERIOR TEETH)

As on all other posterior teeth, the height of contour of the buccal side of both first and second maxillary molar crowns is in the cervical third, usually close to the cervical line. The height of contour of the lingual side of the crown is more occlusal, in or near the middle third of the crown. On teeth in which the fifth cusp is large, the lingual crest of curvature is located even more occlusally (Fig. 7-23).

**C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS**

3. TAPER TOWARD DISTAL OF MAXILLARY MOLARS FROM THE DISTAL VIEW

On both maxillary first and second molars, both the buccal surface and the lingual surface of the crown can be seen because the crown tapers toward the distal and is narrower buccolingually on the distal side than on the mesial side (seen on most distal views in Fig. 7-22).

**C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS**

4. MARGINAL RIDGES OF MAXILLARY MOLARS FROM THE PROXIMAL VIEWS

On both first and second maxillary molars, the concave mesial marginal ridge connects the mesiobuccal cusp and the mesiolingual cusp. It is longer buccolingually and located more occlusally than the distal marginal ridge. Consequently, little of the occlusal surface is visible from the mesial view. Because the distal marginal ridge of these maxillary molars is both short and concave and more cervically positioned than the mesial marginal ridge, more of the occlusal surface (including the triangular ridges) can be seen from the distal view. (Compare mesial and distal views in Fig. 7-22.) This marginal ridge height difference is very helpful in determining right from left sides. In general, marginal ridge grooves are more common on the mesial marginal ridge than on the distal, and are more common on first molars than on seconds. [On first molars: 78% of 69 teeth had mesial marginal grooves, but only 50% of 60 had distal marginal grooves; on second molars, 67% of 75 teeth had mesial marginal grooves, but only 38% of 79 teeth had distal marginal ridge grooves.]

**C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS**

5. CERVICAL LINES OF MAXILLARY MOLARS FROM THE PROXIMAL VIEWS

On both types of maxillary molars, the mesial cervical line has a slight occlusal curvature [averaging only 0.7 mm on 308 first molars and 0.6 mm on second molars]. There is less curvature of the cervical line on the distal surface than on the mesial surface, but the difference is hardly discernible, since this cementoenamel junction is practically fiat buccolingually.

**C. TYPE TRAITS OF FIRST AND SECOND MAXILLARY MOLARS FROM THE PROXIMAL VIEWS**

6. ROOTS OF MAXILLARY MOLARS FROM THE PROXIMAL VIEWS

On maxillary first molars from the mesial view, two roots can be seen: the palatal root and the mesiobuccal root (broad buccolingually) (Appendix 8, mesial views). The breadth of the mesiobuccal root is two-thirds of the faciolingual dimension, so it obscures the third distobuccal root. The apex of this mesiobuccal root is in line with the tip of the mesiobuccal cusp, whereas the convex buccal surface of this root often extends a little buccal to the crown. Observe this characteristic of maxillary first molars from the mesial view in Figure 7-22. The lingual outline of the mesiobuccal root is often more convex and, in the apical third, curves sharply facially toward the apex. The mesial surface of the mesiobuccal root has a longitudinal depression (and although they cannot be seen, there are often two root canals in this root).

**D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW**

Refer to Figure 7-25 for similarities and differences. To follow the description of traits from the occlusal view, the tooth should be held in such a position that the observer is looking exactly perpendicular to the plane of the occlusal surface. Because of the spread of the first molar roots, some of each of the three roots (particularly the lingual root) may be visible when the tooth is in this position (characteristic of first molars as seen in Fig. 7-26). In studying these teeth, it must be remembered that the morphology is variable.

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

1. OUTLINE OF FIRST MOLAR FROM OCCLUSAL VIEW

On the maxillary first molar, the outline of the occlusal surface is not quite square, but it gives the general impression of squareness when compared to other teeth. Actually, it is more like a parallelogram, with two acute (sharper) and two obtuse (blunter) angles (Appendix 8k). The acute angles are the mesiobuccal and distolingual. The parallelogram is larger buccolingually than mesiodistally (arch trait for the maxillary molars). The oblique ridge traverses diagonally across the tooth between the obtuse outline angles, that is, from mesiolingual to distobuccal (Appendix 8d). Also, on many maxillary first molars, the mesiodistal dimension of the lingual half of the crown is slightly wider mesiodistally than the buccal half. Try to locate one or two maxillary first molars in Figure 7-25 that are not wider on the lingual than on the buccal sides. They are a minority.

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

2. NUMBER AND SIZE OF CUSPS ON MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

Most first maxillary molars usually have four larger cusps plus the fifth cusp (cusp of Carabelli), and most second molars have four larger cusps (without a cusp of Carabelli) or have three cusps (when the distolingual cusp is absent). Use Figure 7-28 when comparing the relative size of major cusps for maxillary first and second molars. The cusp size on the four-cusp type of both maxillary first and second molars are, from largest to smallest, the conspicuous mesiolingual [largest 95% of 1469 first molars on stone casts], mesiobuccal, distobuccal, and distolingual [smallest 72% of the time]. The first molar has the smallest fifth (functionless) cusp of Carabelli (or a depression) [present about 70% of the time], whereas the second molar does not have this cusp (see an exception in Fig. 7-29.) On second molars, there is usually a greater difference in the size of the buccal cusps, with the mesiobuccal noticeably larger (Fig. 7-28), and the distolingual cusp either smallest or not present. The triangular shape formed by the three more prominent cusps of a maxillary molar (namely, the mesiolingual, mesiobuccal, and distobuccal cusps) are collectively known as the maxillary molar primary cusp triangle.

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

3. RIDGES OF MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

On the four-cusp type maxillary first molar, each of the four major cusps has at least one definite triangular ridge. The largest mesiolingual cusp usually has a second triangular ridge mesial to the one that forms the oblique ridge (Fig. 7-30). The distal of the two triangular ridges of the mesiolingual cusp aligns with the triangular ridge of the distobuccal cusp to form a diagonal ridge called the oblique ridge (an arch trait of most molars in the maxillae) (Fig. 7-30). The second, more mesial triangular ridge of the mesiolingual cusp aligns with the triangular ridge of the mesiobuccal cusp to form a transverse ridge. The groove between the two triangular ridges on the mesiolingual cusp is called the Stuart groove (named after the late Dr. Charles E. Stuart). Two texts refer to the more distal triangular ridge of the mesiolingual cusp by another name: the distal cusp ridge of the mesiolingual cusp. Subsequently, the oblique ridge is formed by the triangular ridge of the distobuccal cusp and the distal cusp ridge of the mesiolingual cusp. The oblique ridge is smaller on second molars than on first molars?

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

4. FOSSAE OF MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

On four-cusp type maxillary molars, there are four fossae on the occlusal surface (Fig. 7-31). The largest central fossa is near the center of the occlusal surface. It is bounded distally by the elevation of the oblique ridge, mesially by the mesial transverse ridge, and buccally by the buccal cusp ridges. The second largest distal fossa is an elongated fossa (cigar shaped) extending between the mesiolingual and the distolingual cusps. A smaller, mesial triangular fossa is just within the mesial marginal ridge. The fourth minute, distal triangular fossa is just mesial to the distal marginal ridge. On three-cusp type maxillary (second) molars, when the distolingual cusp is missing, the distal (cigar-shaped) fossa is also missing and there are only three fossae remaining (one large central and two very small triangular ones).

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

5. GROOVES ON MAXILLARY MOLARS

Refer to Figure 7-30 while studying these grooves. On the four-cusp type of maxillary first or second molar, the prominent oblique ridge plays an important role in defining developmental grooves. This type of maxillary molar has five major grooves: the central, buccal, distal oblique, lingual, and sometimes the transverse groove of the oblique ridge. Unlike the mandibular molar where the central groove extends from the mesial fossa to the distal fossa, the central groove of the maxillary molar extends from the mesial fossa over the mesial transverse ridge and ends in the central fossa.

## D. TYPE TRAITS OF FIRSTAND SECOND MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

6. PROXIMAL CONTACTS OF MAXILLARY MOLARS FROM THE OCCLUSAL VIEW

Mesial and distal contacts of maxillary molars are all slightly to the buccal of the center of the tooth, but are near the center buccolingually. The mesial contact is more buccal than the distal contact on maxillary molars, and the distal contact on maxillary first molars is nearly centered buccolingually.

## A. TYPE TRAITS OF ALL THIRD MOLARS (DIFFERENT FROM FIRST AND SECOND MOLARS)

The mesial surfaces of third molars contact the distal surfaces of second molars, but the distal surfaces of third molars are not in proximal contact with any tooth. The maxillary third molars occlude with only the mandibular third molars; all other teeth have the potential for occluding with two teeth EXCEPT mandibular central incisors.

## B. SIZEAND SHAPEOFTHIRD MOLARS

Maxillary third molars vary considerably in size, but they are usually the shortest of the permanent teeth and are therefore smaller than the first or second molar. The roots of maxillary third molars are ordinarily shorter [by 2.0 mm, average of 920 teeth], and the root trunks are proportionally longer than the root trunks of the first and second molars. Similarly, mandibular third molars are usually the shortest of the mandibular teeth [averaging 18.2 mm] although these teeth also vary considerably in size and can be either large or small.

## C. SIMILARITIES AND DIFFERENCES OFTHIRD MOLAR CROWNS COMPARED WITH FIRST AND SECOND MOLARS IN THE SAME ARCH

Maxillary third molars have the greatest morphologic variance of all teeth. The great amount of variation in maxillary third molars also makes a general description difficult. The crown may have only one cusp or as many as eight, but it also may resemble a small maxillary first molar (complete with cusp of Carabelli) or second molar (without the cusp of Carabelli, and perhaps without the distolingual cusp). As with the mandibular third molar, the maxillary third molar can be distinguished from the first or second molar in its arch because it has more numerous supplemental grooves, a small occlusal surface, and ridges, giving it a wrinkled appearance, and its roots are shorter, thin, or often fused.

## D. SIMILARITIES AND DIFFERENCES OFTHIRD MOLAR ROO'r5 COMPARED WITH FIRST AND SECOND MOLARS IN THE SAME ARCH

As on maxillary first and second molars, maxillary third molars usually have three roots: mesiobuccal, distobuccal, and lingual, which may be separated, as in the first and second molars, but more commonly are fused most of their length. This results in a long root trunk with the furcation located only a short distance from the apices of the roots. Often the roots are entirely fused from the cervix to the apices as seen in 10 maxillary teeth in Figure 7-36. The roots are noticeably shorter than on the first and second molars [303 teeth averaged 2 mm shorter on their buccal roots and 2.5 mm shorter on their lingual roots]. The roots, fused or not, are often very crooked, and the majority of them curve distally in their apical third.