

## Permanent Premolar

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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. 恆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. 恆齒與乳齒之比較
7. 牙髓腔形態
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 include the following:

- I. Overview of premolars
  - A. General description of premolars
  - B. Functions of premolars
  - C. Class traits of premolars (including traits similar to anterior teeth)
  - D. Arch traits that differentiate maxillary from mandibular premolars
- II. Type traits that differentiate maxillary first from maxillary second premolars
  - A. Type traits of maxillary premolars from the buccal view
  - B. Type traits of maxillary premolars from the lingual view
  - C. Type traits of maxillary premolars from the proximal views
  - D. Type traits of maxillary premolars from the occlusal view
- III. Type traits that differentiate mandibular first from second premolars
  - A. Type traits of mandibular premolars from the buccal view
  - B. Type traits of mandibular premolars from the lingual view
  - C. Type traits of mandibular premolars from the proximal views
  - D. Type traits of mandibular premolars from the occlusal view



## OVERVIEW OF PREMOLARS

### OBJECTIVES

This section is designed to prepare the learner to perform the following:

- Describe the functions of premolars.
- List class traits common to all premolars.
- List arch traits that can be used to distinguish maxillary from mandibular premolars.
- From a selection of all teeth, select and separate out the premolars.
- Divide a selection of all premolars into maxillary and mandibular.



## A. GENERAL DESCRIPTION OF PREMOLARS

The term premolar is used to designate any tooth in the permanent (secondary) dentition of mammals that replaces a primary molar. There are eight premolars: four in the maxillary arch and four in the mandibular arch (Fig. 6-1). They are the fourth and fifth teeth from the midline in each quadrant. The maxillary premolars can be identified by the Universal Numbering System as teeth numbers 5 and 12 (maxillary right and left first premolars, respectively) and numbers 4 and 13 (maxillary right and left second premolars, respectively). The mandibular right and left first premolars are numbers 28 and 21, respectively, with the mandibular right and left second premolars numbered 29 and 20, respectively.

## B. FUNCTIONS OF PREMOLARS

The premolars (upper and lower) function with the molars (a) in the mastication of food and (b) in maintaining the vertical dimension of the face. The first premolars (c) assist the canines in shearing or cutting food morsels, and all premolars (d) support the corners of the mouth and cheeks to keep them from sagging. This is more discernible in older people. Patients who unfortunately have lost all of their molars can still masticate or chew quite well if they still have four to eight occluding premolars. However, it is very noticeable when a person smiles and is missing one or more maxillary premolars.

## C. CLASS TRAITS OF PREMOLARS

### 1. CLASS TRAITS SIMILAR TO ANTERIOR TEETH

Consider first the similarities between premolars and anterior teeth by examining models of the entire maxillary and mandibular arches as you read the following:

**Number of Developmental Lobes:** Like anterior teeth, the facial (or buccal) surfaces of all premolars develop from three facial lobes, usually evidenced by two shallow, vertical depressions separating a center buccal ridge on the facial surface of the crown from mesial and distal portions (Appendix Sa). This centered buccal ridge is more conspicuous on first than second premolars, and is more pronounced on maxillary than mandibular premolars. (The prominent buccal ridge on the maxillary first premolar is similar to the pronounced labial ridge on the maxillary canine.)

## C. CLASS TRAITS OF PREMOLARS

### 2. CLASS TRAITS THAT DIFFER FROM ANTERIOR TEETH

**Tooth Surface Terminology:** Compared to the anterior teeth, the facial surfaces of the posterior teeth are called buccal (resting against the cheeks) instead of labial, and posterior teeth have occlusal surfaces instead of incisal edges. Occlusal surfaces have cusps, ridges, and grooves on the occlusal surface that are basically oriented in a horizontal plane.

**Occlusal Cusps Versus Incisal Edges:** Unlike anterior teeth with incisal edges or ridges and a cingulum, premolars have one buccal (or facial) cusp, and most have one lingual cusp (Appendix 5b). The EXCEPTION is the mandibular second premolar, which often has two lingual cusps [54% of the time].

## C. CLASS TRAITS OF PREMOLARS

### 3. OTHER CLASS TRAITS CHARACTERISTIC OF MOST PREMOLARS

Evaluate the similarities of all premolars while comparing models or extracted specimens of all four types of premolars from the views indicated. Also, use the study pages from the Appendix to identify the class traits. It is important to note that although general characteristics are described in this book, there is considerable variation from these descriptions in nature. Please remember when studying the maxillary premolars to hold them with their crowns down and roots upward. With mandibular premolars, have the crowns upward and the roots below. In this manner, the teeth will be oriented as they were in the mouth.

## 3. OTHER CLASS TRAITS CHARACTERISTIC OF MOST PREMOLARS

### a. Class Traits of Most Premolars From the Buccal View

**Crown Outline Shape:** The crown from the buccal view is broadest at the level of the contact areas and more narrow at the cervix: shaped roughly like a five-sided pentagon, similar to the canine crown shape (Appendix 5g). The mesial and distal outlines of the crown are nearly straight or slightly convex from contact areas to the cervical line.

**Contact Areas:** Both mesial and distal sides of the crown are convex around the contact areas, similar to canines. Mesial proximal contacts are near the junction of the occlusal and middle thirds, and the distal contacts are normally slightly more cervical, in the middle third (Appendix 5e), EXCEPT on mandibular first premolars, where mesial contacts are usually more cervical than the distal contacts.

### 3. OTHER CLASS TRAITS CHARACTERISTIC OF MOST PREMOLARS



#### b. Class Traits of Most Premolars From the Lingual View

Crown Shape (Outline): The crown is narrower on the lingual side than on the buccal side, EXCEPT some three-cusped mandibular second premolars that may be wider on the lingual half. The lingual surface is convex.

### 3. OTHER CLASS TRAITS CHARACTERISTIC OF MOST PREMOLARS



#### c. Class Traits of Most Premolars From the Proximal Views

Marginal Ridges: The relative height of the mesial and distal marginal ridge is similar to the relative height of the proximal contact areas. The mesial marginal ridge is more occlusally positioned than the distal marginal ridge, so if you first look at the mesial side and then the distal side of this tooth, you should be able to see a little less of the triangular ridges from the mesial view (compare mesial and distal surfaces in Appendix 5j). An EXCEPTION is the mandibular first premolar, where the distal marginal ridge is in a more occlusal position than the mesial marginal ridge.

### 3. OTHER CLASS TRAITS CHARACTERISTIC OF MOST PREMOLARS



#### d. Class Traits of Most Premolars From the Occlusal View

Tooth Proportions: Like the majority of anterior teeth (except maxillary central and lateral incisors), all types of premolars, on average, arc wider faciolingually than mesiodistally (Appendix 5k). [Measuring 923 premolars, their crowns were wider faciolingually by 1.2 mm and their roots by 2.8 mm.]

Cusp Ridges and Marginal Ridges Bound the Occlusal Table: Like canine cusps, both the buccal and lingual premolar cusps have mesial and distal cusp ridges. On premolars, these merge laterally with the marginal ridges to surround the portion of the tooth known as the occlusal table (inside of the dotted lines on Appendix 5-1).

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



Refer to Appendix page 6 while reading about differences between maxillary and mandibular premolars. Relative Shape and Size: The maxillary first and second premolars appear more alike than the mandibular premolars (yet the maxillary first premolar crown is larger than the second in all dimensions).

### TYPE TRAITS THAT DIFFERENTIATE MAXILLARY FIRST FROM MAXILLARY SECOND PREMOLARS



#### OBJECTIVES

This section prepares the reader to perform the following:

- Describe the type traits that can be used to distinguish the permanent maxillary first premolar from the maxillary second premolar.
- Describe and identify the labial, lingual, mesial, distal, and occlusal surfaces for all maxillary premolars.
- Assign a Universal number to maxillary premolars present in a mouth (or on a model of the teeth) with complete dentition. If possible, repeat this on a model with one or more maxillary premolars missing.
- Holding a maxillary premolar, determine whether it is a first or a second and right or left. Then assign a Universal number to it.

### A. TYPE TRAITS OF MAXILLARY PREMOLARS FROM THE BUCCAL VIEW



From the buccal view, compare the maxillary first and second premolars in [Figure 6-5](#). Compare tooth models and/or extracted maxillary premolars as you read the following characteristics, holding the crowns down and roots up, just as they are oriented in the mouth.

### 1. RELATIVE SIZE OF MAXILLARY PREMOLAR CROWNS FROM THE BUCCAL VIEW

The crown of the maxillary first premolar is larger than the maxillary second premolar [wider by 0.5 mm and longer by 0.9 mm], but the root is shorter overall [by 0.6 mm; measurements on 458 teeth]. The shoulders (junction of cusp slopes and proximal surfaces) seem more broad, bulging, and angular (especially on the mesial) on the first premolar than on the more gently convex second premolar. The mesial and distal sides of the crown, from the contact areas to the cervical line, converge more noticeably on the maxillary first premolar than second premolar. This makes the cervical portion of the crown of the second premolar appear relatively wider. Observe the more prominent mesial shoulders and increased crown taper on many maxillary first premolars in [Figure 6-5](#).

### 2. LOCATION OF PROXIMAL CONTACTS FOR MAXILLARY PREMOLARS FROM THE BUCCAL VIEW

For both types of maxillary premolars, mesial contacts are usually in the middle third, near the junction of the occlusal and middle thirds. As on anterior teeth, distal contacts are slightly more cervical. Distal contacts of premolars are in the middle third (recall [Appendix 5e](#)).

### 3. LOCATION OF THE BUCCAL CUSP TIP OF MAXILLARY PREMOLARS FROM THE BUCCAL VIEW

The maxillary first premolar has its buccal cusp tip placed slightly to the distal of the vertical midroot axis line with a longer mesial cusp ridge, as compared to the distal cusp ridge ([Appendix 6e](#) and most maxillary first premolars in [Fig. 6-5](#)). This is an EXCEPTION to all other premolars (including maxillary second premolars) and canines, which have their buccal cusp tip placed more to the mesial, or centered, with their mesial cusp ridge shorter than their distal.

### 4. SHAPE OF THE BUCCAL CUSP OF MAXILLARY PREMOLARS FROM THE BUCCAL VIEW

The buccal cusp of the maxillary first premolar is relatively long and pointed or sharp ([Appendix 6f](#), resembling a maxillary canine, with the mesial and distal slopes meeting at almost a right angle (100-110°), compared to the second premolar, which is less pointed and more obtuse (125-130°), as seen on most second premolars in [Figure 6-5](#).

### 5. SHAPE OF THE BUCCAL CUSP OF MAXILLARY PREMOLARS FROM THE BUCCAL VIEW

The buccal ridge is prominent on the maxillary first premolar ([Appendix 6g](#)). A shallow vertical depression mesial to the buccal ridge in the occlusal third of the crown was found about half of the time in the first premolars [52% of 452], but rarely on the distal [2%]. The buccal ridge is less prominent on the maxillary second premolar, and depressions were found only 27% of the time on second premolars, more often in the distal [506 teeth]. The most common location of these depressions is depicted in the drawings in [Figure 6-5](#).

### 6. ROOTS OF MAXILLARY PREMOLARS FROM THE BUCCAL VIEW

Most of the time, the maxillary first premolar has a divided root with buccal and lingual portions or roots coming off a common trunk in the apical third (seen best from the proximal view in [Appendix 6h](#), but both root tips may also be seen from the buccal view). [On 200 teeth, 61% had two roots, 38% had one root, and 1% had three roots.] The buccal and lingual roots are usually relatively straight except for a frequent distal curve of the buccal root near the apex. Sometimes you can see the tip of the lingual root when it is straighter or bends in a different direction than the buccal root. This is evident in several maxillary first premolars in [Figure 6-5](#). The single root of the second premolar is longer on the average than on the first premolar [by 0.6 mm] and is nearly twice as long as the crown. The root-to-crown ratio is 1.8:1, which is the highest for any maxillary tooth. This means that the root is 1.8 times the length of the crown. The apical end of the root of all premolars frequently bends distally [58% of 343 second premolars and 66% of 426 first premolars], but these roots may also be straight or bend mesially.

## **B. TYPE TRAITS OF MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

### **1. RELATIVE CUSP SIZE OF MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

The lingual cusp is shorter than the buccal cusp, considerably more so on the maxillary first premolar. The cusps of the maxillary second premolar are nearly the same length. This trait is seen in almost all first premolars in Figure 6-6 and is evident on the lingual views of maxillary premolars on Appendix page 6. [Maxillary first premolar lingual cusps were 1.3 mm shorter on the average, ranging from 0.3 to 3.3 mm shorter on 317 teeth; second premolar lingual cusps averaged only 0.4 mm shorter on 300 teeth. The crown is a little narrower on the lingual side than on the buccal side, more obviously so on the first premolar than on the second premolar.]

## **2. CUSP RIDGES OF MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

The mesial and distal ridges of the lingual cusp of the maxillary first premolars meet at the cusp tip at a somewhat rounded angle, but the angle is still sharp or steep compared to the molar cusps. The tip of the lingual cusp of the second premolar is relatively sharper.

## **3. LINGUAL CUSP POSITION FOR MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

The tips of the unworn lingual cusps of both maxillary premolars are consistently positioned to the mesial of the midroot axis line (Appendix 6i). This trait is an excellent way to tell rights from lefts, especially for the maxillary second premolar, which is, in most other ways, nearly symmetrical.

## **4. MARGINAL RIDGES OF MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

From the lingual view, differences in marginal ridge heights are apparent on handheld teeth when rotating the tooth just enough one way to see the mesial ridge height, then just enough in the opposite direction to compare the distal ridge height. The distal marginal ridges of both types of maxillary premolars are more cervical in position than the mesial marginal ridge (recall Appendix 5j). (This relative positioning is true of all posterior teeth, with the EXCEPTION of the mandibular first premolar, where the distal marginal ridge is the more occlusal one.)

## **5. ROOTS OF MAXILLARY PREMOLARS FROM THE LINGUAL VIEW**

The lingual root of a two-rooted maxillary first premolar is usually shorter than the buccal root [0.8 mm for 93 teeth]. The apical end of the lingual root of the teeth may bend toward either the mesial or the distal. Both first and second premolar roots taper narrower to the lingual.

## **C. TYPE TRAITS OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEW**

### **1. CROWN SHAPE AND MORPHOLOGY OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS**

All maxillary premolars are shaped like a trapezoid from the proximal view (Appendix 6b). A trapezoid is a four-sided figure with two parallel sides and two nonparallel sides. Maxillary first premolars have a prominent mesial concavity cervical to the contact area; second premolars do not (Appendix 6j). This unique mesial crown concavity is perhaps the most consistent and obvious trait of the maxillary first premolar crown that can be used to distinguish it from a maxillary second premolar and can be used to confirm the mesial surface on the maxillary first premolar. It is important to remember the location of this unique crown concavity when restoring the contours of this surface, or when detecting and removing calcified deposits on this root.

## 2. RELATIVE CUSP HEIGHT OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS

From this view, as from the lingual, the buccal cusp is noticeably longer than the lingual cusp on maxillary first premolars, compared to the second premolar, which has two cusps of nearly equal length (Appendix 6c). This difference is obvious when comparing first and second premolars in [Figure 6-7](#). From this view, it is a challenge telling buccal from lingual on the mandibular second premolar based solely on the cusp heights, since the cusp heights are so similar. Differences in the heights of contour, however (described next) will be useful for distinguishing buccal from lingual surfaces on these teeth.

## 3. HEIGHT (CREST) OF CONTOUR OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS

Like all teeth, the facial height of contour of maxillary premolars is located in the cervical third. Specifically, it is near the junction of the middle and cervical third. Lingually (like other posterior teeth) it is more occlusal, in the middle third (near the center of the crown). This trait helps distinguish the buccal from lingual surfaces on the majority of maxillary premolars from the proximal views in [Figure 6-7](#).

## 4. DISTANCE BETWEEN CUSPS ON MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS

The average distance between the buccal and lingual cusp tips of maxillary first and second premolars is about the same [5.9 mm and 5.7 mm, respectively, or 65-67% of the faciolingual dimension for 243 teeth]. However, both cusp tips are located over the root and well within the boundary of the root contour, an important relationship imparting good functional support for a large chewing area.

## 5. MARGINAL RIDGE GROOVES OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS

The mesial marginal ridge of maxillary first premolars is almost always crossed by a developmental groove called a marginal ridge groove [on 97% of 600 maxillary first premolars]. This marginal ridge groove serves as a spillway for food during mastication (best seen from the occlusal view in Appendix 6k). The distal marginal ridge groove occurs less frequently [39% of 600 teeth]. Short mesial and distal marginal ridge grooves were even less likely to be found crossing the ridges of second premolars [only present on 37% of 641 mesial marginal ridges and 30% of distal marginal ridges of maxillary second premolars].

## 6. CERVICAL LINES OF MAXILLARY PREMOLARS WHEN COMPARING PROXIMAL VIEWS

The cervical line on the mesial of the maxillary first premolar curves occlusally in a broad but shallow arc [averaging only 1.1 mm high on 234 teeth]. As on anterior teeth, the mesial curvature is slightly greater than on the distal side [by 0.4 mm on maxillary premolars]. The cervical line on the lingual surface is in a more occlusal position than on the buccal surface. This accentuates the appearance that the lingual cusp is definitely shorter than the buccal cusp. The cervical line curvature on the mesial of the second premolar is also greater than on the distal [by 0.3 mm].

## 7. ROOTS AND ROOT DEPRESSIONS OF MAXILLARY PREMOLARS FROM THE PROXIMAL VIEWS

The roots of the maxillary premolars, when viewed from the mesial or distal aspect, often have root depressions of varying depths. Knowledge of the frequency with which these depressions occur, as well as the relative location and depth of these depressions, can be helpful clinically when using special instruments under the gingiva to detect and remove calcified deposits that contribute to periodontal disease, and when identifying areas of decay on the roots.

Compare occlusal views of maxillary first and second premolars in [Figure 6-8](#). To follow this description, the teeth or tooth models you are using should be held as those displayed in [Figure 6-8](#), so that the buccal surface is at the top and you are sighting down along the vertical midroot axis.

## D. TYPE TRAITS OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEW

### 1. RELATIVE SIZE OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEWS

In the same mouth, the maxillary first premolar was judged to be larger than the second premolar in 55% of the specimens examined and smaller than the second premolar in only 18% [1392 comparisons were done on dental stone casts].

### 2. GROOVES AND FOSSAE OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEW

Characteristically, central developmental grooves run mesiodistally across the center of both maxillary premolars with a pit at both ends. The length of the central groove of the maxillary first premolar is more than one-third the mesiodistal width of the occlusal surface [average length was 2.7 mm of 408 teeth]. The groove of the second premolar averaged only 2.1 mm, shorter than on first premolars [by 0.6 mm based on 818 teeth] (Appendix 61). This longer central groove is one of the distinguishing characteristics of the maxillary first premolar, compared to the central groove length of the second premolar, and is quite obvious when comparing the maxillary premolars in [Figure 6-8](#).

### 3. RELATIVE PROPORTIONS OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEW

The oblong (rectangular) outline of the maxillary premolar crown is greater buccolingually than mesiodistally [by 2.1 mm on 234 maxillary first premolars, and by 2.4 mm on second premolars]. This is obvious in all maxillary premolars in [Figure 6-8](#).

### 4. OUTLINE OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEW

On both types of maxillary premolars, the lingual half of the tooth is narrower mesiodistally than the buccal half, more so on first premolars. From the occlusal aspect, the outline of the buccal surface of the maxillary first premolar is a rounded and inverted V-shape because of the prominent buccal ridge, but is less prominent on the second premolar as seen in [Figure 6-8](#). This is the only part of the occlusal outline that looks symmetrical. The lingual three-fourths of the tooth seems to be bent slightly mesially. This is due in part to the buccal cusp tip location distal to the midline (UNIQUE to the maxillary first premolar with its mesial cusp ridge longer than its distal cusp ridge) and the lingual cusp tip mesial to the midline ([Fig. 6-9](#)).

### 5. CONTACT AREAS AND HEIGHTS OF CONTOUR OF MAXILLARY PREMOLARS FROM THE OCCLUSAL VIEW

Mesial contacts for both types of maxillary premolars are near or at the junction of the buccal and middle thirds (slightly more buccal on first premolars) ([Fig. 6-9](#)). Recall that one-third of the tooth from this aspect means one-third of the total buccolingual measurements of the crown, rather than one-third of the occlusal surface measurement. Distal contacts are in the middle third on maxillary second premolars, located more lingually than mesial contacts. Just the opposite is true on first premolars with their asymmetry, where the distal contact is more buccal than the mesial contact ([Fig. 6-9](#)). Picture this asymmetry when viewing the hexagon outline presented in Appendix 6m for the maxillary first premolar. The lingual height of contour is usually mesial to the center line of the tooth for both first and second premolars, with the tip of the lingual cusp always mesial to the center of the tooth.

## TYPE TRAITS THAT DIFFERENTIATE MANDIBULAR FIRST FROM MANDIBULAR SECOND PREMOLARS

### OBJECTIVES

The section prepares the reader to perform the following:

- Describe the type traits that can be used to distinguish the permanent mandibular first premolar from the mandibular second premolar.
- Describe and identify the labial, lingual, mesial, distal, and occlusal surfaces for all mandibular premolars on a photograph, model, or extracted tooth.
- Assign a Universal number to mandibular premolars present in a mouth (or on a model of the teeth) with complete dentition. If possible, repeat this on a model with one or more mandibular premolars missing.
- Holding a mandibular premolar, determine whether it is a first or a second and right or left. Then assign a Universal number to it.

### LEARNING EXERCISE

Look in your own mouth and determine which of these categories matches your mandibular second premolars. The three-cusp type occurs with only slightly greater frequency than the two-cusp type [54.2% of 532 teeth for the three-cusp type versus 43% for the two-cusp type]. The morphologic details of mandibular premolars are a challenge to describe because of the great amount of variation. To list all of the frequent variations would lead to confusion rather than to clarification. Bear in mind while studying these teeth that one description will not exactly fit every tooth. Most descriptions in this book are for unknown teeth. Most extracted tooth specimens will have signs of attrition, and some will show evidence of tooth decay (caries) or wear from bruxing or grinding teeth.

## A. TYPE TRAITS OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

Refer to views from the buccal of mandibular first and second premolars in [Figure 6-10](#).

### 1. RELATIVE CROWN SHAPE AND SIZE OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

As with all premolars and canines, the premolar crown shape from the facial view is roughly a five-sided pentagon (Appendix 5g). From this view, both types of mandibular premolars appear nearly symmetrical except for the shorter mesial than distal cusp ridge and the greater distal bulge of the crown. The greater distal bulge gives the appearance of a slight distal tilt of the crown relative to the midroot axis. The crown of the mandibular first premolar bears some resemblance from this aspect to the second premolar, but there are differences that make first premolars distinguishable. The buccal cusp of the mandibular first premolar crown appears longer, is centered over the root, and resembles a maxillary canine from this aspect. In general, the first premolar is slightly longer overall than the second with a longer crown [by 0.6 mm] and a shorter root [by 0.3 mm average for 465 teeth].

## 2. MORPHOLOGY OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

The buccal ridge and adjacent depressions of both types of mandibular premolars are less discernible than on the maxillary premolars. However, when vertical depressions on either side of the indistinct buccal ridge are present on the mandibular first premolar, the mesial crown depression is more likely to be deeper, whereas on the mandibular second premolar, the distal crown depression is more likely to be deeper ([Fig. 6-11](#)). [Of 285 mandibular first premolars, 80% had a smooth buccal surface in the occlusal third without depressions, 17% had a deeper depression on the mesial side of the buccal ridge, and only 3% had a deeper distal depression. Of mandibular second premolars, 74% had no discernible depressions, 25% had a deeper distal than mesial depression, and only 1% had a deeper mesial depression.] The location of these deeper depressions (mesial or distal) is consistent with the location of cusp ridge notches.

## 3. CERVICAL LINES OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

The cervical line on the buccal surface of the first premolar curves more mesiodistally than on second premolars.

## 4. PROXIMAL CONTACT AREAS OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

Because of the greater length of the buccal cusp, the contact areas on the mandibular first premolar are located more cervically from the cusp tip than they are on mandibular second premolars. On mandibular second premolars, both contact areas are positioned closer to the cusp tip or are in a more occlusal position than on the mandibular first premolars because the second's cusp ridges join at a less steep angle.



## 5. ROOTS OF MANDIBULAR PREMOLARS FROM THE BUCCAL VIEW

The roots of mandibular premolars taper gradually to the apex. The roots are noticeably more blunt on mandibular second premolars than on first premolars. As with most roots, there is a tendency for the apical third of the root to bend distally [on 58% of 424 teeth mandibular first premolars and 62% of 343 teeth mandibular second premolars; the tendency for a mesial bend was 23% and 17% on first and second premolars, respectively]. The root of the mandibular second premolar appears only slightly thicker [0.2 mm wider mesiodistally] and is slightly longer [0.3 mm] than the root of the first premolar. The root of the mandibular second premolar is nearly twice as long as the crown, with a root-to-crown ratio of 1.80:1.

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

### 1. CROWN SHAPE OF MANDIBULAR PREMOLARS FROM THE LINGUAL VIEW

On mandibular first premolars, as on most teeth, the crown is much narrower mesiodistally on the lingual half than on the buccal half. This can also be seen on second premolars with one lingual cusp. However, the width of the lingual half of a second premolar with two lingual cusps is usually as wide or wider mesiodistally than the buccal half. ONLY this three-cusp mandibular second premolar and some maxillary first molars have their crowns wider on the lingual half than on the buccal half.

## 2. LINGUAL CUSPS AND GROOVES OF MANDIBULAR PREMOLARS FROM THE LINGUAL VIEW

The lingual cusp of the mandibular first premolar is quite small and short, and is often pointed at the tip. It is nonfunctional, and could be considered a transition between the canine cingulum and prominent lingual cusp or cusps of the second premolar (best appreciated from the proximal views in [Fig. 6-14](#)). Much of the occlusal surface of this tooth can be seen from the lingual aspect because of the most obvious shortness of the lingual cusp. For 321 first premolars measured, the lingual cusp averaged 3.6 mm shorter than the buccal cusp (range from 1.7 to 5.5 mm shorter.) This tooth may have almost no lingual cusp or as many as four lingual cusplets.

## 3. MARGINAL RIDGES OF MANDIBULAR PREMOLARS FROM THE LINGUAL VIEW

From the lingual view, differences in marginal ridge heights are apparent on handheld teeth when rotating the tooth first enough in one direction to see the mesial marginal ridge height, then enough in the opposite direction to compare the distal ridge height. As with most other posterior teeth, the distal marginal ridges of the mandibular second premolars are slightly more cervically located than the mesial marginal ridges (evident on all mandibular second premolars in [Fig. 6-12](#)). An EXCEPTION to all other adult teeth is the mandibular first premolar, the only adult tooth where the mesial marginal ridge is more cervically located than the distal marginal ridge (evident in [Fig. 6-12](#) for many mandibular first premolars). This is similar to the UNIQUE relative location of the mesial proximal contact of the mandibular first premolar (more cervical) and the distal proximal contact (more occlusal).

## 4. GROOVES ON MANDIBULAR PREMOLARS FROM THE LINGUAL VIEW

On mandibular second premolars with two lingual cusps [present 54% of the time], a lingual groove passes between the mesiolingual and distolingual cusps and extends slightly onto the lingual surface of the crown (seen occlusally in [Fig. 6-13](#)). On mandibular first premolars, there is frequently a mesiolingual groove separating the mesial marginal ridge from the mesial slope of the small lingual cusp (Appendix 6r) [present in 67% of 609 first premolars]. Rarely, a similar groove might be present between the distal marginal ridge and the distal slope of the lingual cusp [8% of these 609 first premolars]. This difference in grooves extending onto the lingual surfaces of first and second mandibular premolars is presented in [Fig. 6-13](#).

## 5. ROOTS OF MANDIBULAR PREMOLARS FROM THE LINGUAL VIEW

The roots of second mandibular premolars are tapered and only slightly longer than the roots of first premolars [0.3 mm longer on average for 465 teeth].

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

### 1. CROWN SHAPE OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

Mandibular premolars are shaped like a rhomboid from the proximal view (Appendix 6b). A rhomboid is a four-sided figure with opposite sides parallel to one another, like a parallelogram. As on all mandibular posterior teeth, the crown of the mandibular first premolar tilts noticeably toward the lingual surface at the cervix (much more than any other premolar). This tilt places the tip of the buccal cusp almost over the midroot axis line (obvious on all mandibular first premolars in Fig. 6-14). As was also seen from the lingual aspect, the lingual cusp of the mandibular first premolar is considerably shorter than the buccal cusp by more than one-third of the total crown length [3.6 mm average for 321 teeth]. By virtue of being so short and narrow mesiodistally, it is a nonfunctioning cusp (Appendix 6p). The tip of the short lingual cusp results in the cusp tip location usually being in line vertically with the lingual outline of the cervical portion of the root. The short lingual cusp also results in an occlusal plane that approaches 45° relative to the long axis of the root.

### 2. MARGINAL RIDGES OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

The mesial marginal ridge of the mandibular first premolar slopes cervically from the buccal toward the center of the occlusal surface at nearly a 45° angle and is nearly parallel to the triangular ridge of the buccal cusp (Appendix 6s, and mesial views of the mandibular first premolars in Fig. 6-14). The distal marginal ridge of the mandibular first premolar is in a more horizontal position compared to the mesial marginal ridge, and is longer from buccal to lingual than the mesial marginal ridge. The difference in marginal ridge angle is most helpful in differentiating rights from lefts (by identifying the more downward sloping mesial marginal ridge). Also, the triangular ridge of the lingual cusp is short and is in a nearly horizontal plane.

### HEIGHT (CREST) OF CONTOUR OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

As on all teeth, the height of contour of both types of mandibular premolar crowns on the facial surface is in the cervical third. On the mandibular first premolar, the buccal height of contour of the crown is just occlusal to the cervical line, like the mandibular canine next to it (Fig. 6-14). The buccal height of contour on second premolars is near the junction of the cervical and middle thirds. The buccal crown outline of the second premolar is flatter or less convex than on the first mandibular premolar from the height of contour to the cusp tip.

### 5. CERVICAL LINES OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

Similar to other teeth, the occlusal curve of the cervical line on the proximal surfaces of premolars is greater on the mesial surface than on the distal. [The mesial cervical line of the mandibular first premolar curves an average of 0.9 mm for 238 teeth versus 0.6 mm on the distal; the mesial of second mandibular premolar curves occlusally an average of 0.8 mm for 227 teeth versus 0.5 mm (almost flat) on the distal.] The cervical line is also located more occlusally on the lingual than on the buccal [by as much as 2 mm on first premolars]. This makes the crowns appear to be quite short on the lingual side.

### 6. ROOTS OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

Both types of mandibular premolar roots taper apically, with the least taper in the cervical third. Rarely, an anomaly occurs where a mandibular premolar has a furcated root (i.e., the apical part of the root is divided into a buccal and lingual portion [discussed later in Chapter 12 on anomalies]).

### 7. ROOT DEPRESSIONS OF MANDIBULAR PREMOLARS FROM THE PROXIMAL VIEWS

Mandibular first premolars have a shallow longitudinal depression in the apical and middle thirds of the mesial root surface about half of the time [45 of 100 teeth], but are even more likely to have a longitudinal depression on the distal surface [86 of 100 teeth], which is deeper than on the mesial [69% of the time]. The relative depths of the depressions on mesial and distal root surfaces of this tooth are not a reliable basis on which to determine rights from lefts. Most mandibular second premolars [81%] have no depression on the mesial root surface, but are likely to have a longitudinal depression in the middle third of the distal root surface [73% of 100 teeth]. To summarize, all types of premolars, on average, are likely to have a deeper root depression on the distal root surface than on the mesial EXCEPT the maxillary first premolar. See Table 6-6 for a summary of the location and relative depth of root depressions on all types of premolars.

## D. TYPE TRAITS OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

For the occlusal view of mandibular first and second premolars, refer to [Figure 6-15](#). To follow this description, the teeth or tooth models should be held with the occlusal surface toward the observer and the buccal surface up, and the observer looking exactly along the vertical midroot axis.

## OUTLINE SHAPE OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

There is much variation in the occlusal morphology of the mandibular first premolar. The outline of the crown is not symmetrical (more bulk in the distal half) as seen in practically all mandibular first premolars in [Figure 6-15](#). It often looks as though the mesiolingual corner of the crown has been pushed inward on the mesiolingual corner ([Appendix 6u](#)). This results in a somewhat diamond-shaped outline (also [Appendix 6u](#)). This "pushed in" mesiolingual surface is a reliable trait to identify the mesial surface of a mandibular first premolar.

## 2. OCCLUSAL MORPHOLOGY OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

### a. Ridges, Fossae, and Grooves of the Mandibular First Premolars From the Occlusal View

Due to the much larger buccal than lingual cusp on the mandibular first premolars, the triangular ridge of the buccal cusp is long and slopes lingually from the cusp tip to where it joins the very short triangular ridge of the lingual cusp. Most often the two triangular ridges unite smoothly near the center of the occlusal surface and form an uninterrupted pronounced transverse ridge that completely separates the mesial and distal circular fossae.

## 2. OCCLUSAL MORPHOLOGY OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

### b. Ridges, Fossae, and Grooves of the Two-cusp Mandibular Second Premolars From the Occlusal View

Mandibular second premolars (two-cusp type), as on maxillary second premolars, have more numerous supplemental grooves on their occlusal surfaces than do first premolars. On the two-cusp type mandibular second premolar, the lingual cusp is smaller than the buccal cusp. There is a large triangular ridge on the buccal cusp and a correspondingly smaller one on the lingual cusp that join to form a transverse ridge (unlike the three-cusp type). There is a curved central developmental groove but no lingual groove on the two-cusp type of second mandibular premolar.

## 2. OCCLUSAL MORPHOLOGY OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

### c. Ridges, Fossae, and Grooves of the Three-cusp Mandibular Second Premolar

On the three-cusp type of mandibular second premolar, there are three triangular ridges: one on each of the two lingual cusps and one on the buccal cusp. These three ridges converge toward the central fossa ([Fig. 6-21](#)) but do not connect to form a transverse ridge. This tooth has mesial and distal fossae like all other premolars, but it is the ONLY PREMOLAR to also have a central fossa. The large central fossa is located quite distal to the center of the occlusal surface and in the middle buccolingually. Comparing size and depth of the mesial triangular fossa and central fossa, the central fossa was usually largest [on 65% of 200 teeth; the mesial fossa was largest on only 25% of the teeth].

## 2. OCCLUSAL MORPHOLOGY OF MANDIBULAR PREMOLARS FROM THE OCCLUSAL VIEW

### d. Marginal Ridge Grooves of Mandibular Premolars From the Occlusal View

On both the two-cusp and three-cusp second premolar types, grooves crossing the marginal ridges (that is, marginal ridge grooves) are not commonplace. [On the mesial marginal ridge, only 24% of 200 teeth had grooves crossing them, compared to distal marginal ridge grooves on only 11%.] The first premolar is much more likely to have a mesiolingual groove.