University of Washington
Department of Restorative Dentistry

2009-2010
RESD 515:
Course Director:  S Dogan
Assistant Director:  J Wataha

RESD 516:
Course Director:  J Wataha
Assistant Directors:  S Dogan, J Newman

RESD 517:
Course Director:  S Dogan
Assistant Director:  T Mitchell

Affiliate Faculty Members

Jeff Abolofia, DDS
David Chen, DDS, PS
James Johnson, DDS
Chris Lewis, DDS
Tom Mitchell, DDS
Reza Nebaie, DDS
Tom Quickstad, DDS
Saman Saghafi, DDS
Curtis Sapp, DDS, PS
Tuanh Smith, DDS
Jennifer Strelow, DDS
Attila Talaber, DMD
Wallace Wong, DDS, PS
Eric S Yao, DDS

Senior Student TAs
Kyle Ettinger
Daniel Seetin

RIDE Faculty:
Richard McCoy, DDS, MS
Jack Ashlock, DDS
GENERAL INFORMATION

ATTENDANCE and ABSENCES

Attendance for all lectures and laboratory sessions are mandatory. Absences from lecture or laboratory sessions must be approved in advance if at all possible in the opinion of the course director. Course directors strongly discourage you to miss lecture and/or laboratory sessions because of personal reasons. If an unforeseen situation arises that causes an absence, it must be documented in writing (email OK) to the course director as soon as possible. The course director reserves the right to decide if makeup sessions exercises or exams are possible.

ETHICAL AND PROFESSIONAL BEHAVIOR

Professional and ethical behavior is a mindset that you will develop in dental school and carry with you into your professional careers. As community leaders, you will be expected to behave to the highest standards of human behavior. Because of this reality for members of our profession, students are expected to behave in an ethical and professional manner during the lectures and labs as part of their development toward competent dental professionals.

During lectures, students should be respectful of the needs of others to hear and see and should not disrupt or interrupt the lecture. Students are expected to maintain the security of their written exams and quizzes. Students should not give or receive unauthorized aid on exams or quizzes.

During the laboratory, students should accept criticism in a professional manner and be respectful of the needs and time of others. Students should assess their work accurately, learn to admit weaknesses, take criticism professionally, and strive to improve. Students should be professional about their assessment of the work of other students. Students should not give or receive unauthorized aid during the competency exams, and should not take the work of others as their own during the weekly lab exercises or exams.
To determine the course grade, the overall course percentage will be rounded to one digit past the decimal (e.g., 86.5); the grade will be assigned according to the table below:

<table>
<thead>
<tr>
<th>Overall Course %</th>
<th>Grade</th>
<th>Overall Course %</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-96.0</td>
<td>4.0</td>
<td>69.9-68.7</td>
<td>1.9</td>
</tr>
<tr>
<td>95.9-94.7</td>
<td>3.9</td>
<td>68.6-67.4</td>
<td>1.8</td>
</tr>
<tr>
<td>94.6-93.4</td>
<td>3.8</td>
<td>67.3-66.1</td>
<td>1.7</td>
</tr>
<tr>
<td>93.3-92.1</td>
<td>3.7</td>
<td>66.0-64.8</td>
<td>1.6</td>
</tr>
<tr>
<td>92.0-90.8</td>
<td>3.6</td>
<td>64.7-63.5</td>
<td>1.5</td>
</tr>
<tr>
<td>90.7-89.5</td>
<td>3.5</td>
<td>63.4-62.2</td>
<td>1.4</td>
</tr>
<tr>
<td>89.4-88.2</td>
<td>3.4</td>
<td>62.1-60.9</td>
<td>1.3</td>
</tr>
<tr>
<td>88.1-86.9</td>
<td>3.3</td>
<td>60.8-59.6</td>
<td>1.2</td>
</tr>
<tr>
<td>86.8-85.6</td>
<td>3.2</td>
<td>59.5-58.3</td>
<td>1.1</td>
</tr>
<tr>
<td>85.5-84.3</td>
<td>3.1</td>
<td>58.2-57.0</td>
<td>1.0</td>
</tr>
<tr>
<td>84.2-83.0</td>
<td>3.0</td>
<td>56.9-55.7</td>
<td>0.9</td>
</tr>
<tr>
<td>82.9-81.7</td>
<td>2.9</td>
<td>55.6-54.4</td>
<td>0.8</td>
</tr>
<tr>
<td>81.6-80.4</td>
<td>2.8</td>
<td>54.3-53.1</td>
<td>0.7</td>
</tr>
<tr>
<td>80.3-79.1</td>
<td>2.7</td>
<td>≤ 53.0</td>
<td>0.0</td>
</tr>
<tr>
<td>79.0-77.8</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77.7-76.5</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>76.4-75.2</td>
<td>2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75.1-73.9</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>73.8-72.6</td>
<td>2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72.5-71.3</td>
<td>2.1</td>
<td></td>
<td></td>
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<tr>
<td>71.2-70.0</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Grades Below 2.0**

For grades > 1.5 but less than 2.0 (e.g., 1.6-1.9), a student will **NOT** be required to remediate or repeat the course providing that he/she scored 70% or better for the combined midterm and final laboratory and written exams. The student will be given a grade of 2.0.

A student with an earned grade of 1.6-1.9 who scored less than 70% for the combined midterm and final laboratory and written exams will be required to take a remediation exam customized at the discretion of the course director to address the student’s deficiencies. A student failing any remediation examination will receive the original grade as the final course grade. A final course grade of 2.0 will be awarded for students passing the remediation exam.

An overall course grade of 1.5 or below will receive the earned grade as the final course grade. There will be no remediation exam(s) permitted in this case before the final grade is issued.
Final course grades of < 2.0 will be reported immediately to the Student Progress Committee for management as directed in the Academic Regulations Manual of the School of Dentistry, with the recommendation that the student repeat the entire course at the next regularly scheduled time. Unless the Student Progress committee dictates otherwise, students are required to earn a grade of 2.0 or greater in RESD 515 to take RESD 516. RESD 517 can be taken only if the student receives a grade of 2.0 or greater in both RESD515 and RESD 516.

Incomplete ('I') grades may be awarded when all of the following circumstances are met: (1) The student does not complete all course requirements by the final day of the course; (2) the student's performance has been satisfactory to within two weeks of the end of the quarter; (3) the student presents proof satisfactory to the course director that circumstances beyond his/her control prevented completion of course requirements. Such proof must be received by the course director no later than the time grades are due at the Registrar's Office according to the University calendar. Incomplete grades will be managed as directed in the Academic Regulations Manual of the School of Dentistry.

**LABORATORY REGULATIONS**
**(DURING HOURS OF INSTRUCTION)**

Please follow the UW School of Dentistry policies at:
http://www.dental.washington.edu/compliance/policies.php under clinical administrative policies list (D1 Simulation Clinic Policy).

The D-1 simulation clinic is a clinic where professionalism in attitude, dress, and cleanliness of the highest order is expected. Requirements include:

*No eating or drinking

*Clean up before and after yourself. You will be held responsible for the cleanliness of your own bench during class hours each day. A messy bench after the laboratory period may result in the loss of points for the week's project at the discretion of the course director.

*Students are expected to comply with the dress code. Follow the SoD dress code for the laboratory! These are safety issues and not personal preferences.

*Protective eyewear is required when using rotary instruments. Get used to them now. It is an OSHA requirement for your office. You must wear your own glasses or the safety glasses from your issue. We also encourage you to use the dental loops in your kit. Learning to work with magnification will help you in later courses.
LABORATORY PROCEDURES

*Students are expected to have a full complement of proper instruments. Lost or broken instruments should be replaced immediately from dental stores. Instructors are not expected to teach if the student is not prepared with proper instruments or materials.

*Do your own work at your assigned bench.

*Plan your time wisely - look ahead to the next project for the day.

*Organize your lab bench and set up for the day’s project.

*Maintain clean instruments, in good condition.

*Make sure papers and projects are turned in with your 2 digit secret number.

*Place a piece of tape with your 2 digit secret number on the top-center of your dentoform.

SCHOOL OF DENTISTRY COMPETENCIES ADDRESSED

RESD 515, 516, and 517 contribute to the following overall UW School of Dentistry competencies:

<table>
<thead>
<tr>
<th>#</th>
<th>Competency</th>
<th>Contribution of RESD 515, 516, 517</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><em>Examine a patient using contemporary diagnostic methods to evaluate the head and neck region and reach a diagnosis of the patient’s oral and craniomaxillofacial health status.</em></td>
<td>Students learn (lecture/preclinic) appropriate location of points of maximum intercuspation and areas of inappropriate occlusal contact, then apply this knowledge as they construct full contour waxups of teeth. This knowledge is basis for later clinical examination in clinic.</td>
</tr>
<tr>
<td>13</td>
<td><em>Assess the dentition to determine the need for orthodontic treatment</em></td>
<td>Students learn (lecture/preclinic) the importance of the direction of applied occlusal force along the long-axis of teeth and the role of orthodontics in adjusting tooth alignment to optimize such forces. Students learn (lecture) the common (Angle’s) classification of occlusion and how anterior and posterior teeth align in each classification, and how optimal occlusal forces may or may not be possible in each classification.</td>
</tr>
<tr>
<td>14</td>
<td><em>Manage periodontal diseases</em></td>
<td>Students learn (lecture/preclinic) the importance of appropriately directed occlusal forces to periodontal health and how misdirected forces may damage periodontal tissues.</td>
</tr>
<tr>
<td>18</td>
<td><em>Practice dentistry within the ethical standards of the dental profession and the law</em></td>
<td>Students learn the potential clinical dichotomies of occlusal function vs. esthetics (in the anterior exercises and competencies) and that the patient must be informed about these dichotomies and that occlusal stability and periodontal health supercede esthetics concerns. Students learn that appropriate occlusal analysis is imperative to the successful diagnosis and treatment of occlusal problems and that ‘short-cuts’ with many contemporary articulators are not an ethically sound option, in spite of their widespread use.</td>
</tr>
<tr>
<td>21</td>
<td><em>Recognize the role of lifelong learning and self-assessment in maintaining competencies</em></td>
<td>Students learn (preclinical exercises and competency exams) the importance of performing self-assessments as a means to continual improvement and growth.</td>
</tr>
</tbody>
</table>
Emergency!

Note: The University Environmental Health and Safety website has more information. If you are disabled, see the University brochure: *Campus Health and Safety, Emergency Evacuation for Persons with Disabilities*.

When you hear the fire alarm:
* Collect your coats, books, and belongings and immediately and calmly exit the classroom, lecture hall, or laboratory. TURN OFF GAS, EQUIPMENT, AND LIGHTS before leaving.
* Go to the nearest exit. Know an alternative exit in case the primary exit is not possible.
* Do NOT use the elevators under any circumstance. Smoke travels rapidly in elevator shafts and power may be lost to the elevators.
* Go to your predesignated emergency assembly point. It is important to let someone know you are no longer in the building.

When there is a power outage:
* Stay at your location; determine if the outage is transient or longer-term; adjust to the lower-light conditions.
* If the outage appears long-term, calmly exit the building.

If there is an earthquake:
* Do NOT run for a building exit. It is dangerous and life-threatening to do this!
* DROP AND COVER your head for protection from falling material.
* After the shaking subsides, calmly evacuate. Do not go back into the building until officials have deemed the building safe. Be prepared for aftershocks by identifying potential points of refuge along your exit path. Once outside the building, move away for the building!
* Do NOT use the elevators under any circumstance.
* Go to your predesignated emergency assembly point. It is important to let someone know you are no longer in the building.

Safety!

Please exercise the following precautions to avoid injury or disabling injury. *It takes milliseconds to be injured in a manner that might end your career!*
* WEAR appropriate eye protection when working. No exceptions!
* Manage your Bunsen burner. NEVER leave your lab bench with the burner lit unattended.
* Minimize the chance of burns by maintaining a neat, organized work area.
* Cover your clothing with a lab coat or gown. Wear full-foot, closed toe shoes. Wear full-length pants. Keep hair tied back. Do not wear dangling jewelry or loose clothing that may be ignited or caught in equipment.
* When working with any equipment or engaged in any process that generates, dust, wear a mask.
* Pay attention to what you are doing!
RESTORATIVE DENTISTRY 515

DENTAL ANATOMY

Lecture, Room T-733, 9:30 - 11:200 AM
Laboratory, D-1 Lab, 12:45 - 4:45 PM

Course Director: S. Dogan
Assistant Director: J. Wataha

University of Washington
Department of Restorative Dentistry

Autumn 2009
ACKNOWLEDGEMENT

I wish to acknowledge the support and efforts supplied by Dr. Richard McCoy during compilation of this syllabus over many years at the University of Washington.

Dr. RICHARD McCOY, D.D.S, M.S.
Dr. McCoy is a 1961 graduate of the University of Washington. He received his M.S. in Restorative Dentistry/Applied Gnathology from Loma Linda. After his retirement from the U.S. Navy in 1988 he taught at Northwestern before coming to the University of Washington. He retired from the University of Washington in July 2006.
ORIGIN

This manual is derived from the work of many people. The origin of the concepts for the workbook comes from the University of Michigan and an enlightened group of dental educators including:

Major M. Ash, Jr.          Michael A. Baity
Richard E. Corpron        Charles B. Cartwright
John Dowson               James R. Hayward
Richard E. Charlick       Sally Holden
William A. Gregory

The discrimination training concepts were first clearly put forth in the dental educational literature by Dr. William Knight and Dr. Pamela Gunzel

To Dr. Maxwell Anderson to whom we owe our utmost appreciation for development of this excellent workbook.
OBJECTIVES

This course is your first dental lecture and laboratory course presented in the first quarter of your first year of dental school. It introduces you to:

1. The oral cavity.
2. The morphology and anatomy of permanent individual teeth within the oral cavity.
3. The inter-arch and intra-arch relationships between the teeth.
4. Replicating the anatomy of individual teeth in wax for future application to fixed prosthetics and dental materials.

This course is followed by a functional waxing and occlusion course which deals with the functions of the teeth and temporomandibular joint. The lectures will stress nomenclature (you need to learn the language of dentistry) and morphologic concepts of the teeth. You need to be able to accurately reproduce the appropriate anatomy clinically in filled resins, amalgam, and gold and to communicate what is right and wrong with the anatomy of any crown to your laboratory technician. These skills are important to your future practice of dentistry.

BEHAVIORAL OBJECTIVES (EXPECTED OUTCOMES)

Upon completion of this course you should be able to:

1. Recognize the normal anatomic, physiologic, and biomechanical relationships of the dental structures for diagnosis and treatment of oral pathology as it involves the dentition.
2. Recognize and define the shape and contour relationship of the normal dentition.
3. Identify, describe, and be able to reproduce in drawings and wax, the morphology of permanent teeth from both an external perspective and a cross-sectional view.
4. Discuss the relationships between teeth and the investing and supporting structures.
5. Correctly name the individual parts of the permanent teeth.

6. Recognize the clinical significance of tooth form and contour.

**GRADES**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>140</td>
</tr>
<tr>
<td>Drawing Exercises</td>
<td>140</td>
</tr>
<tr>
<td>Petite Rounds</td>
<td>140</td>
</tr>
<tr>
<td>Laboratory Exercises</td>
<td>915</td>
</tr>
<tr>
<td>Midterm Laboratory Examination</td>
<td>120</td>
</tr>
<tr>
<td>Midterm Tooth Identification Test</td>
<td>165</td>
</tr>
<tr>
<td>Final Laboratory Examination</td>
<td>120</td>
</tr>
<tr>
<td>Final Written Examination</td>
<td>260</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2000</strong></td>
</tr>
</tbody>
</table>
Laboratory Projects  All students are required to complete all laboratory exercises in order to pass the course.

Laboratory Criteria - We will add wax to our dentoform models to recreate lost tooth structure in the correct morphologic relationship to the adjacent teeth and the opposite arch. These exercises will be graded according to the written criteria you will receive for each project. Again, once graded, you may retain the final product for future reference. Any waxup done with the wrong wax or on the wrong tooth preparation will receive “no points” for that waxup.

In addition to the waxing projects, you will be graded on the neatness of your laboratory space. Instructors will evaluate your work area both during and after the close of the laboratory period. Since each of the laboratory periods is a timed event, you must complete the project on time. You will be required to leave the lab on time and we will grade the neatness and cleanliness of your work area. This will be a subtractive grade. That is, you will receive the full point total for a clean work area since we assume you are a neatness freak. You will lose up to 20 points for the respective laboratory session points for a messy area.
**Drawing Exercises (140 points)** - Two drawings will be required on Week #2 and three drawings will be done in class each of the following six weeks. Twenty-five minutes will be allocated each week for the drawings.

In preparation for these drawing quizzes, there are illustrations in each chapter which exhibit “blank” areas for you to practice your drawings. The “Appendix For Drawings” at the end of Chapter 8 is comprised of acceptable drawings which you may use to check your effort, either by comparing side-by-side or use as an overlay.

**Quizzes (140 points)** - There will be weekly quizzes (7) given during each lecture period starting with Week 2. Each quiz will be worth 20 points. There will be no “make up” for missed quizzes.

**Petite Rounds (140 points)** - The first 20 minutes of each laboratory session will be devoted to group testing as specified on page 11.

**Midterm Tooth ID Test (165 points)** - During the lecture period of the next to last day of the course, a natural tooth identification test will be given as part of your mid-term examination.

**Written Final Exam (260 points)** - This exam will contain drawings and questions from the syllabus, lectures, and from the 3D Interactive Tooth Atlas.
Textbooks, Software and Syllabi

REQUIRED

1. Dental Anatomy and Occlusion Syllabus
   University of Washington, Seattle, 2009

2. 3D Interactive Tooth Atlas
   Brown & Herbranson Imaging

3. Waxing DVDs are available in the Health Sciences Library.
   by David Newell and Mike Bowman

OPTIONAL

1. Wheeler’s Dental Anatomy, Physiology, and Occlusion:
**LABORATORY PROTOCOL**

With the exception of the first lab, the laboratory protocol will **generally** follow the following scheme:

**Lab Schedule for RESD 515 (Students)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:45 - 1:05 pm</td>
<td>Petite Rounds</td>
</tr>
<tr>
<td>1:05 - 1:45</td>
<td>First Wax Up Exercise</td>
</tr>
<tr>
<td>1:45 - 2:05</td>
<td>Instructor Grade First Wax Up (Pass/Fail)</td>
</tr>
<tr>
<td>2:05 - 2:45</td>
<td>Second Wax Up</td>
</tr>
<tr>
<td>2:45 - 3:00</td>
<td>Self Evaluation, Partner Evaluation, Consensus Evaluation</td>
</tr>
<tr>
<td>3:00 - 3:30</td>
<td>BREAK - <strong>No students</strong> in the D1-Laboratory</td>
</tr>
<tr>
<td>3:30 - 4:45</td>
<td>Instructor-Student Wax Up Coaching</td>
</tr>
</tbody>
</table>

**Lab Schedule for RESD 515 (Instructors)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:15 - 1:45</td>
<td>MEETING in the Instructors Room</td>
</tr>
<tr>
<td>1:45 - 2:05</td>
<td>Instructor Grade First Wax Up (Pass/Fail)</td>
</tr>
<tr>
<td>2:05 – 3:00</td>
<td>BREAK</td>
</tr>
<tr>
<td>3:00 - 3:30</td>
<td>Instructor Grade Second Wax Up</td>
</tr>
<tr>
<td>3:30 - 4:45</td>
<td>Instructor-Student Wax Up Coaching</td>
</tr>
</tbody>
</table>

1. **PETITE ROUNDS**: A group exercise will precede each waxing exercise. In this exercise you will be randomly assigned with a group of four or five other classmates.

   Your group, and the nine other groups in the class will rotate through ten stations, at each of which will be either a tooth to identify or an error model accompanied by a correct tooth for you to identify. You will have **90 seconds** at each station. Your group must decide which model is in error and identify the specific error or correctly identify the natural tooth. **You must form a consensus opinion** for all answers. You will receive the same grade as the rest of your group. **Argue for what you believe**. The grade becomes part of your laboratory grade for the course.

   Your group answer sheet will be returned to the first name on the discrimination answer sheet for that day after the scores have been entered on the grade sheet.
2. **WAXING EXERCISE:** You will individually wax each of the tooth types.

**SETUP:** Set up the dentoform for the waxing exercise and view the tooth to be waxed. Gain some concept of where you will add wax and how much you will need in each area. Review the criteria for this waxing exercise. Know what’s expected to meet the criteria.

**FIRST WAX EXERCISE:** Start to apply wax when instructed to do so. Time guidelines are indicated on the laboratory exercise schedule for that day. At the completion of this portion of the waxing exercise, you **MUST** put down your waxing instruments when instructed to do so.

**SECOND WAX EXERCISE:** Start to apply wax when instructed to do so. Time guidelines are indicated on the laboratory exercise schedule for that day. At the completion of this portion of the waxing exercise, you **MUST** put down your waxing instruments when instructed to do so.

a. **EVALUATE YOUR WAXING** against the waxing criteria. You are to determine whether your pattern meets the criteria and if not, what errors are present when viewed against the criteria for this waxing.

b. **EVALUATE YOUR LAB PARTNER’S WAXING:** After evaluating your own waxup, you will trade waxups with an assigned classmate. You will then have about five minutes to evaluate your classmate’s product against the same criteria you evaluated your product against.

c. **CONSENSUS EVALUATION:** You and the classmate with whom you traded wax patterns, will form a **consensus opinion** on both of the patterns. The mark on the evaluation sheet will reflect a consensus opinion.

d. **INSTRUCTOR EVALUATION:** All students will be required to take a break while the faculty evaluates your waxup. At the end of the break, you will return and see what errors the instructor saw. If there is agreement between your consensus opinion and the instructor, everything is fine. If there are differences, then the instructor will be available to discuss the differences with you.

**ERROR CORRECTION:** After any discrepancies in evaluation of your waxup have been clarified between you and your instructor, you will have until **4:45 PM** to correct any discrepancies. When that time is up, all grading will cease and no additional points will be given for discrepancy correction. Remember that discrepancies **MUST** be corrected without losing criteria you have already correctly achieved in order to receive credit for the final evaluation.
# DENTAL ANATOMY RESD 515
## COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture</th>
<th>Lab</th>
</tr>
</thead>
</table>
| OCT 02 | Overview of the course, and dental terminology **(DOGAN)** | 1. Petite Rounds Exercise  
2. Prepare typodont for assembly  
4. Waxing DVD  
5. Practice waxing exercise - wax #9 \(\frac{1}{2}\) central incisor |
| OCT 09 | Maxillary incisors (Quiz on Units 1 & 2) **(LEWIS)** | 1. Petite Rounds  
2. Wax #8 - full crown maxillary central incisor |
| OCT 16 | Mandibular incisors (Quiz on Units 2 & 3) **(MITCHELL)** | 1. Petite Rounds  
2. Wax #7 - full crown maxillary lateral incisor |
| OCT 23 | Maxillary and mandibular canines (Quiz on Units 3 & 4) **(ABOLOFIA)** | 1. Petite Rounds  
2. Wax #6 - full crown |
| OCT 30 | Maxillary premolars (Quiz on Units 4 & 5) **(DOGAN)** | 1. Petite Rounds  
2. Wax #4 - full crown |
| NOV 06 | Mandibular premolars (Quiz on Units 5 & 6) **(LEWIS)** | 1. Petite Rounds  
2. Wax #29 - full crown |
| NOV 13 | Mandibular molars (Quiz on Units 6 & 7) **(LEWIS)** | 1. Petite Rounds  
2. Wax molar #30 - full crown |
| NOV 20 | Maxillary molars (Quiz on Units 7 & 8) **(ABOLOFIA)** | 1. Petite Rounds  
2. Wax #3 - full crown |
| DEC 04 | Natural Tooth Identification Test **(DOGAN)** | MID-TERM LABORATORY EXAMINATION |
| DEC 11 | FINAL LECTURE EXAMINATION **(DOGAN)** | FINAL LABORATORY EXAMINATION |
WORKBOOK EXERCISES

PROTOCOL

Most workbook units consist of the following sections:

1. **OBJECTIVES** - A list of what knowledge you should obtain from the specific unit. Read these carefully because you will be tested on these specific items.

   You have to review each week the corresponding unit in your 3D Interactive Tooth Atlas.

2. **GENERAL PROCEDURES** - A listing of how to complete the section and the proper sequence of events for a thorough understanding of the material presented. This section also contains the reading assignment.

3. **GLOSSARY** - The terms you are expected to know for each week of the course. The glossary is introduced as we progress through the course. Keep up and make sure you can use the words from the glossary in speech and written communications. You will be tested on the terms. This is the language of dentistry.

4. **LABELING AND IDENTIFICATION** - A series of drawings relevant to the specific tooth or teeth we are covering in this lesson. Some of the terms will be new and some will be application of the glossary terms. You should be able to identify these areas and specific structures for test purposes.

5. **EXERCISE** - A series of questions or drawings which you perform. If there are drawings, they will have the criteria by which they are to be evaluated.
FIRST WAX EXERCISE will be graded as PASS or FAIL!
The grade you receive for your SECOND WAX EXERCISE will combine your ability to meet the criteria for each project and evaluation of your work. After your waxup, you and your partner will perform evaluations about how well your project meets each criteria. An instructor will then grade your project in the same manner. You will receive 3 points for each criteria where you and the instructor agree that the criteria has been met, 1 point will be given where there is agreement that the criteria has not been met, and no points given where there is disagreement. After the instructor’s evaluation, you will have until 4:45 PM to correct deficiencies to the instructor’s satisfaction. When met, this will mean an additional 3 points in the final evaluation column for each criteria satisfied.

No points will be awarded after 4:45 PM.
OCTOBER 02

Unit: 1
Lecture: DR. DOGAN
10:00 - 11:30 Overview of Course
Dental Terminology

Lab:
12:45 - 4:45
Petite Rounds
Prepare dentoform for assembly
Check 2½ dimension models
Review instrument issue and View Waxing Video
Preliminary waxing exercise (½ #9)

Points: NONE

OCTOBER 09

Unit: 2
Lecture: DR. LEWIS
9:30 - 11:20 Quiz (20 points)
Drawing maxillary incisors (14 points)
Lecture on maxillary incisors/criteria explanation #8

Lab:
12:45 - 4:45 Petite Rounds (20 points)
1st Waxup of #8 (21 points)
2nd Waxup of #8 (84 points)
Self evaluation, partner evaluation, consensus evaluation
Instructor evaluation
Discrepancy discussion and correction

Total Points = 159
OCTOBER 16

Unit: 3
Lecture: DR. MITCHELL
9:30 - 11:20 Quiz (20 points)
      Drawings (21 points)
      Lecture on mandibular incisors/criteria explanation #7

Lab:
12:45 - 4:45 Petite Rounds (20 points)
        1st Waxup of #7 (21 points)
        2nd Waxup of #7 (84 points)
        Self evaluation, partner evaluation, consensus evaluation
        Instructor evaluation
        Discrepancy discussion and correction

Total Points = 166

OCTOBER 23

Unit: 4
Lecture: DR. ABOLOFIA
9:30 - 11:20 Quiz (20 points)
      Drawings (21 points)
      Lecture on the canines/criteria explanation #6

Lab:
12:45 - 4:45 Petite Rounds (20 points)
        1st Waxup of #6 (21 points)
        2nd Waxup of #6 (84 points)
        Self evaluation, partner evaluation, consensus evaluation
        Instructor evaluation
        Discrepancy discussion and correction

Total Points = 166
OCTOBER 30

Unit:  5  
Lecture: DR. DOGAN  
9:30    -  11:20 Quiz (20 points)  
Drawings (21 points)  
Lecture on the maxillary premolars/criteria explanation #4  

Lab:  
12:45  -  4:45  
Petite Rounds (20 points)  
1\textsuperscript{st} Waxup of #4 (30 points)  
2\textsuperscript{nd} Waxup of #4 (120 points)  
Self evaluation, partner evaluation, consensus evaluation  
Instructor evaluation  
Discrepancy discussion and correction  

Total Points = 211

NOVEMBER 06

Unit:  6  
Lecture: DR. LEWIS  
9:30    -  11:20 Quiz (20 points)  
Drawings (21 points)  
Lecture on the mandibular premolars/criteria explanation #29  

Lab:  
12:45  -  4:45  
Petite Rounds (20 points)  
1\textsuperscript{st} Waxup of #29 (30 points)  
2\textsuperscript{nd} Waxup of #29 (120 points)  
Self evaluation, partner evaluation, consensus evaluation  
Instructor evaluation  
Discrepancy discussion and correction  

Total Points = 211
NOVEMBER 13

Unit: 7
Lecture: DR. LEWIS
9:30 - 11:20 Quiz (20 points)
         Drawings (21 points)
         Lecture on the mandibular molars/criteria explanation #30

Lab:
12:45 - 4:45 Petite Rounds (20 points)
         1st Waxup of #30 (30 points)
         2nd Waxup of #30 (120 points)
         Self evaluation, partner evaluation, consensus evaluation
         Instructor evaluation
         Discrepancy discussion and correction

Total Points = 211

NOVEMBER 20

Unit: 8
Lecture: DR. ABOLOFIA
9:30 - 11:20 Quiz (20 points)
         Drawings (21 points)
         Lecture on maxillary molars/criteria explanation #3

Lab:
12:45 - 4:45 Petite Rounds (20 points)
         1st Waxup of #3 (30 points)
         2nd Waxup of #3 (120 points)
         Self evaluation, partner evaluation, consensus evaluation
         Instructor evaluation
         Discrepancy discussion and correction

Total Points = 211

NOVEMBER 26-27

HAPPY THANKSGIVING
DECEMBER 04

Lecture: DR. DOGAN - Natural Tooth Identification Test (165 points)

LAB: MIDTERM EXAMINATION (120 POINTS)

You will have from 01:00 until 2:30 to complete the waxup of a crown of a selected anterior or premolar tooth. The tooth preparation and wax to use will be given to you in class. The waxup can be any tooth we have discussed in lecture. You may use your 2½ dimension models to help with this test.

DECEMBER 11 - FINAL EXAMINATIONS

Lecture Examination - 260 points will be all inclusive of the course including lecture, syllabus, and 3D Interactive Tooth Atlas.

Laboratory Examination - 120 points (waxup) will be similar to the midterm. You will have from 01:00 until 2:30 for the waxup. You may use 2½ dimension models and your syllabus and 3D Interactive Tooth Atlas. Wax will be provided.
UNIT 1
DENTAL TERMINOLOGY AND NOMENCLATURE

This unit is concerned with the explanation and illustration of dental terminology relating to tooth anatomy and morphology. It deals primarily with two groups of terms, the first relating to the anatomical and supporting structures of the tooth, and second consisting of terms of orientation.

1. OBJECTIVES

Upon completing this unit, you should be able to:

A. Demonstrate your understanding of all the terms listed in the glossary in written and verbal communication.

B. Identify all basic and supporting structures of the tooth listed in the glossary.

C. Identify and locate the teeth in the dentition by name, number, arch, and quadrant.

D. Identify the areas indicated by terms of orientation.

E. Combine terms of orientation according to the guidelines given.

2. GENERAL PROCEDURES

• ATTEND THE CLASS

• COMPLETE NOMENCLATURE AND SELF-TEST ON UNIT 1

• Review “3D INTERACTIVE TOOTH ATLAS”

• REVIEW LABORATORY WAXING DVD (Available in the Library)
3. **GLOSSARY**

**Alveolar Bone** - the bone of the maxillae or mandible that surrounds and supports the teeth

**Alveolus** - the bony lining of the socket that holds the root(s) of the tooth and is a portion of the maxillary and mandibular process

**Anterior** - along or toward the front of the dental arch

**Apical Foramen** - the main opening at the apex of a root for entry and exit of pulp tissue

**Arch** - in dental anatomy, the arrangement of the teeth in the form of a curve

**Biologic Width** - the area, 2.04 mm average, between the base of the gingival sulcus and the alveolar crest

**Buccal** - toward the cheek; that surface of posterior teeth (premolars, molars) in contact with or facing the cheek

**Cementoenamel Junction (CEJ)** - the junction of the cementum and the enamel (generally visibly indicated by the cervical line running along the cervix (neck) of the tooth

**Cementodentinal Junction (CDJ)** - the junction of the cementum and the dentin

**Cementum** - a hard tissue forming the outer cover of the root of a tooth and surrounding the dentin along the root portion of the tooth

**Crown** - the portion of the tooth from the CEJ to the incisal/occlusal surface that is covered by enamel. The entire area from the CEJ to the incisal/occlusal surface is more strictly called the *anatomical crown*. In a healthy mouth, however, the anatomical crown is not fully visible, being surrounded along the cervical area by gingiva. The visible portion of the crown is called the *clinical crown*.

**Dentin** - that portion of the tooth underlying the enamel and cementum and surrounding the pulp cavity. Dentin comprises the bulk of the tooth.

**Dentinoenamel Junction (DEJ)** - the junction of the dentin and the enamel
**Distal** - away from the midline of the arch

**Enamel** - a hard, mineralized tissue forming the outer cover of the anatomical crown of a tooth and surrounding the dentin in the crown portion of a tooth

**Facial** - relating to or involving the face; an inclusive term for the labial and buccal surfaces, both surfaces being in direct contact with areas of the face

**Gingiva** - that part of the periodontium that consists of mucosal tissue and surrounds a tooth at the cervix and extends to cover the maxillary and mandibular alveolar processes

**Incisal** - pertaining to the cutting or tearing surface of anterior teeth (incisors, canines)

**Labial** - toward the lips; that surface of anterior teeth directly contacting or facing the lips

**Lingual** - toward the tongue; that surface of anterior and posterior teeth immediately adjacent to or facing the tongue

**Mandibular** - relating to the mandible or lower jaw

**Maxillary** - relating to the maxilla or upper jaw

**Mesial** - toward the midline of the arch. The surface of anterior and posterior teeth facing toward the midline

**Midline** - an imaginary line dividing a body into left and right; an imaginary line dividing the maxillary and mandibular arches into maxillary and mandibular left and right **quadrants**

**Occlusal** - pertaining to the grinding, crushing, and chewing surface of posterior teeth

**Perikymata** - parallel ridges formed by cyclic deposition of enamel

**Periodontal Membrane (Ligament)** - a complex of collagenous fiber bundles that surrounds the root(s) of a tooth and connects the cementum with the alveolar bone

**Periodontium** - an inclusive term for the supporting and investing structures of a tooth. The main structures are gingiva, alveolar bone, cementum, and periodontal ligament

**Posterior** - along or toward the back or rear of the dental arch
**Pulp** - an innervated connective tissue possessing the formative, nutritive, sensory, and defensive functions essential to the nourishment and vitality of a tooth

**Pulp Cavity** - the space or void housing the entire dental pulp

**Pulp Chamber** - that portion of the pulp cavity that is housed in the coronal section of a tooth

**Pulp Canal (root canal)** - that portion of the pulp cavity that extends from the pulp chamber to the apex of the root of a tooth

**Quadrant** - half of the maxillary or mandibular arch, when divided by the midline

**Root** - that portion of a tooth covered by cementum and embedded in a bony socket call the alveolus

**Root Apex** - the end or furthest point of the root of a tooth

**Vestibule** - the portion of the oral cavity bounded on one side by the teeth, gingiva, and alveolar ridge; and on the lateral side by the lips and cheeks. Referred to as **buccal, labial, and/or facial vestibule.**
4. **LABELING AND IDENTIFICATION** of the tooth: Basic and supporting structures

Directions:

A. **Locate and label** the following on Figure 1-1

1. anatomical crown
2. clinical crown
3. root
4. apical foramen
5. cementoenamel junction or CEJ or cervical line
6. cementodentinal junction or CDJ
7. dentinoenamel junction or DEJ
8. pulp chamber
9. root apex
10. pulp canal
11. periodontal ligament
12. alveolar bone
13. gingiva
14. cementum
15. dentin
16. enamel

B. **List** the structures on Figure 1-1 that comprise the periodontium.

1.
2.
3.
4.
B. THE PERMANENT DENTITION

Directions: **Label** the following on Figure 1-2 (view taken from front of patient):

a. **All** teeth by number. (Label on the **lingual side** of the arch.)

b. **Each tooth** in the **maxillary left quadrant** by name.

c. **All maxillary right anterior** teeth by name.

d. **All mandibular right posterior** teeth by name.
C. **Terms of Orientation**

Terms of orientation have functions similar to the adjectives and adverbs that occur in daily language. In dentistry, they are used to describe and indicate place, direction, and extent. Many of them originate from anatomical terms, e.g., alveolar (alveolus), apical (apex), cervical (cervix), coronal (crown), pulpal (pulp), radicular (root). They appear in single, combined, or compound forms. For the purposes of this course, we will be using examples of terms of orientation in describing tooth surfaces, line and point angles, and in designating related anatomical areas.

Directions:

Identify the surfaces indicated by arrows on Figure 1-3 by name.

Arrow

A =

B =

C =

D =

E =

F =

G =
COMBINING TERMS OF ORIENTATION

Directions:
1. **Read Introduction** to Combined terms of Orientation
2. **Study Procedure** for Combining Terms of Orientation
3. **Do Exercises**

INTRODUCTION

Terms of orientation are usually combined to indicate an area which includes or is formed by two or more surfaces. An area of the tooth that is usually described by combined terms of orientation is the tooth angle. Tooth angles are formed by the meeting of two or three surfaces. These angles are identified by the surfaces that form them. For example, the mesiolabial angle is understood to be the junction of the mesial and labial surfaces.

There are two types of tooth angles: **line angles** and **point angles**. Two surfaces make up a line angle; three surfaces make up a point angle. (In some cases wherein a tooth angle is not specified as either a line or a point angle, the number of surfaces combined indicates the type of tooth angle.) In order to show how the surfaces of the tooth meet, the tooth is usually compared to a box with its edges and corners representing line and point angles respectively. This is illustrated below.

![Diagram of tooth angles](image)

**Fig. 1-4**
PROCEDURES FOR COMBINING TERMS OF ORIENTATION

1. The procedures for combining the names of the surfaces constituting either a line angle or a point angle are the result of general practice and long usage. They are as follows:
   
a. **Mesial and distal precede all other terms.**
   
e.g., mesiobuccal line; distolinguoincisal point angle

b. **Labial, buccal, facial, and lingual** follow mesial or distal and precede incisal or occlusal in any combination.
   
e.g., distolabial line angle; labioincisal line angle; mesiobucco-occlusal point angle

c. **Incisal and occlusal occur last in any combination.**
   
e.g., linguoincisal line angle; disto-occlusal line angle; mesiolinguo-occlusal point angle

   **MESIAL, DISTAL**

   **BUCCAL, LINGUAL, FACIAL, LABIAL**

   **INCISAL, OCCLUSAL, GINGIVAL**

   d. To achieve a pleasant sound and a degree of uniformity, certain letters in the combined terms are dropped and substituted. In a two-term combination, the final letters **AL** are dropped from the first term and replaced by **O**. The second term remains unchanged. In a three-term combination, the final letters **S** or **L** are dropped from each of the first two terms and replaced by **Os**. The third or last term remains unchanged.
   
e.g., mesial-lingual angle = mesiolingual line angle
distal-labial-incisal point angle = distolabioincisal point angle

e. A hyphen separates the term occlusal from the preceding term in any combination in which it occurs,
   
e.g., mesio-occlusal line angle; distobucco-occlusal point angle

2. In other circumstances, procedures for combining terms of orientation are more flexible. For example, in designating a direction on, or a section of an anterior
tooth extending from the incisal surface to the root apex, it is acceptable to describe the direction or section either as incisoapical or apicoincisal. Note that, as in tooth angles, the final letters AL are dropped from the first term and replaced by O.

**NOTE:** Combined terms of orientation are usually abbreviated by using the first letters of the indicated surface.

e.g., mesiodistal -> MD; buccolingual -> BL

Once you are familiar with the meaning and function of each term of orientation, you will be able to relate the abbreviated form with the complete term.

**EXERCISE**

Directions:

a. Combine the terms of orientation in the following exercise:

1. A line angle formed by a distal and labial surface would be called a ______________________ line angle.

2. The junction of the labial surface and the incisal surface is the ______________________ line angle.

3. The meeting of the buccal and occlusal surfaces would form what type of an angle? ________________________

4. The line angle formed by the occlusal and mesial surfaces is called the ________________________ line angle.

5. What do you call the point angle formed by the mesial, lingual, and incisal surfaces? ________________________.

6. The point angle formed by the junction of the distal, buccal, and occlusal surfaces is called the ________________________ point angle.

7. The junction formed by the occlusal, lingual, and distal surfaces is called the ________________________ point angle.

8. A line extending from the neck to the root end of the tooth indicates a ______________________ or __________________ direction.
9. On Figure 1-5, draw a double-headed arrow indicating the **mesiodistal** width of the crown.

Fig 1-5 Mandibular Left Canine, Labial (Facial) View
b. Dividing Into Anatomical Thirds

Directions:

Divide Figure 1-6 to 1-9 into the anatomical thirds indicated for each figure.

Figure 1-6

1. Divide the crown of the right incisor into: cervical, middle, and incisal thirds.

2. Divide the crown of the left incisor into: distal, middle, and mesial thirds.

3. Divide the root of the right central incisor into: apical, middle, and cervical thirds.

Figure 1-7 Divide the crown and root into lingual, middle, and labial thirds.

Figure 1-6 Maxillary Right and Left Central Incisors, Labial (Facial) View

Figure 1-7 Maxillary Right Central Incisor, Distal View
Figure 1-8

1. Divide the Crown into:
   a. distal, middle, and mesial thirds
   b. occlusal, middle, and cervical thirds

2. Divide the roots into cervical, middle, and apical thirds.

Figure 1-8 Mandibular Left First Molar, Buccal View

Figure 1-9 Divide the crown into buccal, middle, and lingual thirds.

Figure 1-9 Mandibular Left Second Premolar, Mesial View
9. SELF-TEST

1. Which of the following groups of terms describe the areas indicated on Figure 1-10 in order apicoincisally?

   a. pulp chamber, dentin, pulp canal, alveolar bone, apical foramen
   b. anatomical crown, pulp canal, pulp chamber, CEJ, cementum
   c. alveolar bone, root canal, cementum, gingiva, and dentin
   d. apical foramen, alveolar bone, gingiva, cementum, CEJ
   e. none of the above

Figure 1-10 Labiolingual Section of a Maxillary Central Incisor
2. The double-headed arrow on Figure 1-11 describes what direction?
   a. occlusocervical
   b. labiolingual
   c. incisocervical
   d. occlusoapical
   e. cervicoapical

Figure 1-11
Mandibular Right First Molar, Buccal View

3. Which of the following describes area C on figure 1-12?
   a. lingual third
   b. labial third
   c. middle third
   d. apical third
   e. incisal third

Figure 1-12
Maxillary Right Central Incisor, Mesial Aspect
4. Which of the following is true about premolars?
   a. They follow canines and precede molars
   b. There are usually four of them in each arch
   c. They are located posteriorly in the arch
   d. All of the above
   e. None of the above

5. Which of the following groups of numbers identify the maxillary left anterior teeth?
   a. 6, 7, 8
   b. 14, 15, 16
   c. 9, 10, 11
   d. 23, 24, 25
   e. 2, 3, 4

6. That portion of the pulp cavity found mainly within the coronal portion of the tooth is called the:
   a. pulp canal
   b. pulp cavity
   c. root canal
   d. pulp chamber
   e. pulp space

7. The junction of the dentin and the enamel is called the:
   a. gingival line
   b. cervical line
   c. cervicoenamel ridge
   d. dentinoenamel junction
   e. none of the above

8. Which of the following is an example of a correctly formulated point angle?
   a. mediodistal
   b. disto-occlusoincisal
   c. distolabioincisal
   d. mesiolinguodistal
   e. bucco-occlusal
9. Which of these statements is **false** concerning the anatomical crown of the tooth?

a. it is located over the pulp chamber
b. it is covered by enamel
c. cementum can cover a very small part of the anatomical crown
d. it is fully visible in a healthy mouth
e. none of the above
LABORATORY EXERCISE #1

DENTAL ANATOMY

OBJECTIVES

1. Preview the Typodont
2. Check your 2.5X models
3. Select waxing instruments
4. Waxing DVD
5. Waxing Exercise
LABORATORY EXERCISE #1

INSTRUMENTS

a. Identify each of the following instruments from your issue and set them aside, then put away the remainder of your issue. We will use it at a later date.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosewood Lab Knife</td>
<td>carve stone</td>
</tr>
<tr>
<td>Yeti Gray sculpturing wax</td>
<td>wax for initial waxing exercises</td>
</tr>
<tr>
<td>AB2/BB2 burnisher</td>
<td>carrying wax for bulk addition</td>
</tr>
<tr>
<td>D-4 carver (half Hollenback)</td>
<td>carve wax</td>
</tr>
<tr>
<td>UW 1</td>
<td>carrying small amounts of wax and</td>
</tr>
<tr>
<td>PKT 2</td>
<td>correcting void (may be heated)</td>
</tr>
<tr>
<td>Touch-O-Matic burner</td>
<td>for heating waxing instruments</td>
</tr>
<tr>
<td>#7 wax spatula</td>
<td>for carrying bulk wax (may be heated)</td>
</tr>
<tr>
<td>Scraper</td>
<td>Clean wax off of counter top</td>
</tr>
<tr>
<td>Plaster spatula #3</td>
<td>mix plaster &amp; stone</td>
</tr>
</tbody>
</table>
WAXING EXERCISE #1

OBJECTIVE: To replace the missing tooth structure for tooth #9 and to use the waxing instruments for the first time. We are not concerned at this time about the beauty of your waxing, only in your gaining some experience with adding wax and carving it to a smooth surface in three dimensions.

PROCEDURES

1. Cover your work area with laboratory bench paper to protect the bench surface.
2. Lay out the instruments you just identified.
3. Connect the tygon tubing and start your Touch-O-Matic bunsen burner. Adjust the flame to a reducing (blue) flame. Ask your instructor for verification of this step.
4. Put your ½ #9 in the appropriate position in your dentoform.
5. Use your AB2/BB2 burnisher or #7 wax spatula to carry bulk wax to the ½ #9 (maxillary right central incisor). The instruments should be heated in the flame and the wax added to the preparation as it starts to cool and gain some viscosity. If the wax is too hot, it will simply flow over everything and be uncontrolled. (Remember, the purpose of this exercise is to gain some appreciation for correctly handling wax.)
6. When you have added a slightly greater amount of wax than needed to reproduce the morphology of #8, use your wax carving instruments to refine the shape of the tooth to mimic the mirror image of #9.
7. If you remove too much, add wax back with the UW 1 or PKT 2 and then recarve to an appropriate shape.
8. If you encounter difficulty, seek help from your instructor.

NOTE: There is an excellent waxing DVD on reserve in the library. It takes you step-by-step through waxing an anterior tooth (#7). It should be helpful to you as you begin waxing.
WAXING CRITERIA:

a. Facial contour - identical to #8 - hold the dentoform up and sight from the distal of #8. Are the contours similar?

b. Incisal height - equal to #8

c. No wax extending over the marked margins on any surface.

d. Distoincisal angle more rounded than the mesioincisal angle and contact slightly more cervical. Same as for tooth #8.

PRELIMINARY WAXING PROCEDURE
(RECOMMENDED FOR EACH WAXING EXERCISE)

1. Mark the tooth’s cut margins (the junction between cut and uncut surfaces) lightly with the side of a very sharp red pencil. This will help you identify exactly where the margin is located.

2. Seat the tooth in your dentoform and analyze it from all aspects; facially, lingually, proximally, and incisally/occlusally. Try to picture the amount of wax needed to wax back the missing tooth structure. The tooth may then be waxed right in the typodont or you may remove it and wax it outside the dentoform. If you remove the tooth, be sure not to add too much wax and preclude seating the tooth back in the dentoform.
<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Your evaluation</th>
<th>Partner’s evaluation</th>
<th>Consensus evaluation</th>
<th>Faculty evaluation</th>
<th>*Final evaluation</th>
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<tbody>
<tr>
<td>1. Finish</td>
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<td>3. Facial outline</td>
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TOTAL ____
UNIT 2
MAXILLARY INCISORS

Unit 2 introduces you to the morphology of permanent maxillary central and lateral incisors. It is the first of a series of units dealing with the morphology of individual teeth in the permanent dentition.

1. OBJECTIVES

Upon completion of this unit, you should be able to:

a. Demonstrate your understanding of all the terms listed in the glossary in verbal and written communication.

b. Identify all areas of maxillary central and lateral incisors that have names.

c. Identify and distinguish between maxillary right and left central and lateral incisors including normal variations.

d. Draw maxillary central and lateral incisors.
   1. singly, and in proper relation to adjacent teeth when shown
   2. according to given criteria

e. Identify and distinguish given sectional views of the pulp in maxillary central and lateral incisors.

f. Satisfactorily complete:
   1. the identification exercise and satisfactorily complete the nomenclature test
   2. the self-test prior to the next class period
2. GENERAL PROCEDURE
   
   A. ATTEND THE LECTURE: “Maxillary Incisors”

   B. COMPLETE EXERCISES IN:
      
      1. Labeling and Pulp Study
      2. Identification
      3. Drawing

   C. COMPLETE NOMENCLATURE AND SELF-TEST on Unit 2

   D. Review “3D INTERACTIVE TOOTH ATLAS”
3. **GLOSSARY**

**Cervix (cervical line)** - is the junction between the crown and root of the tooth. It is often referred to as the neck of the tooth and is demarcated by the cervical line.

**Cingulum** - a point of calcification forming the lingual lobe and part of the height of contour

*Developmental Groove* - lightly depressed line marking the junction of two lobes, e.g., distofacial groove joining the middle and distal lobes on facial surface

**Fossa** - a rounded depression found on the lingual surface of anterior teeth and occlusal surfaces of posterior teeth. The lingual fossa of an incisor is bounded by the cingulum, the mesial and distal marginal ridges, and the incisal ridge or edge.

**Height of Contour** - widest point on the surface of a tooth, e.g., height of contour found on the cingulum, height of contour found on the cervical or gingival 1/3 of the labial surface, or height of contour on a mesial or distal surface. Refer to chart on page 2-4.

**Incisal Ridge** - a thick, elongated elevation along the incisal surface (anterior teeth). An incisal ridge can be seen when there has been little or no incisal wear. A knife-like elongated incisal edge occurs when the incisal ridge is worn.

**Lobe** - that part of a tooth formed by a separate point of calcification. Incisors have four lobes or four points of calcification: mesial, middle, distal, and cingulum.

**Mamelon**- rounded incisal extensions of the labial lobes, e.g., distal, mesial, middle mammelon

*Marginal Ridge* - an elongated elevation bounded by a mesial or distal surface and a depression (fossa), e.g., mesial marginal ridge

**Pit** - a small, pin-point depression, e.g., lingual pit

**Proximal Contact Area** - area on the mesial or distal surface that touches the adjacent tooth in the same arch, e.g., mesial or distal contacts area

**Pulp Horn** - a small incisal extension of coronal pulp tissue

*This term is defined differently for posterior teeth.
4.

**HEIGHTS OF CONTOUR AND CONTACT POSITIONS FOR THE PERMANENT DENTITION**

<table>
<thead>
<tr>
<th>TOOTH</th>
<th>AGE</th>
<th>MESIAL</th>
<th>DISTAL</th>
<th>FACIAL</th>
<th>LINGUAL</th>
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<tbody>
<tr>
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<td>7</td>
<td>I</td>
<td>I/M</td>
<td>C</td>
<td>C</td>
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<td>C</td>
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<td>I/M</td>
<td>M</td>
<td>C</td>
<td>C</td>
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<td>M</td>
<td>M</td>
<td>C</td>
<td>M</td>
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<td>M</td>
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<td>M</td>
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<tr>
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<td>M</td>
<td>M</td>
<td>C</td>
<td>M</td>
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<tr>
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<td>M</td>
<td>M</td>
<td>C</td>
<td>M</td>
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<td>I</td>
<td>C</td>
<td>C</td>
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<td>I</td>
<td>C</td>
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<td>12</td>
<td>M</td>
<td>M</td>
<td>C</td>
<td>M</td>
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</tbody>
</table>

Age = average eruption age  
I = incisal third  
M = middle third  
C = cervical third  
O = occlusal third
PROXIMAL CONTACT AREAS
5. LABELING EXERCISE AND PULP STUDY

a. Labeling exercise

Directions:

Using given terms, label the indicated areas on Figure 2-1 to 2-10.

MAXILLARY CENTRAL INCISOR #8

TERMS for figures 2-1 through 2-5

1. Cervical line
2. Cingulum
3. Distal contact area
4. Distal lobe
5. Distal mammelon
6. Distal marginal ridge
7. Distoincisal angle
8. Distolabial groove
9. Height of contour
10. Incisal ridge
11. Lingual fossa
12. Mesial contact area
13. Mesial lobe
14. Mesial mammelon
15. Mesial marginal ridge
16. Mesioincisal angle
17. Mesiolabial groove
18. Middle lobe
19. Middle mammelon
20. Root apex

Fig 2-1 Labial view
Fig 2-2 Lingual View
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height</th>
<th>Mesiodistal Crown (mm)</th>
<th>Labiolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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</thead>
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<tr>
<td>Maxillary Central</td>
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<td>8.5</td>
<td>7.0</td>
<td>23.5</td>
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</table>

After Kraus

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**Fig 2-3 Incisal View**

**Fig 2-4 Mesial View**

**Fig 2-5 Distal View**
MAXILLARY LATERAL INCISOR #7

TERMS for figures 2-6 through 2-10

1. Cervical line
2. Cingulum
3. Distal contact area
4. Distal lobe
5. Distal mammeloon
6. Distal marginal ridge
7. Distoincisal angle
8. Height of contour
9. Incisal ridge
10. Lingual fossa
11. Lingual pit
12. Mesial contact area
13. Mesial lobe
14. Mesial mammeloon
15. Mesial marginal ridge
16. Mesioincisal angle
17. Middle lobe
18. Middle mammeloon
19. Root apex

Fig 2-6 Labial View

Fig 2-7 Lingual View
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Labiolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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<tbody>
<tr>
<td>Maxillary Central 10.5 8.5 7.0 23.5 7</td>
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<tr>
<td>Maxillary Lateral 9.0 6.5 6.0 22.0 8</td>
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After Kraus

Fig 2-8 Incisal View

Fig 2-9 Mesial View

Fig 2-10 Distal View
1. **Study** the morphology of pulpal sections of the maxillary central and lateral incisor as illustrated on Figure 2-11 to 2-18. **Note** the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of maxillary central and lateral incisors that influence the shape or configuration of their pulpal sections. Pay attention to the cross-sections 2-13 and 2-14. Know how to view these to determine the proper relationships for cross-sections of all the teeth.

2. **Label** the indicated area on figure 2-11 using the glossary as a reference source.
PULPAL SECTIONS OF A MAXILLARY CENTRAL INCISOR

Fig 2-13 Transverse Section at Cervix*

Fig 2-14 Transverse Section at Midroot*

Fig. 2-15 Mesiodistal and Faciolingual Root Sections

*Transverse sections of the root at the Cervix and at the Midroot are illustrated as they appear from an incisal aspect (Figs 2-13 and 2-14).
PULPAL SECTIONS OF A MAXILLARY LATERAL INCISOR

Fig. 2-16 Mesiodistal Section From Labial

Fig 2-17 Labiolingual Section From Mesial

Fig 2-18 Transverse Section at cervix

Fig 2-19 Transverse Section at Midroot
IDENTIFYING CHARACTERISTICS OF:

MAXILLARY CENTRAL AND LATERAL INCISORS

The following list of tooth identifying characteristics has been designed to give you only a few of the more important identifying characteristics of maxillary central and lateral incisors, and to indicate which characteristics are most important. There are many other characteristics which may be helpful in the identification of these teeth. The list given in this workbook is considered substantially adequate in identifying the majority of these teeth. Using your 2 1/2 dimension models, observe the following identifying features.

1. **MAXILLARY CENTRAL INCISOR**

   a. Major characteristics

   1. **Large Size**

      This is the largest incisor in size, averaging 2-3 mm wider mesiodistally than other incisors.

   2. **Sharp Mesioincisal Angle**

      The mesioincisal angle is sharper or more acute than the distoincisal angle.

   3. **Root**

      A cross section of the root at the cervix is triangular with the base of the triangle on the labial and apex on the lingual.

   b. Other Characteristics

   1. **Cingulum Toward Distal**

      The cingulum as viewed from the incisal is either located at the mesiodistal center of the lingual surface or is often swung slightly to the distal.

   2. **Mesial Heights of Contour**

      The height of contour is closer to the incisal edge on the mesial than on the distal.
3. **CEJ Curvature**

The CEJ curves toward the incisal edge on the mesial and distal.

4. These teeth are the least likely of any maxillary or mandibular incisor to have root grooves.

2. **MAXILLARY LATERAL INCISOR**

   a. **Major Characteristics**

   1. **Rounded Incisal Angles**

      The incisal angles are more rounded than those of a maxillary central incisor with the distoincisal angle more rounded than the mesioincisal.

   2. **Prominent Marginal Ridges**

      The marginal ridges on this incisor are more prominent than on any other incisor.

   3. **Deep Lingual Fossa and Pit**

      Due to prominent marginal ridges, this incisor exhibits a deep lingual fossa and frequently a deep, sharp, and often stained lingual pit.

   4. **Egg-Shaped Root**

      A cross section of the root at the cervix is egg-shaped or ovoid with the widest portion at the labial.

   b. **Other characteristics**

   1. **Height of Contour**

      The height of contour is closer to the incisal edge on the mesial than on the distal, but neither one is as close to the incisal edges as the heights of contour on a maxillary central.
2. **CEJ Curvature**

The CEJ curves closer to the incisal edge on the mesial than on the distal but not as prominently as on the maxillary central.

3. **Root Curvature**

The apical 1/6 of the root frequently curves toward the distal.

4. **Root Grooves**

This tooth is frequently confused with a small mandibular canine. However, there are seldom any grooves, depressions, or concavities on the mesial and distal surfaces of maxillary lateral incisor roots as is common in mandibular canines. If a root groove is present, it will most often be on the distal but can also occur on the mesial.

3. **DISTINGUISHING BETWEEN MAXILLARY CENTRAL AND LATERAL INCISORS**

1. Central incisors have larger crowns than lateral incisors.
2. Centrals are more symmetrical than laterals in outline form.
3. Central’s mesioincisal angle is close to 90°; lateral’s mesioincisal angle often is acute.
4. Central’s roots are wide cervically while laterals are the same length, but narrower.
5. Lateral’s root tip often bends to the distal. Central’s is most often straight.
6. Cingulum of central is usually distally positioned while the lateral is centered
7. Lateral is more likely to have lingual pits than the central.
8. Central’s crown in widest mesiodistally; lateral’s mesiodistal and faciolingual dimensions are almost the same.
9. From the incisal, the central looks triangular while the lateral is round or oval.
10. From the incisal, the central’s incisal ridge is often curved mesiodistally; the lateral has a shorter incisal ridge which tends to be straighter.
11. Lateral’s mesial and distal contacts are more apical than the corresponding central’s mesial and distal contacts.
12. The facial contour of the central is flatter than that of the lateral incisor.
13. On the mesial aspect, the CEJ of the central incisor is curved more towards the incisal than that of the lateral.
DRAWING EXERCISES

GENERAL DIRECTIONS

1. Using the workbook tables, indicate the dimension

2. Draw the appropriate tooth singly or in relation with adjacent teeth, whichever is indicated. Carefully follow all criteria corresponding to each drawing.
STEPS IN COMPLETING DRAWING EXERCISES
(REGARDLESS OF VIEW)

1. **Establish crown-root proportions**

   Divide box into two imaginary parts to accommodate the crown and root in correct proportions or to center the incisal edge on the crown (incisal view). Check given measurements. Except for mesial views, the drawings given are approximately four times as large as the actual sizes indicated by the measurements.

2. **Locate heights of contour**

   The heights of contour indicate the approximate area of contact between adjacent teeth and area of greatest convexity on the proximal, facial, or lingual.

3. **Locate center for cingulum, root, apex, or incisal edge**

   Divide the crown and the root (if included in the view) into imaginary thirds or quarters to place the root apex, cingulum, or incisal edge in proper perspective with respect to the mesiodistal or labiolingual center of the tooth.

4. **Connect heights of contour to incisal edge, CEJ, or to other heights of contour to complete crown outline**

   Using the heights of contour to set limits of convexity or width, the general crown outline can be formed. Other anatomical features, e.g., mamelons, lobes, marginal ridges, can then be added onto the completed crown outline.

5. **Trace root outline** initially approximating cervical width of crown then narrowing very gradually toward root apex. The cervical 1/3 to 1/2 of the root generally closely approximates the cervical width of the crown before it starts to narrow considerably to form the root apex.
MAXILLARY CENTRAL INCISOR

Dimensions: From Workbook

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Labiolingual Crown Width ______ mm

Fig. 2-20  **Labial View**

**Drawing Criteria**

1. Total tooth length same as #9 and longer then #7.
2. Root length same as #9 and #7.
3. Crown height same as #9 and longer than #7.
4. Crown width same as #9 and greater than #7.
5. CEJ is the same height and curvature as CEJ of #9.
6. Mesioincisal angle sharp in contrast to more rounded distoincisal angle.
7. Mesioincisal and distoincisal angles similar in shape to those of #9.
8. Mesioincisal angle sharp in contrast to rounded mesioincisal angle of #7.
9. Distoincisal angle less rounded than distoincisal angle of #7.
10. Height of contour nearer the incisal edge on the mesial than on the distal.
11. Mesial height of contour contacting the mesial height of contour of #9 and distal height of contour contacting the mesial height of contour of #7.
12. Cervical concavity present on the distal outline in contrast to straighter mesial outline.
13. Root outline similar to #9 and straight in comparison with #7.
14. Three mammelons, lobes, and developmental grooves (generally present on unworn teeth).

15. Proportions correct.


Fig. 2-20
MAXILLARY CENTRAL INCISOR #8

Fig. 2-21  Incisal View

DRAWING CRITERIA

2. Incisal ridge centered labiolingually but slightly curved mesiodistally.
3. Mesial and distal marginal ridges converge toward the cingulum.
5. Contact between #8 and adjacent teeth at appropriate faciolingual points.
6. Proportions correct.
7. Drawing neatly accomplished.
MAXILLARY CENTRAL INCISOR #8

Fig. 2-22 Mesial View

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other.

2. Incisal edge centered labioliognally under the crown and root.

3. Labial crown outline convex; lingual crown outline convex only in cingulum area.

4. Cingulum a prominent convexity on cervical 1/3 of lingual surface. Remaining lingual surface, outlined by the mesial and distal marginal ridges, parallel to each other descending slightly inward from the cingulum toward the incisal edge.

5. Labial and lingual heights of contour within cervical 1/3 crown.

6. CEJ curves incisally rather than apically. (Compare with CEJ curvature on labial and lingual views.)

7. Contact area close to incisal edge.

8. Drawing neatly accomplished.
MAXILLARY LATERAL INCISOR #7

Fig. 2-23  Lingual View

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other.
2. Crown and root drawn in proportion to the crown and root of adjacent teeth.
3. CEJ curved apically.
4. MI angle less rounded than DI angle.
5. Height of contour nearer the incisal edge on the mesial than on the distal. Height of contour must be in contact with heights of contour of adjacent teeth.
6. Cingulum located centrally in contrast to distally oriented cingulum on #8.
7. Mesial and distal marginal ridges appear to converge in a V-like formation toward the center of the cingulum at the site of the lingual pit.
8. Prominent lingual pit located cervically in the lingual fossa.
9. Root curved distally at the apical 1/6.
10. Drawing is neatly accomplished.
MAXILLARY LATERAL INCISOR #7

Fig. 2-24  Incisal View

DRAWING CRITERIA

2. Incisal ridge centered labiolingually.
3. Marginal ridges converging into the cingulum at site of lingual pit.
4. Cingulum centrally located.
5. Lingual pit prominent.
6. #7 in contact with #6 and #8 at appropriate faciolingual points.
7. Proportions correct.
8. Drawing is neatly accomplished.
MAXILLARY LATERAL INCISOR #7

Dimensions:

- Total tooth Length ________ mm
- Crown Height ________ mm
- Mesiodistal Crown Width ________ mm
- Labiolingual Crown Width ________ mm
- Root Length ________ mm

Fig. 2-25   Facial View

Drawing Criteria

1. Crown and root drawn in proportion to each other.
2. Crown and root drawn in proportion to adjacent teeth.
3. CEJ curved apically.
4. Mesioincisal angle of #7 less rounded than distoincisal angle (but more rounded than mesioincisal of #8).
5. Height of contour nearer the incisal edge on the mesial than on the distal. Heights of contour of #7 should contact the heights of contour of adjacent teeth.
6. Cervical concavity on the distal outline apparent in contrast with straighter mesial cervical outline.
7. Root often curved distally at apical 1/6.
8. Three mammelons, three lobes, and two developmental grooves separating mesial and distal lobe from middle lobe.
VI. **SELF-TEST**

1. Fig. I is which view of a maxillary central incisor?
   a. incisal
   b. labial
   c. mesial
   d. distal
   e. lingual

2. Fig. I is an incisal view of which tooth?
   a. #7
   b. #8
   c. #9
   d. b and c
   e. none of the above

3. Fig. II represents a transverse section of the cervix of tooth # __
   a. 8
   b. 7
   c. 10
   d. b and c
   e. a and b
4. Fig. 2-32 is a mesiodistal section of tooth # ______
   a. 7
   b. 8
   c. 9
   d. 10
   e. none of the above

5. In drawing the heights of contour of #8, which of the following is correct?
   a. The mesial height of contour contacts the distal height of contour of #7.
   b. The mesial height of contour contacts the mesial height of contour #9.
   c. The mesial height of contour is located within the cervical 1/3.
   d. a and c
   e. b and c

6. Which anatomical landmark is indicated by the arrow on Fig. 2-33?
   a. mesioincisal angle
   b. mesial heights of contour
   c. mesial marginal ridge
   d. distal marginal ridge
   e. distal contact area
7. Important characteristics of permanent maxillary central incisors include which of the following?

1. cingulum toward distal
2. mesioincisal angle sharper than distoincisal angle
3. distoincisal angle sharper than mesioincisal angle
4. contact area closer to the incisal edge on the mesial
5. contact area closer to the incisal edge on the distal

a. 1, 2, 4
b. 2, 4, 5
c. 1, 3, 5
d. 2, 3, 5
e. 1, 2, 3

8. Maxillary permanent lateral incisor anatomy is characterized by:

1. prominent cingulum and lingual marginal ridges
2. extremely shallow lingual fossa
3. cervical line curvature closer to the incisal on the mesial
4. shape of a cross section at the cervical line
5. ovoid shape of a cross-section of the cervical third of the root

a. 2, 3, 5
b. 1, 2, 4
c. 1, 4, 5
d. 1, 3, 5
e. 2, 4, 5

9. #10’s location in the arch partly accounts for the _____ inclination of its root.

a. mesial
b. distal
c. lingual
d. incisal
e. cervical

10. Which of the following is true about the root of #9?

a. narrower on the labial than on the lingual
b. narrower on the lingual than on the labial
c. often curved distally
d. convex mesiocervically
e. none of the above
CRITERIA EXPLANATION FOR TOOTH #8

1. FINISH:
   - **Margins:**
     - Wax should be flush with margin, neither over nor under-waxed (overhang or submarginal). The wax should also be smooth with no under (flat) or over (bulbous) contour.
   - **External surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even and polished with no scratches, “wavy” contours, or pits present.
   - **Anatomy:**
     - The incisal ridge, marginal ridges, cingulum area, and lingual fossae should exhibit smooth, polished surfaces with no scratches, pits or waviness. All junctions between these structures must be smooth and flowing.

2. ANATOMY:
   - **Ridges:**
     - Are subtle, yet distinct
     - Mesial and distal marginal ridges flow from cingulum to the incisal ridges at the corners.
     - Mesial marginal ridge is equal to or slightly longer than the distal marginal ridge.
   - **Cingulum:**
     - Is slightly distally oriented and has correct proportion to the rest of the tooth.
   - **Lingual fossa:**
     - Flows smoothly into ridges and cingulum.
     - It is slightly concave (shallow depression) in design, both mesiodistally and incisogingivally.

3. FACIAL OUTLINE:
   - **Gingival:**
     - Gingival form flows smoothly up from margins on both mesial and distal.
   - **M/D:**
     - Mesioincisal angle is sharper than distoincisal angle and is comparable to the mesioincisal angle of #9.
     - Slight distal concavity between CEJ and proximal contact in contrast to straighter mesial outline.
     - Height and width identical to #9.

   - **Incisal:**
• Shape and contour identical to #9.

4. MESIAL/DISTAL OUTLINES:
   • **Faciolingual:**
     • Incisal edge centered within the crown
   • **Lingual contour:**
     • Convex only in cingulum area
     • Facial contour convex throughout
   • **Cingulum:**
     • A prominent convexity on cervical 1/3 of lingual surface
     • Size and shape identical to #9
     • Marginal ridges parallel to each other
   • **HOC’s:**
     • Facial and lingual HOC’s within cervical 1/3
     • Lingual HOC slightly more incisal than facial HOC
     • HOCs smoothly flow in incisal direction into the proximal contact area similar to tooth #9

5. CONTACTS/EMBRASURES:
   • **Proximal Contacts:**
     • Mesioincisal contacts the proximal HOC’s of adjacent teeth in incisal 1/3
     • Distoincisal contacts at junction of incisal and middle 1/3
     • Distoincisal contact is more apical than mesioincisal contact area
     • Contact approximately 0.5 to 0.75 mm in diameter
   • **Embrasures:**
     • Area and space same as tooth #9
     • Incisal embrasure small but present
     • Gingival embrasure allows adequate room for gingival tissue
     • Facial embrasures distinct, but small
     • Lingual embrasures largest and adequately open to ensure tissue health
     • Mesiolingual slightly greater than distolingual

6. INCISAL OUTLINE:
   • **Size/Shape:**
     • Incisal ridge is same length, thickness, and form as incisal ridge of #9
     • Cingulum deviates slightly to distal
   • **Outline:**
     • Incisal ridge centered labiolingually but curved mesiodistally
     • Mesio gingival embrasure slightly larger than distogingival
     • Outline looks triangular
7. **LINGUAL OUTLINE:**
   - **Shape:**
     - Outline converges toward lingual similar to #9 Incisal similar to #9
   - **Cingulum:**
     - At same level incisogingivally as #9 and identical in shape
   - **HOC’s:**
     - Proximal contacts approximately 0.5 to 0.75 mm in diameter
     - HOC’s of adjacent teeth the same as facial proximal contacts
RESD 515 Autumn 2009

First Wax Up Exercise

Student Secret ID#: ________________________________

<table>
<thead>
<tr>
<th>Tooth # 8</th>
<th>Criteria</th>
<th>Comments</th>
</tr>
</thead>
</table>
| PASS      | □ Ridges, cingulum, lingual fossa, grooves, pits:  
• Congruent with the overall structure of the tooth and with adjacent teeth. Appropriate length, direction/position, and depth/prominence.  
□ Incisal edge placement and contours:  
• Appropriate and support the overall anatomical and esthetic requirements of the tooth.  
• In harmony with arch form and form an appropriate shape that provides correct overall tooth dimensions.  
□ Heights of contour, proximal contacts/areas, and embrasures:  
• Correct shape and height in relation to the adjacent teeth.  
• In the correct third and not over- or under-contoured on  
  Facial_________Lingual_________Mesial_________Distal_________  |
| FAIL      | □ Outlines and Finish  
• Facial_________Mesial/Distal_________Lingual_________  |

POINTS: ______________

_____________________________ Faculty Signature/Stamp
## WAXING CRITERIA FOR #8

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Your evaluation</th>
<th>Partner’s evaluation</th>
<th>Consensus evaluation</th>
<th>Faculty evaluation</th>
<th>*Final evaluation</th>
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**TOTAL ________**

*NOTE: To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.*
UNIT 3
MANDIBULAR INCISORS

1. OBJECTIVES

Upon completion of this unit, you should be able to do the following:

A. Demonstrate your knowledge of all terms listed in the glossary in written and verbal communication.

B. Identify all areas of mandibular central and lateral incisors that have names.

C. Identify and distinguish between mandibular right and left central and lateral incisors including normal variations.

D. Identify the maxillary teeth occluding or articulating with mandibular central and lateral incisors.

E. Draw the mandibular central and lateral incisors:
   1. singly, and in proper relation to adjacent teeth, when shown
   2. according to given criteria

F. Identify and distinguish given sectional views of the pulp in mandibular central and lateral incisors.

G. Satisfactorily complete:
   1. The identification exercise and the nomenclature test and self-test prior to the next class period.

II. GENERAL PROCEDURE

A. ATTEND THE CLASSROOM LECTURE “Mandibular Central and Lateral Incisors.”

B. COMPLETE NOMENCLATURE AND SELF-TEST ON Unit III.

C. Review “3D INTERACTIVE TOOTH ATLAS”
III. GLOSSARY

Embrasure - a V-shaped open space formed by the point of contact between proximal surfaces of adjacent teeth and the subsequent divergence of these contacting surfaces. Embrasures include: incisal (occlusal), facial, lingual, and gingival.

Interproximal - pertaining to the area between the proximal surfaces of adjacent teeth.

Occlusion - the arrangement and relationships of the teeth in the maxillary and mandibular arches (their contacts, alignment, overjet, and overbite).

Overbite (Vertical Overlap) - the incisocervical relationship between the incisal edges of the maxillary and mandibular anterior teeth and the occlusocervical relationship between the buccal cusps of maxillary and mandibular posterior teeth.
**Overjet (Horizontal Overlap)** - usually the facial overlap between the lingual surface of the maxillary anterior and/or buccal cusps of posterior teeth and the facial surface of the mandibular teeth.

**Proximal** - pertaining to nearest adjacent surfaces in the same arch, e.g., mesial surface of #7 is proximal or adjacent to the distal surface of #8.

**Proximal Height of Contour (proximal contact)** - point of greatest convergence on the mesial and distal surfaces. This area is contact for adjacent teeth.

**Root Groove (root concavity, root depression, interradicular groove)** - a linear, elongated, and usually shallow depression running cervicoapically on the mesial and/or distal surfaces on some teeth, e.g., root groove on the distal surface of #23.

**Interproximal Space** - the space between adjacent teeth in a dental arch. This space is divided into gingival and incisal (occlusal) embrasures and contact point.
IV. LABELING EXERCISE AND PULP STUDY

A. Labeling

Directions:

Label all indicated areas on each of fig. 3-3 to 3-12.

MANDIBULAR CENTRAL INCISOR #25

TERMS for Figures 3-3 and 3-4

1. Cervical line
2. Cingulum
3. Distal contact area
4. Distal lobe
5. Distal mammelon
6. Distal marginal ridge
7. Distoincisal angle
8. Distolabial groove
9. Height of contour
10. Incisal ridge
11. Lingual fossa
12. Mesial contact area
13. Mesial lobe
14. Mesial mammelon
15. Mesial marginal ridge
16. Mesioincisal angle
17. Mesiolabial groove
18. Middle lobe
19. Middle mammelon
20. Proximal root concavity
21. Root apex
MANDIBULAR CENTRAL INCISOR #25

TERMS for Figures 3-5 through 3-7

1. Cervical line
2. Cingulum
3. Distal contact area
4. Distal lobe
5. Distal mammelon
6. Distal marginal ridge
7. Distoincisal angle
8. Distolabial groove
9. Height of contour
10. Incisal ridge
11. Lingual fossa
12. Mesial contact area
13. Mesial lobe
14. Mesial mammelon
15. Mesial marginal ridge
16. Mesioincisal angle
17. Mesiolabial groove
18. Middle lobe
19. Middle mammelon
20. Proximal root concavity
21. Root apex
MANDIBULAR LATERAL INCISOR #26

TERMS for Figures 3-8 through 3-12

1. Cervical line  
2. Cingulum  
3. Distal contact area  
4. Distal lobe  
5. Distal mammelon  
6. Distal marginal ridge  
7. Distoincisal angle  
8. Distolabial groove  
9. Height of contour  
10. Incisal ridge
11. Lingual fossa  
12. Mesial contact area  
13. Mesial lobe  
14. Mesial mammelon  
15. Mesial marginal ridge  
16. Mesioincisal angle  
17. Mesiolabial groove  
18. Middle lobe  
19. Middle mammelon  
20. Proximal root concavity  
21. Root apex

Fig 3-8 Labial View

Fig 3-9 Lingual View
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Labiolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
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<td>5.5</td>
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<td>23.5</td>
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</table>

After Kraus

![Fig 3-10 Incisal View](image)

![Fig 3-11 Mesial View](image)

![Fig 3-12 Distal View](image)
B. **Pulp Study**

Directions:

*Study* the morphology of pulpal sections of the mandibular central incisor and mandibular lateral incisor as illustrated on Fig. 3-13 to 3-20. **Note** the close relationship between the pulpal and external morphology of these teeth. Be able to **identify** the characteristics of mandibular central and lateral incisors that influence the configuration of their pulpal sections.

**B. IDENTIFICATION EXERCISE**

**PULPAL SECTIONS OF A MANDIBULAR CENTRAL INCISOR**

Fig 3-13 Mesiodistal section - From Labial

Fig 3-14 Labiolingual section – From Mesial

Fig 3-15 Transverse section – at the cervix

Fig 3-16 Transverse section – at midroot
PULPAL SECTIONS OF A MANDIBULAR LATERAL INCISOR

Fig 3-17 Mesiodistal section – From Labial

Fig 3-18 Labiolingual section – From Mesial

Fig 3-19 Transverse section – at the cervix

Fig 3-20 Transverse section – at midroot
IDENTIFICATION EXERCISES

Directions: Using your 2 1/2 dimension models:

1. **Identify** all areas of these incisors that have been indicated in your labeling exercise.

2. Observe the CEJ on these incisors.

3. Using your Dentoform, examine the occlusal relationship of the mandibular incisors with the maxillary incisors and the occlusal relationships of the rest of the teeth in the mouth. Note that except for the lower central incisors and maxillary third molars which contact only one tooth in the opposing arch, each tooth in the dentition often articulates or occludes with two opposing teeth such that each mandibular tooth (with the exception of the mandibular central incisors) is positioned more mesially and more lingually than its maxillary counterpart. Thus, a mandibular tooth will normally occlude with its maxillary counterpart and the tooth immediately mesial to it, e.g., #23 occludes with #10 and #9; #30 occludes with #3 and #4. Likewise, a maxillary tooth (with the exception of the maxillary third molars) will occlude with this mandibular counterpart and the tooth immediately distal to it.

Although the extent of contact varies from tooth to tooth, the alignment and occlusion of the dentition may be expressed in a diagram similar to Fig. 3-21.
IDENTIFYING CHARACTERISTICS OF:
MANDIBULAR INCISORS

1. DISTINGUISHING MANDIBULAR FROM MAXILLARY INCISORS

a. General characteristics

1. Size

Mandibular incisors are wider labiolingually than mesiodistally. However, they are still normally narrower labiolingually than maxillary incisors.

2. Smooth Lingual Surface

Mandibular incisors are characterized by smooth, concave lingual surfaces, and only slightly prominent marginal ridges, lingual fossae and cinguli.

3. Flat, Grooved Root

The root of a mandibular incisor is very narrow mesiodistally and wide labiolingually. This accounts for the long, narrow outline of the cross section for transverse section of the root. Concavities or depressions (if present) on the proximal root surfaces give the root cross-section a bow shape. These longitudinal grooves may or may not be present on the mesial and distal root surfaces. When not present, the faciolingual contours are convex. This differs from the triangular cross-section of the root of a maxillary central incisor and the oval root cross-section of the maxillary lateral. The apex of the root of the mandibular central incisor may deviate towards the distal. Similar to the mesial and distal crown outlines the facial and lingual root surfaces have a relatively equally straight, longitudinal contour (Fig. 3-14).

4. Labial Wear Pattern

In a normal occlusion, the wear pattern of a mandibular incisor is either restricted to the incisal edge or evident on the incisofacial surface. Why would this be true?
3. DISTINGUISHING MANDIBULAR CENTRAL INCISORS FROM MANDIBULAR RIGHT AND LEFT LATERAL INCISORS

a. Major Characteristics

1. Symmetrically Fan-Shaped Central

From a labial view, the mandibular central is symmetrically fan-shaped. In contrast, the mandibular lateral has a more rounded distal outline making it asymmetrical in appearance (see Fig. 3-3 and 3-8).

2. Symmetrical Labial Line Angles On Central

On a mandibular central, the mesiolabial and distolabial line angles are symmetrical (Fig. 3-3) whereas on the mandibular lateral, the distolabial line angle is more rounded than the mesiolabial line angle (see Fig. 3-8), even along the cervical 1/3.

3. Incisal Ridge On Central At Right Angles With Bisecting Line

On the mandibular central, the incisal ridge forms a right angle with a line bisecting the crown labiolingually, whereas on the lateral, the incisal ridge twists on the crown so that the distal area of the incisal ridge appears closer to the lingual (see Fig. 3-10). The perpendicular midline that bisects the cervical line mesiodistally shows the incisal edge to be displaced slightly further to the lingual.

b. Other Characteristics

1. Central Smaller Than Lateral

The mandibular central is approximately ½ mm smaller than the mandibular lateral in all dimensions. This includes root dimensions.

2. Rounded Distoincisal Angle On Lateral

On the mandibular lateral, the distoincisal angle is usually more rounded than the mesioincisal angle (Fig. 3-8), whereas on the mandibular central both angles are identical in form (Fig. 3-3). Wear or abrasion on the incisal surface frequently obscures or distorts this characteristic of the incisal angles on both teeth.
3. **Proximal Contacts** are at same level; lateral distal contact is more apical.

4. **Asymmetrical Lateral Incisor**

   From the facial and lingual views, the lateral incisor has a more rounded distoincisal angle and the crown is tipped distally on its root. Central is more symmetrical.

5. **Lateral’s Cingulum Towards Distal**

   From incisal, lateral’s cingulum is distally oriented to midline. Central’s cingulum is centered.

6. **Mesial CEJ Curvature Closer To Incisal**

   On both the central and lateral incisors, the curvature of the CEJ toward the incisal on the distal is slightly less than on the mesial. However, the difference in curvature is not pronounced and is often difficult to distinguish (see 2 1/2 x models). However, when the curvatures are different it offers the best way to distinguish between left and right central incisors.

7. **Distal Root Concavity On Lateral**

   There may or may not be a proximal root concavity on the central or on the mesial of the lateral but there **always** is a concavity on the distal root surface of a mandibular lateral (see 2 1/2 x models).

8. **Incisal Ridge Curvature**

   Looking at the central and lateral from a labiolinguoincisal direction, the incisal ridge is slightly to the lingual from the long axis of the tooth (Fig. 3-6; 3-11).
VI. DRAWING EXERCISES

MANDIBULAR CENTRAL INCISOR #25

Dimensions: From Workbook

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Labiolingual Crown Width ______ mm

Fig. 3-22 Labial View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. Crown and root in correct proportion to adjacent teeth.
3. Mesioincisal and distoincisal angles sharp and similar in form to those of #24.
5. Mesial and distal heights of contour relatively equal. (Distal height of contour may be slightly closer to cervical.) Heights of contour should contact those of adjacent teeth.
6. CEJ curved apically, similar to CEJ of #24.
7. Root straight and centered under the crown.
8. Drawing is neatly accomplished.
MANDIBULAR CENTRAL INCISOR #25

FIG. 3-23  **Mesial View**

**DRAWING CRITERIA**

1. Crown and root drawn in proper proportion to each other.
2. Incisal edge slightly lingual to the midline of the crown and root.
3. Labial outline convex in contrast to concavity on the lingual outline above the cingulum.
5. Labial and lingual heights of contour within cervical 1/3 of crown. Labial HOC is just above cervical line. Lingual HOC is slightly more incisal on the cingulum.
6. CEJ curved incisally and correctly outlined.
7. Contact area centrally located labiolingually near the incisal edge.
8. Root groove or concavity may be present extending longitudinally along the labiolingual center of the root. Is less pronounced than on the distal.
10. Drawing is neatly accomplished.
MANDIBULAR LATERAL INCISOR #26

Dimensions: From Workbook

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Labiolingual Crown Width ______ mm

Fig. 3-24   Labial View

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other.
2. Crown and root drawn in correct proportion to adjacent teeth.
3. Distoincisal angle more rounded than mesioincisal angle.
4. Crown outline asymmetrical. (Distal outline more rounded than mesial outline.)
5. Mesial height of contour closer to the incisal edge than distal height of contour. Heights of contour must contact heights of contour of adjacent teeth.
6. Root centered under the crown.
7. Contacts in incisal 1/3. Distal slightly more apical than mesial contact.
8. Drawing is neatly accomplished.
Fig 3-24
MANDIBULAR LATERAL INCISOR #26

Fig. 3-25  Incisal View

DRAWING CRITERIA

1. Crown slightly narrower mesiodistally than labiolingually.

2. Incisal edge is slightly lingual to midline (mesiodistal) and is inclined slightly toward the lingual on the distal.

3. Cingulum distally located.

4. Contact between #26 and adjacent teeth at appropriate heights of contour.

5. Incisal view provides correct proportions compared with adjacent teeth.


7. Drawing is neatly accomplished.

Fig 3-25
MANDIBULAR LATERAL INCISOR #26

FIG. 3-26  Mesial View

DRAWING CRITERIA

2. Incisal edge is slightly to the lingual over crown and root.
3. Distal crown outline may be partly visible (due to distal twist of crown).
4. Labial and lingual heights of contour within the cervical 1/3 of crown. Labial HOC is just incisal to cervical line. Lingual HOC is slightly more incisal on cingulum.
5. CEJ curved incisally.
6. Root groove may be present extending along the labiolingual center of the root. Is less pronounced than on distal.
7. Cingulum less prominent than that of a maxillary incisor (see tooth #8 or #7).
8. Contact area close to incisal edge.
9. Drawing is neatly accomplished.
VI.  **SELF-TEST**

1. Which characteristics correctly identify the mandibular central incisor:
   
a. crown is generally narrower mesiodistally than the crown of a mandibular lateral incisor  
b. crown is asymmetrical with a rounded distoincisal angle  
c. mesial and distal heights of contour are at relatively equal distances from the cervical  
d. a and b  
e. a and c

2. Which of the following characteristics describe #26?
   
a. distal contact area closer to cervical than mesial contact area  
b. labial surface flatter than #7’s  
c. appears twisted on its crown when viewed incisally  
d. all of the above  
e. none of the above

3. When comparing #7 and #8 with #25 and #26:
   
a. #8 is wider labiolingually and mesiodistally  
b. the marginal ridges and cinguli of #7 and #8 are relatively more prominent than those of #25 and #26  
c. unlike the root of #7, the root of #25 is often curved distally  
d. a and b  
e. a, b, c

4. Which arrow Fig. 3-27 points to the distal height of contour?
   
a. I  
b. II  
c. III  
d. IV  
e. I or II
5. Fig 3-31 is an incisal view of:
   a. #8 or #9
   b. #24 or #25
   c. #22 or #27
   d. #23 or #26
   e. none of the above

6. Which of these is a mandibular lateral incisor?
   a. 1
   b. 2
   c. 3
   d. none of the above
7. Which pair of cross-sections belong to a mandibular lateral incisor?

a. II and IV
b. II and III
c. III and V
d. I and VI
e. I and V

Fig 3-29
8. The mesial aspect of #25 is indicated by which diagram?
   a. I
   b. II
   c. all of the above
   d. none of the above

9. In normal occlusion, #23 articulates with:
   a. #22 and #24
   b. #8 and #9
   c. #10 and #11
   d. #9 and #10
   e. #22 and #21

10. The lingual height of contour of a mandibular lateral incisor is found on which area?
    a. lingual 1/3 of the root
    b. mesial 1/3 of the crown
    c. labial 1/3 of the crown
    d. cervical 1/3 of the crown
    e. middle 1/3 of the crown
CRITERIA FOR TOOTH #7

1. FINISH
   - **Margins:**
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)
   - **External Surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, “wavy” contours or pits present
   - **Anatomy:**
     - Marginal ridges, cingulum area, and lingual fossa should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All junctions between these structures must be smooth and flowing

2. ANATOMY
   - **Ridges:**
     - Marginal ridges most distinct of all incisors
     - Mesial and distal marginal ridges flow from cingulum to the incisal ridges at the corners
   - **Cingulum:**
     - Centered and correct proportion to the rest of the tooth
   - **Lingual Fossa:**
     - Distinct and deeper than central incisor
     - Correct proportion to the rest of the tooth
     - Deep, sharp lingual pit

3. FACIAL OUTLINE:
   - **Outline:**
     - Gingival form flows smoothly up from margins on both mesial and distal
     - Outline form not as symmetrical as #8
   - **M/D:**
     - Incisogingival dimension shorter than for #8
     - Mesioincisal angle is sharper than distoincisal angle
     - Both angles are more rounded than for #8
     - **Mesioincisal angle may be acute**
   - **Incisal:**
     - Incisal correct proportion and position to #6 and #8
4. **MESIAL/DISTAL OUTLINES:**
- **L/Li Outline:**
  - Marginal ridges form slight concavity from cingulum to incisal ridge
- **L/Li Contours:**
  - Facial contour not as flat as for central incisor
- **Cingulum:**
  - In cervical 1/3 of lingual surface and has correct proportional size and shape to the rest of the tooth
- **HOCs:**
  - Facial and lingual HOCs in cervical 1/3
  - HOCs at the same level
  - HOCs smoothly flow in an incisal direction into the proximal contact area

5. **CONTACTS/EMBRASURES:**
- **Proximal Contacts:**
  - Mesioincisal contacts adjacent contact area at junction of incisal and middle 1/3
  - Distoincisal contacts adjacent contact area in middle 1/3
  - Contact areas 0.5 to 0.75 mm in diameter
- **Embrasures:**
  - Incisal embrasures small but greater than centrals
  - Lingual embrasures similar in size and shape to each other
  - Incisal embrasure small but present
  - Gingival embrasures allow adequate room for gingival tissue
  - Facial embrasures distinct, but small
  - Lingual embrasures largest and adequately open to insure tissue health

6. **INCISAL OUTLINE:**
- **Size/Shape:**
  - Outline appears round or oval
  - Incisal ridge shorter than #8 but is straighter
  - Distinct lingual fossa present
- **Outline:**
  - Cingulum centered
  - Marginal ridges similar in length
  - Mesiodistal and faciolingual dimensions almost the same
7. **LINGUAL OUTLINE:**

- **Shape:**
  - Distinct marginal ridges are the same length
  - Marginal ridges flow smoothly from cingulum to incisal ridge

- **Cingulum:**
  - Cingulum centered mesiodistally
  - Lingual pit present at incisal end of cingulum

- **HOCs:**
  - Proximal contacts 0.5 to 0.75 mm in diameter
  - Proximal contacts contact adjacent teeth the same as when viewed from the facial
RESD 515 Autumn 2009

First Wax Up Exercise

Student Secret ID#: ________________________________________

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<th>Tooth # 7</th>
<th>Criteria</th>
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<tr>
<td>□ PASS</td>
<td><strong>Ridges, cingulum, lingual fossa, grooves, pits:</strong></td>
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<td></td>
<td>• Congruent with the overall structure of the tooth and with adjacent</td>
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<td>teeth. Appropriate length, direction/position, and depth/prominence.</td>
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<td>□ FAIL</td>
<td><strong>Incisal edge placement and contours:</strong></td>
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<td>• Appropriate and support the overall anatomical and esthetic</td>
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<td>requirements of the tooth.</td>
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<td>• In harmony with arch form and form an appropriate shape that</td>
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<td>provides correct overall tooth dimensions.</td>
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<td><strong>Heights of contour, proximal contacts/areas, and embrasures:</strong></td>
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<td>• Correct shape and height in relation to the adjacent teeth.</td>
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<td>• In the correct third and not over- or under-contoured on</td>
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<td>Facial_______Lingual_______Mesial_______Distal_______</td>
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<td>□</td>
<td><strong>Outlines and Finish</strong></td>
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<td>• In harmony with arch form and that provides correct overall tooth</td>
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POINTS: __________
WAXING CRITERIA FOR #7

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<td>□ HOCs</td>
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*Refer to syllabus for further explanation of criteria

**TOTAL ________**

**NOTE:** To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.
UNIT 4
MAXILLARY AND MANDIBULAR CANINES

I. OBJECTIVES

Upon completing this unit, be able to:

A. Demonstrate your comprehension.

B. Identify all areas of maxillary and mandibular cuspids that have names.

C. Identify and distinguish between right and left maxillary and mandibular cuspids including normal variations.

D. Draw the maxillary and mandibular canines:
   1. singly, and in proper relation to adjacent teeth when shown
   2. according to given drawing criteria

E. Identify and distinguish given sectional views of the pulp in maxillary and mandibular cuspids.

F. Identify the teeth opposing maxillary and mandibular cuspids in normal occlusion.

G. Satisfactorily complete:
   1. the identification exercise and satisfactorily complete the nomenclature test
   2. the self-test prior to the next class period

GENERAL PROCEDURE

A. ATTEND THE CLASSROOM LECTURE “Canines (Cuspids)”

B. COMPLETE EXERCISES IN:
   1. Labeling and Pulp Study
   2. Identification
   3. Drawing

C. COMPLETE NOMENCLATURE AND SELF-TEST ON Unit IV

D. Review “3D INTERACTIVE TOOTH ATLAS”
III. GLOSSARY

**Cusp** - a conical mass or elevation found on the occlusal surface of a posterior tooth. A cusp also constitutes the incisal surface of a canine.

**Cusp Apex** - the terminal point of an unworn cusp on the crown of a canine or a posterior tooth.

**Cusp Ridge** - the cervically oriented slope extending from the cusp apex to the proximal surface or extending between two proximal surfaces through a cusp to form the buccal or lingual margin of a tooth (as opposed to marginal ridges forming the proximal margins of a tooth).

**Distolingual Fossa** - a depression found on the lingual surface of a canine bounded by the lingual ridge, distal cusp ridge, distal marginal ridge, and distal 1/3 of the cingulum.

**Lingual Ridge** - an elongated enamel elevation found on the lingual surface of a canine extending from the cusp apex to the cingulum.

**Mesiolingual Fossa** - a depression found on the lingual surface of a canine bounded by the lingual ridge, mesial cusp ridge, mesial marginal ridge, and mesial 1/3 of the cingulum.
IV. LABELING EXERCISE AND PULP STUDY

1. Labeling Exercise

Directions: label Fig. 4-1 to 4-10

MAXILLARY CANINE (CUSPID) #6

TERMS

1. Cervical line
2. Cingulum
3. Cusp apex
4. Distal contact area
5. Distal cusp ridge
6. Distal lobe
7. Distal marginal ridge
8. Distolinguinal fossa
9. Height of contour
10. Lingual ridge
11. Mesial contact area
12. Mesial cusp ridge
13. Mesial lobe
14. Mesial marginal ridge
15. Mesiolinguinal fossa
16. Middle lobe
17. Proximal root concavity
18. Root apex

Fig 4-1 Labial View

Fig 4-2 Lingual View
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Labiolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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After Kraus

![Fig. 4-3 Incisal view](image1)

![Fig. 4-4 Mesial view](image2)

![Fig. 4-5 Distal view](image3)
MANDIBULAR CANINE (CUSPID) #27

TERMS

1. Cervical line
2. Cingulum
3. Cusp apex
4. Distal contact area
5. Distal cusp ridge
6. Distal lobe
7. Distal marginal ridge
8. Distoincisal angle
9. Distolingual fossa
10. Height of contour
11. Lingual ridge
12. Mesial contact area
13. Mesial cusp ridge
14. Mesial lobe
15. Mesial marginal ridge
16. Mesioincisal angle
17. Mesiolingual fossa
18. Middle lobe
19. Proximal root concavity
20. Root apex

Fig. 4-6 Labial view

Fig. 4-7 Lingual view
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
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<td>11</td>
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<tr>
<td>Mandibular Canine</td>
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<td>7.0</td>
<td>7.5</td>
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After Kraus

![Fig. 4-8 Incisal view](image)

![Fig. 4-9 Mesial view](image)

![Fig. 4-10 Distal view](image)
2. Pulp Study

Directions:

Study the morphology of pulpal sections of maxillary and mandibular canines as illustrated on Fig. 4-11 to 4-18. Note the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of the maxillary canine and mandibular canine that influence the shape or configuration of their pulpal sections.

PULPAL SECTIONS OF A MAXILLARY CANINE

![Diagram of a maxillary canine showing mesiodistal and labiolingual sections.]

Fig 4 -11
Mesiodistal section
From Labial

Fig 4 -12
Labiolingual section
From Mesial
TRANSVERSE SECTIONS OF MAXILLARY CANINES

Fig 4-13
Transverse Section
at the cervix

Fig 4-14
Transverse Section
PULPAL AND TRANSVERSE SECTIONS OF MANDIBULAR CANINES

Fig 4-15
Mesiodistal section
From Labial

Fig 4-16
Labiolingual section

Fig 4-17
Transverse Section
at the cervix

Fig 4-18
Transverse Section
at midroot
V. IDENTIFICATION EXERCISE

Directions:

1. Refer to Identifying Characteristics of Maxillary and Mandibular Canines below for help in identifying these teeth.
2. Identify the opposing teeth articulating with maxillary and mandibular canines in normal occlusion (Fig. 3-21).

IDENTIFYING CHARACTERISTICS OF CANINES (CUSPIDS)

I. DISTINGUISHING CANINES (CUSPIDS) FROM INCISORS

A. Major Characteristics

1. One Cusp on Canine

When unworn, a canine shows a single, pointed cusp.

2. Wear Pattern on Canine

When worn or abraded, canines are left with a sloped or flattened shaped area on the incisal (normally towards the lingual on maxillary canines and towards the facial for mandibular canines). In contrast, the incisal surface of an incisor wears away in a flat or ribbon-shaped manner.

3. Size

Canines are generally larger than incisors.

B. Other Characteristics:

1. Cingulum Size

The cingulum on a maxillary canine is larger than on any other anterior tooth.

2. Root Shape

The roots of both maxillary and mandibular canines are broad labiolingually and narrow mesiodistally often with proximal root grooves. Maxillary incisors are not as broad labiolingually being more ovoid.
DISTINGUISHING MAXILLARY FROM MANDIBULAR CUSPIDS

A. Major Characteristics:

1. **Cingulum Size**

   The cingulum of a mandibular canine is much smaller than the maxillary canine’s cingulum.

2. **Crown Height and Width**

   The maxillary canine crown is proportionately wider mesiodistally and narrower incisocervically (short and fat) than the mandibular canine. The mandibular canine crown, which is long and narrow, actually has the greatest incisocervical dimension of all teeth in the mouth although the maxillary canine generally has the longest root.

3. **Crown Outline** - The mesial outline (facial view) of the maxillary canine is definitely convex while the mesial outline of the mandibular canine is nearly straight.

B. Other characteristics:

1. **Wear Patterns**

   The wear pattern on a maxillary canine is usually lingually oriented whereas the wear pattern on a mandibular canine is generally either labially oriented or perpendicular to the long axis of the tooth.

2. **Root Bifurcation**

   If a canine has a bifurcated root, it is a mandibular canine. However, bifurcated roots on mandibular canines are not common.

3. **Marginal Ridges and Lingual Fossae**

   Maxillary canines generally have more prominent marginal ridges and deeper lingual fossae and pits than mandibular canines. Mandibular canines seldom have lingual pits or grooves.

4. **Cervical Line** - Facially, the cervical line of the mandibular canine is semicircular and thus has a more symmetrically contoured cervical line than the maxillary canine.
5. **Cusp Tip Location** - In contrast to the maxillary canine whose cusp tip is centered or slightly facial to the bisecting line, the cusp tip of the mandibular canine inclines slightly to the lingual of a bisecting line when viewed from the mesial or distal.

6. The cusp tips of both maxillary and mandibular canines are most often centered mesiodistally.

7. Maxillary canines are pentagonal when viewed from the facial while mandibular canines have straighter mesial and distal outlines.

8. The general rule for anterior teeth is that any apical deviation will be towards the distal. The exception to this rule is the mandibular canine which more often has a mesial deviation of its apex.

9. Longitudinal grooves are generally present on the mesial and distal root surfaces of mandibular canines. However, although similar longitudinal grooves can be present on maxillary canines, a longitudinal groove is more common on maxillary canines on the distal surface, as is also true for maxillary lateral incisors.

10. Maxillary has a more acute cusp angle.

11. Proximal contacts closer to level of cusp tip on mandibular canines.

12. Maxillary canines have an extra labial bulge of crown above their roots.

13. Mandibular canines have more continuous mesial crown/root outlines

14. More pronounced lingual contours and anatomy on uppers, smoother lingual surface on lowers.

15. From incisal, mesiodistal cusp ridges are straight on uppers, distal cusp ridge curves to lingual on lowers.

16. Maxillary canines have marked asymmetry between the mesial and distal halves of the crown when viewed from the incisal. Mandibular canines are more symmetrical.
III. DISTINGUISHING RIGHT AND LEFT CANINES

A. Major characteristics:

1. Rounded distolabial line angle

   The distolabial line angle is more rounded on the cervical 1/3 of the crown than the mesiolabial line angle.

2. Mesial Height of Contour closer to incisal

   The mesial height of contour is closer to the incisal than the distal height of contour (Figs. 4-1 and 4-6).

3. Rounded distal surface

   When viewed from the labial, the distal surface is more rounded than the mesial surface. The mesial surface has a sharper mesioincisal angle (Figs. 4-1 and 4-6).

B. Other characteristics:

1. Mesiocervical Line Closer to Incisal

   As is common with the other anterior teeth, the cervical line on the mesial surface of canines extends more incisally than on the distal (Figs. 4-4 and 4-5; 4-9 and 4-10).

2. Shorter Mesial Cusp ridge

   On an unworn canine, the mesioincisal cusp ridge is slightly shorter than the distoincisal cusp ridge (Fig. 4-1 and 4-6).
V. **DRAWING EXERCISE**

**MAXILLARY CANINE #6**

Dimensions:

- Crown Height  ______ mm
- Root Length  ______ mm
- Total Tooth Length  ______ mm
- Mediodistal Crown width  ______ mm
- Labiolingual Crown Width  ______ mm

Fig. 4-19  **Labial View**

**DRAWING CRITERIA**

1. Crown and root drawn in correct proportion to each other.
2. Crown and root drawn in correct proportion to adjacent teeth.
3. Cusp apex centered under the crown and root.
4. Mesial height of contour closer to the incisal (junction of incisal and middle thirds) while the distal height of contour is located in the middle third. Heights of contour should contact those of adjacent teeth.
5. Mesial cusp ridge slightly shorter than distal cusp ridge.
6. Distoincisal angle more rounded than mesioincisal angle.
7. The crest of the cervical line is slightly mesial to midline of tooth.
8. Mesial and distal root surfaces are slightly convex tapering to form a bluntly pointed apex.
9. Drawing is neatly accomplished.
MAXILLARY CANINE #6

Fig. 4-20  Lingual View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. Crown and root drawn in correct proportion to adjacent teeth.
3. Cusp apex centered under the crown and root.
4. Mesial cusp ridge shorter than distal cusp ridge.
5. Mesial height of contour is located at the junction of the incisal and middle thirds of the crown. The distal height of contour is in the middle third. Heights of contour should contact those of adjacent teeth.
6. Distoincisal angle more rounded than mesioincisal angle.
7. Lingual ridge located between the ML and DL fossae and extends cervically toward the cingulum.
8. Marginal ridges converging into centrally located cingulum.
9. Labial and lingual root outlines both visible (due to narrowing of root width on the lingual and presence of deep proximal root grooves).
10. Drawing is neatly accomplished.
MAXILLARY CANINE #6

Fig. 4-21 Incisal View

DRAWING CRITERIA

1. Cusp apex centrally located or slightly to the facial of center labiolingually.

2. The distofacial outline is noticeably wider and more concave than the mesiofacial outline if a line were drawn labiolingually bisecting the cingulum and cusp tip.

3. Lingual ridge centrally located mesiodistally between the ML and DL fossae.

4. Marginal ridges converging toward the cingulum.

5. Convex cingulum is centrally located in lingual third.

6. There are three distinct lobes marked by depression on the labial surface with the middle lobe being by far the most prominent.

7. Contact between #6 and adjacent teeth at approximate heights of contour.

8. Crown is drawn in proportion to adjacent teeth.

9. Drawing is neatly accomplished.
MAXILLARY CANINE #6

Fig. 4-22   Mesial View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. Cusp apex centered under crown and root.
3. Cingulum is a prominent convexity on lingual surface in cervical 1/3.
4. Lingual ridge continues from cingulum toward cusp apex and is visible above mesial marginal.
5. Root concavity may be present extending along the labiolingual center of root surface.
6. CEJ curved incisally.
7. Root apex appears as a blunt tip.
8. Contact area centrally located labiolingually near the junction of the incisal 1/3 and middle 1/3.
9. Drawing is neatly accomplished.
MANDIBULAR CANINE #27

Dimensions:

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Labiolingual Crown Width ______ mm

Fig. 4-23  Labial View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Cusp apex centered under the crown and root.
4. Mesial cusp ridge shorter than distal cusp ridge.
5. Mesial height of contour is located in the incisal third while the distal height of contour is located at the junction of the incisal and middle thirds. Heights of contour should contact those of adjacent teeth.
6. Distoincisal angle more rounded than mesioincisal angle.
7. Mesial outline form is nearly straight. Distal is convex.
8. Symmetrically contoured cervical line.
9. Root apex centered under crown root or deviates slightly mesially.
10. Drawing is neatly accomplished.
Fig 4-23
MANDIBULAR CANINE #27

Fig. 4-24  Lingual View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Cusp apex centered under the crown and root. Root apex slight deviation to mesial.
4. Mesial cusp ridge shorter than distal cusp ridge.
5. Mesial height of contour is in incisal third. The distal height of contour is at junction of incisal and middle thirds.
6. Heights of contour should contact those of adjacent teeth.
7. Distoincisal angle more rounded in contrast to sharper mesioincisal angle.
8. Marginal ridges extending from the cusp ridges and converging into the cingulum.
9. Lingual ridge located between the ML and DL fossae and extending cervically from the cusp apex to the cingulum.
10. Labial and lingual root outlines both visible (due to narrower root width on the lingual and presence of proximal root concavities).
11. Mesial outline form nearly straight while distal is convex.
12. Drawing is neatly accomplished.
MANDIBULAR CANINE #27

Fig. 4-25  Incisal View

DRAWING CRITERIA

1. Cusp apex slightly to lingual of the center of the tooth labiolingually and centered mesiodistally.

2. The mesial and distal halves are almost symmetrical.

3. Marginal ridges converge into the cingulum.

4. Lingual ridge centrally located mesiodistally between the ML and DL fossae extending into the cingulum.

5. Cingulum centrally located.

6. The lingual profile is less rounded than for the maxillary canine.

7. Contact between #27 and adjacent teeth at approximate heights of contour.

8. Outline form drawn in correct proportion to adjacent teeth.

9. Drawing is neatly accomplished.
MANDIBULAR CANINE #27

Fig. 4-26  Mesial View

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other.
2. Cusp apex slightly lingual of center of crown and root.
3. Cingulum a convexity on the lingual surface (smaller in comparison to the cingulum of #6).
4. Root concavity frequently present extending longitudinally along the labiolingual center of the root.
5. CEJ curved incisally.
6. Labial outline along the cervical is more evenly convex in contrast with cervical constriction on the labial outline of #6.
7. Contact area at incisal 1/3.
8. Lingual ridge apparent above mesial marginal ridge.
9. Lingual outline from cusp tip to cingulum is slightly concave.
10. Labial and lingual HOCs in cervical 1/3. Labial HOC closer to cervical line than for maxillary canine. Lingual HOC is on the cingulum near its center.
11. Drawing is neatly accomplished.
V. **SELF-TEST**

1. A is a horizontal cross-section of the midroot of:
   
   a. #6  
   b. #11  
   c. #27  
   d. a or b  
   e. none of the above

2. Disregarding position, which two of these pulpal sections represent those of a maxillary canine.

   a. I and III  
   b. I and IV  
   c. II and III  
   d. III and IV  
   e. none of the above
3. Which of these pulpal sections belongs to a mandibular cuspid

a. I
b. II
c. III
d. none of the above

4. Area III of fig. 4-31 indicated which of the following?

a. distal mamelon
b. distal fossa
c. distal cusp
d. distal pit
e. mesial lobe

Fig 4-31
5. Which of these figures illustrates the distal aspect of a maxillary canine?

   a. I
   b. II
   c. III
   d. IV
   e. I and III

6. Choose the correct statement concerning the maxillary canines:

   a. The maxillary canine cusp occludes mesial to the mandibular canine cusp.
   b. The maxillary canine crown is much longer incisocervically than the mandibular canine crown.
   c. Distal contact area is closer to the cervical than the mesial contact area.
   d. Mesioincisal cusp ridge is longer than distoincisal cusp ridge.
7. Which of the following statements is false in differentiating maxillary and mandibular canines:
   a. The mandibular canine shows greater cingulum development.
   b. The mandibular canine crown is narrower mesiodistally.
   c. The crown of the mandibular canine appears longer than the crown of the maxillary canine incisocervically.
   d. Root depressions are common to both.

8. In normal occlusion, #11 occludes on the:
   a. embrasure between #23 and #24
   b. mesial marginal ridge of #27
   c. distal marginal ridge of #21
   d. embrasure between #22 and #21
   e. none of the above

9. The pulp cavity of #6 or #11 appears widest when viewed:
   a. mesiodistally at the midthird of the root
   b. labiolingually at the cervix
   c. labiolingually at the midthird of the root
   d. mesiodistally at the cervix
   e. none of the above

10. The horizontal cross-section of the pulp canal of #22 or #27 is generally:
    a. oval in shape with a constricted mesiodistal portion
    b. oval in shape with the smallest diameter oriented labially
    c. round in shape
    d. triangular in shape with the base to the buccal side
    e. triangular in shape with the base to the lingual side
CRITERIA EXPLANATION FOR TOOTH #6

1. **FINISH**
   - **Margins:**
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)
   - **External Surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, “wavy” contours, or pits present
   - **Anatomy:**
     - Marginal ridges, cingulum area, and lingual fossa should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All junctions between these structures must be smooth and flowing

2. **ANATOMY**
   - **Ridges:**
     - Marginal ridges most distinct of all anteriors
     - Mesial and distal marginal ridges flow from cingulum to the incisal ridges at the corners
   - **Cingulum:**
     - Centered and correct proportion to the rest of the tooth
     - Larger than on any other anterior tooth
   - **Lingual Fossa:**
     - Two distinct fossae separated by a distinct lingual ridge
     - Correct proportion to the rest of the tooth

3. **FACIAL OUTLINE:**
   - **Outline:**
     - Shape identical to #11
     - Wider mesiodistally and shorter incisocervically than the mandibular canine so appears “short and fat”
     - Mesial outline definitely convex
     - Pentagonal outline
     - Gingival cervical line asymmetric
   - **M/D:**
     - Distal is more rounded than mesial
     - Mesial has a sharper mesioincisal angle than distal
   - **Incisal:**
     - Incisal correct proportion and position to #11
     - Cusp tip centered mesiodistally
     - Acute cusp angle identical to #11
4. **MESIAL/DISTAL OUTLINES:**
   - **L/Li Outline:**
     - Cusp tip centered or slightly facial to bisecting line
     - Lingual ridge visible above marginal ridges
   - **L/Li Contours:**
     - Marginal ridges slightly convex
   - **Cingulum:**
     - In cervical 1/3 of lingual surface and has correct proportional size and shape to the rest of the tooth
   - **HOCs:**
     - Facial and lingual HOCs in cervical 1/3
     - HOCs at the same level
     - HOCs smoothly flow in an incisal direction into the proximal contact area similar to #11

5. **CONTACTS/EMBRASURES:**
   - **Proximal Contacts:**
     - Mesioincisal contacts adjacent contact area at junction of incisal and middle 1/3
     - Distoincisal contacts adjacent contact area in middle 1/3
     - Contact areas 0.5 to 0.75 mm in diameter for mesioincisal
     - Distoincisal contact area is slightly larger than mesial
   - **Embrasures:**
     - Incisal embrasures small but greater than central or lateral incisors
     - Distoincisal greater than mesioincisal
     - Incisal embrasure small but present
     - Gingival embrasures allows adequate room for gingival tissue
     - Facial embrasures distinct, but small
     - Lingual embrasures largest with the ML being the largest overall

6. **INCISAL OUTLINE:**
   - **Size:**
     - Cingulum centrally located in lingual 1/3
   - **Shape:**
     - Three distinct lobes on facial separated by developmental grooves
     - Lingual ridge noticeable
     - Mesiodistal cusp rides are straight
     - Mesioincisal cusp ridge slightly shorter than distoincisal ridge
     - Cusp apex centrally located (L/Li) or slightly to the facial
   - **Outline:**
     - Marked asymmetry between mesial and distal outlines
     - Distofacial outline wider and more concave than mesiofacial

7. **LINGUAL OUTLINE:**
**Shape:**
- Cusp apex centered
- Marginal ridges are distinct and flow smoothly from cingulum to incisal ridge
- Mesial cusp ridge slightly shorter than distal
- Lingual ridge distinct from incisal to cingulum
- ML and DL fossae readily apparent

**Cingulum:**
- Cingulum centered mesiodistally
- Proportioned correctly to rest of the tooth
- Exhibits correct size and shape

**HOCs:**
- Mesioincisal proximal contact 0.5 to 0.75 mm in diameter
- Distoincisal proximal contact slightly larger than mesial contact
- Proximal contacts contact adjacent teeth the same as when viewed from the facial
- Mesial HOC at junction of incisal and middle 1/3
- Distal HOC in middle 1/3
# First Wax Up Exercise

Student Secret ID#: ________________________________________

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<td></td>
<td><strong>FAIL</strong></td>
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- **Ridges, cingulum, lingual fossa, grooves, pits:**
  - Congruent with the overall structure of the tooth and with adjacent teeth. Appropriate length, direction/position, and depth/prominence.

- **Incisal edge placement and contours:**
  - Appropriate and support the overall anatomical and esthetic requirements of the tooth.
  - In harmony with arch form and form an appropriate shape that provides correct overall tooth dimensions.

- **Heights of contour, proximal contacts/areas, and embrasures:**
  - Correct shape and height in relation to the adjacent teeth.
  - In the correct third and not over- or under-contoured on Facial_______Lingual_______Mesial_______Distal_______

- **Outlines and Finish**
  - In harmony with arch form and that provides correct overall tooth dimensions: Facial_______Mesial/Distal_______Lingual_______

POINTS: ____________
### WAXING CRITERIA FOR #6 FULL CROWN

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<th>Partner’s evaluation</th>
<th>Consensus evaluation</th>
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*Refer to syllabus for further explanation of criteria

**TOTAL ______**

**NOTE:** To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.
I. OBJECTIVES

Upon completing this unit, you should be able to do the following:

A. Demonstrate your understanding of all the terms listed in the glossary in verbal and written communication.

B. Identify all areas of first and second premolars including normal variations.

C. Identify and distinguish between maxillary right and left first and second premolars including normal variations.

D. Identify the mandibular teeth occluding with maxillary first and second premolars.

E. Draw the maxillary first and second premolars:
   1. singly, and in relation to given adjacent teeth when shown
   2. according to given criteria

F. Identify and distinguish sectional views of the pulp of maxillary first and second premolars.

G. Satisfactorily complete:
   1. the identification exercise and satisfactorily complete the nomenclature test
   2. the self-test prior to the next class period

II. GENERAL PROCEDURES

A. ATTEND CLASSROOM LECTURE Titled: “Maxillary Premolars”
B. COMPLETE EXERCISES IN:
   1. Labeling and Pulp Study
   2. Identification
   3. Drawing

C. COMPLETE NOMENCLATURE AND SELF-TEST ON Unit V

D. Review “3D INTERACTIVE TOOTH ATLAS”

E. REVIEW LABORATORY WAXING DVD (Available in the Library)
III.  GLOSSARY

**Buccal Ridge** - a term given to the middle lobe of the buccal cusp of a maxillary premolar.

**Central Groove** - is a developmental groove that separates buccal and lingual triangular ridges. It extends mesiodistally across the center of the occlusal surface ending in mesial or distal triangular fossae.

**Developmental Groove** - a linear depression marking the junction of adjacent lobes, cusps, and major areas of the occlusal surface.

**Marginal Groove (Spillway)** - a linear depression crossing a marginal ridge, e.g., mesial marginal groove of #5 or #12.

**Marginal Ridge** - an enamel elevation that forms the proximal border of a posterior tooth and connects the cusp ridges of bordering cusps.

**Occlusal (Crown) Outline** - the visible outline or profile formed by the areas along the heights of contour of a posterior tooth when the tooth is viewed from the occlusal aspect.

**Occlusal Table** - the occlusal surface of a posterior tooth as formed by the inner inclines of the cusps and fossa areas. The cusp ridges and marginal ridges make up the exterior boundary of the table.

**Octagonal** - a polygon of eight sides and eight angles (generally used to describe the occlusal outline of a maxillary first premolar).

**Root Furcation** - the point or area at which the root of a tooth divides or the point or area at which the roots of a tooth unite. The point of division into two roots is called **bifurcation**; the point of division into three roots is called **trifurcation**.

**Root Trunk (Base)** - the cervical 1/3 or cervical 1/2 of a multi-rooted tooth between the cervical line and the point of furcation.

**Sulcus** - an elongated V-shaped depression formed by the meeting of the inner inclines of the cusps or marginal ridges of a posterior tooth. (This meeting of the inner inclines of the cusps is generally marked by the central groove.)

**Supplemental Groove** - a linear depression which is usually found on the occlusal surface of a posterior tooth but which does not mark the specific junction of lobes or major areas of the tooth as does a developmental groove.
Trapezoidal - similar to or approximating a polygon of four sides having only two sides parallel.

Triangular Fossa - a depression on the occlusal surface of posterior teeth bounded by a marginal ridge, an occlusal pit, and two occlusal grooves originating from this pit and extending in opposite directions.

Triangular Ridge - an enamel elevation found on posterior teeth extending from the apex of a cusp to the central portion of the occlusal surface. A cross-section of this ridge is triangular in shape. For example, maxillary premolars have two such ridges – buccal and lingual triangular ridges.
IV. LABELING EXERCISE AND PULP STUDY

1. Labeling Exercise
   Directions: Label Fig. 5-1 to 5-10

MAXILLARY FIRST PREMOLAR #5

TERMS

1. Bifurcation
2. Buccal cusp
3. Buccal cusp apex
4. Buccal triangular ridge
5. Buccal root
6. Central groove
7. Cervical line
8. Distal contact area
9. Distal marginal ridge
10. Distal pit
11. Distal fossa
12. Distobuccal cusp ridge
13. Distobuccal groove
14. Distolingual cusp ridge
15. Distolingual groove
16. Height of contour
17. Lingual cusp
18. Lingual cusp apex
19. Lingual triangular ridge
20. Lingual root
21. Mesial concavity
22. Mesial contact area
23. Mesial marginal groove
24. Mesial marginal ridge
25. Mesial pit
26. Mesial triangular fossa
27. Mesiobuccal cusp ridge
28. Mesiobuccal groove
29. Mesiolingual cusp ridge
30. Mesiolingual groove
31. Proximal root concavity
32. Root apex

Fig 5-1
Buccal View

Fig 5-2
Lingual View
# SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Buccolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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After Kraus

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**Fig 5-3**
Occlusal View

**Fig 5-4a**
Mesial View

**Fig 5-4b**
Mesial View

**Fig 5-5**
Distal View
MAXILLARY SECOND PREMOLAR #4

TERMS

1. Buccal cusp
2. Buccal cusp apex
3. Buccal triangular ridge
4. Central groove
5. Cervical line
6. Distal contact area
7. Distal marginal ridge
8. Distobuccal cusp ridge
9. Distolingual cusp ridge
10. Height of contour
11. Lingual cusp
12. Lingual cusp apex
13. Lingual triangular ridge
14. Mesial contact area
15. Mesial marginal ridge
16. Mesiobuccal cusp ridge
17. Mesiolingual cusp ridge
18. Root apex.

Fig 5-6
Buccal View

Fig 5-7
Lingual view
## SIZE AND ERUPTION - MAXILLARY SECOND PREMOLAR

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<th>Tooth</th>
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<th>Buccolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
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</table>

After Kraus

**Fig 5-8**
Occlusal View

**Fig 5-9**
Mesial View

**Fig 5-10**
Distal View
Study the morphology of pulpal sections of the maxillary first premolar and maxillary second premolar as illustrated on Fig. 5-11 to 5-20. Note the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of maxillary first and second premolars that influence the shape or configuration of their pulpal sections.

**PULPAL SECTIONS OF A MAXILLARY FIRST PREMOLAR**

![Fig 5-11 Mesiodistal Section - From Facial](image1)

![Fig 5-12 Mesiodistal Section – From Lingual](image2)
5-10

MAXILLARY FIRST PREMOLAR

Fig 5-13 Buccolinguval Section
- From Mesial

Fig 5-14 Transverse Section at Cervix

Fig 5-15 Transverse Section at Midroot
PULPAL SECTIONS OF A MAXILLARY SECOND PREMOLAR

Fig 5-16
Mesiodistal Section
- From Facial

Fig 5-17
Mesiodistal Section
- From Lingual

Fig 5-18
Buccolingual Section
- Mesial Surface

Fig 5-19
Transverse Section
- at Cervix

Fig 5-20
Transverse Section
- at Midroot
B. IDENTIFICATION EXERCISE

1. Use maxillary premolars for this exercise.
2. Refer to the identifying Characteristics of Maxillary Premolars below for help in identifying the features of these teeth.
3. Identify all mandibular teeth opposing or occluding with maxillary first and second premolars (Fig. 3-21 on page 3-10).

IDENTIFYING CHARACTERISTICS OF MAXILLARY FIRST AND SECOND PREMOLARS

1. Maxillary First Premolar:
   a. Major characteristics:
      1. Two cusps
         Two prominent, sharp or pointed cusps, the buccal cusp being the larger of the two.
      2. Mesial Concavity
         This premolar has a distinct concavity that runs from the middle portion of the mesial surface of the crown, through the cervical area and down the mesial root surface.
   b. Other Characteristics

      The major characteristics listed above are generally adequate aids in identifying maxillary first premolars. However, the following characteristics are important not only in identifying finer details of maxillary first premolar anatomy but also in identifying traits which are peculiar to maxillary first premolars.

      1. Mesial Marginal Groove

         This tooth almost always has a distinct mesial marginal groove.

      2. Long Central Groove

         The central groove which extends between the mesial and distal occlusal pits is longer on the maxillary first premolar than on the maxillary second premolar.
3. **Straight Buccal Cusp Ridge**

   The buccal cusp ridge follows a straight line but is not parallel to the central groove. It is closer to the central groove on the mesial.

4. **Sharp Buccal Line angles**

   The buccal line angles on the maxillary first premolar are sharper than on any other premolars.

5. **Smaller Lingual Cusp**

   The lingual cusp on the maxillary first premolar is slightly smaller than the buccal cusp. It is also shorter than the lingual cusp of the maxillary second premolar.

6. **The tip of the buccal cusp is located toward the distal from the midline of the crown. The lingual cusp tip is displaced slightly to the mesial of the buccal cusp tip.**

7. **Rounded Distolingual Line Angle**

   The Distolingual line angle is more rounded than any other line angle on this tooth. This characteristic of the maxillary first premolar is most obvious from an occlusal view.

8. **Distal Marginal Ridge Closer to Cervical**

9. **Central Groove Located Over Center of Root**

10. **Outline Form**

    The external outline form (viewed from the occlusal Fig. 5-21A) is octagonal with the widest mesiodistal dimension along the buccal cusp ridge and the narrowest mesiodistal dimension along the lingual. Contrasting this outline is the occlusal table which exhibits a trapezoidal outline form (Fig. 5-21B).
11. Long Distobucco-occlusal Groove

   This groove is one of the longest and most prominent grooves (besides the central groove) on a maxillary first premolar.

12. Visible Buccal Ridge

   This premolar has a visible buccal ridge and buccal lobes which often is made more obvious by a slight depression on the occlusal 1/2 of the buccal surface along the mesial and sometimes along the distal at the junction of the lobes.

13. Lingual Height of Contour on Middle 1/3

   The buccal height of contour is located on the cervical 1/3 but the lingual height of contour is found on the middle 1/3 of the crown.

14. Viewed from the facial, the distal outline form is more nearly straight while the mesial border exhibits a slight concave form.

15. One or Two Roots

   This tooth frequently has two roots, but it is not unusual for it to have one root. In rare instances, this premolar may even have three roots.

16. Deep mesial root groove is present from bifurcation onto the enamel of the crown. Distal root groove, if present, is much smaller.
II. Maxillary Second Premolar

a. Major Characteristics

1. Two Cusps of Relatively Equal Size

The maxillary second premolar has two sharp cusps with the buccal cusp being only slightly larger than the lingual cusp.

2. No Mesial concavity

The mesial surface at the cervical is smoothly convex with no mesial concavity present.

3. Ovoid Occlusal Outline

The buccal line angles of the maxillary second premolar are more rounded than those of a maxillary first premolar.

4. Occlusal Table

The occlusal table is more rectangular than trapezoidal as is present for the 1st premolar.

b. Other Characteristics

1. No Mesial Marginal Groove

2. Short Central Groove

The marginal ridges of a maxillary second premolar are thicker and wider. Consequently, the central groove on this tooth is shorter than on a maxillary first premolar and often will have only one occlusal pit in lieu of a central groove. If a central groove is present, there is usually a pit at both ends of it.

3. Buccal Cusp Ridge Evenly Convex

4. Lingual Cusp Size

The lingual cusp of a maxillary second premolar is slightly smaller than the buccal cusp but still larger than the lingual cusp of a maxillary first premolar.

5. Lingual Cusp Apex Toward Mesial
6. Rounded Distolingual Line Angle

Like the maxillary first premolar, the distolingual line angle of a maxillary second premolar is more rounded than any other line angles of the tooth. This characteristic is most evident from an occlusal view.

7. Distal Marginal Ridge Closer to Cervical

8. Central Groove Over Center of Root

9. No Prominent Buccal Ridge

10. Lingual Height of Contour on Middle 1/3

11. One Root

This premolar generally has one root but it may occasionally have two.

12. Supplemental Grooves

Supplemental or additional small occlusal grooves are often seen extending out of the central groove.

13. May have both mesial and distal root grooves, but mesial is NOT as highly developed as on maxillary first premolar.

III. OTHER DISTINGUISHING CHARACTERISTICS BETWEEN MAXILLARY FIRST AND SECOND PREMOLARS

1. From the lingual, the entire buccal profile of the 1st premolar crown is visible. Very little of any buccal profile is visible from the lingual of second maxillary premolars.

2. From the occlusal, the mesiolingual orientation of the buccal cusp ridge of the 1st premolar gives the crown a twisted appearance. The crown of the second premolar is not twisted.

3. Occlusal grooves of the 1st premolar form a characteristic pattern. The second premolar has more of a variety of patterns.
V. DRAWING EXERCISE

MAXILLARY FIRST PREMOLAR #5

Dimensions:

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Buccolingual Crown Width ______ mm

Fig. 5-22 Buccal View

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Buccal cusp apex located slightly to distal of center under the crown and root.
4. MB cusp ridge is slightly longer in length than the DB cusp ridge.
5. Mesial height of contour relatively equal to distal height of contour.
6. Heights of contour should contact the heights of contour of adjacent teeth.
7. CEJ less convex than CEJ of #6 (or other anterior teeth).
8. Root straight and centered over the crown.
9. Distal outline form almost straight mesial outline form exhibits a slight concavity from the contact area to the cervical line.
10. Drawing is neatly accomplished.

Fig 5-22

ResD 515 Dental Anatomy 2009, Page 161
MAXILLARY FIRST PREMOLAR #5

Fig 5-23 Lingual View

Dimensions:

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Lingual cusp apex located mesially in contrast to buccal cusp apex.
4. Lingual cusp a little shorter and narrower in than the buccal cusp. As a result, the buccal profile is frequently visible. The occlusal portion of the buccal ridge is also partly visible.
5. Mesial height of contour relatively equal to distal height of contour. Heights of contour contacting those of adjacent teeth.
6. Buccal root outline on the mesial may be partly visible due to mesial concavity.
7. Drawing neatly accomplished.
MAXILLARY FIRST PREMOLAR #5

Fig. 5-24  Occlusal view

DRAWING CRITERIA

1. Occlusal external outline is octagonal in shape.
2. Crown outline wider buccolingually than mesiodistally.
3. Crown is widest mesiodistally along the buccal cusp ridge and narrowest along the lingual cusp ridge.
4. Line angles: Buccal line angles sharp; mesiolingual line angle less sharp than buccal line angles but sharper than distolingual line angle. (Distolingual line angle the most rounded of the line angles of this tooth).
5. Prominent (visible) buccal ridge and lobes present.
6. Buccal cusp apex is centered, whereas lingual cusp apex is positioned closer to the mesial than the distal.
7. Buccal cusp ridges on a relatively straight plane, with mesiobuccal cusp ridge inclining slightly toward the occlusal central groove.
8. Lingual cusp ridge shorter than buccal cusp ridge; closer to the lingual surface than buccal cusp ridge is to the buccal surface.
9. Occlusal table formed by the buccal and lingual cusp ridges and mesial and distal marginal ridges.
10. Long central groove centrally located buccolingually; extending between two occlusal pits, mesial and distal.
11. Mesial marginal groove originating from the mesial pit and crossing the mesial marginal ridge. Distal marginal groove stops short of distal marginal ridge.
12. Mesiobucco-occlusal and mesiolinguo-occlusal grooves originating from the mesial pit and extending in a mesiobuccal and mesiolingual direction respectively. Distobucco-occlusal groove originating from the distal pit and extending in a distobuccal direction (of the four grooves branching out of the central groove, the DBO groove extends furthest); distolinguo-occlusal groove originating from the distal pit and moving in a distolingual direction.
13. Buccal and lingual triangular ridges originating respectively from the buccal cusp apex and the lingual cusp apex, increasing in width as they extend toward the central groove.
14. Proximal contact areas located toward the buccal and contacting heights of contour of adjacent teeth.

15. Crown drawn in correct proportion to adjacent teeth.

16. Drawing is neatly accomplished.
MAXILLARY FIRST PREMOLAR #5

Fig. 5-25  Mesial view

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. Central sulcus located under the center of the root.
3. Buccal cusp apex and lingual cusp apex positioned approximately under the junction of the middle 1/4 and buccal 1/4 and junction of middle 1/4 and lingual 1/4 respectively.
4. Buccal cusp longer than lingual cusp.
5. Buccal height of contour located on the cervical 1/3 and lingual height of contour on the middle 1/3 of the crown.
6. Mesial marginal groove extending from the central sulcus crossing the mesial marginal ridge.
7. Contact area located more to the buccal than to the lingual.
8. CEJ slightly curved occlusally.
9. Mesial concavity originating from the middle of the crown crossing the cervical and extending apically along the central portion the root. Interradicular groove is the term sometimes used to describe the extension of the mesial concavity onto the root.
10. Root may or may not be bifurcated.
11. Drawing is neatly accomplished.
MAXILLARY SECOND PREMOLAR #4

Dimensions:

Crown Height _________ mm
Root Length _________ mm
Total Tooth Length _________ mm
Mesiodistal Crown Width _________ mm
Buccolingual Crown Width _________ mm

Fig. 5-26  **Buccal View**

**Drawing Criteria**

1. Crown and root drawn in correct proportion to each other.
2. The crown and root drawn in correct proportion to adjacent teeth.
3. Buccal cusp apex centered under the crown and root.
4. MB and DB cusp ridges relatively equal in length.
5. Mesial height of contour relatively equal to distal height of contour. Heights of contour contacting those of adjacent teeth.
6. CEJ slightly curved apically.
7. Root straight and centered over the crown.
8. Drawing is neatly accomplished
MAXILLARY SECOND PREMOLAR #4

Fig. 5-27  Lingual View

Drawing Criteria

1. Crown and root drawn in correct proportion to each other.
2. The crown and root in correct proportion to adjacent teeth.
3. Lingual cusp apex located slightly mesially in contrast to centrally located buccal cusp apex.
4. Lingual cusp close to same height and width as buccal cusp. Buccal cusp profile barely visible.
5. Mesial height of contour relatively equal to distal height of contour. Heights of contour contacting heights of contour of adjacent teeth.
6. Drawing is neatly accomplished.
MAXILLARY SECOND PREMOLAR #4

Fig. 5-28  Occlusal View

Drawing Criteria

1. Occlusal outline is ovoid in shape.
2. The crown is widest mesiodistally along the buccal cusp ridge and narrowest along the lingual cusp ridge.
3. Buccal line angles less sharp than those of a maxillary first premolar.
4. Distolingual line angle most rounded of main line angles.
5. Buccal cusp apex centrally located in contrast to mesially positioned lingual cusp apex.
6. Buccal cusp ridge evenly convex in contrast to the buccal cusp ridge of a maxillary first premolar.
7. Occlusal table rectangular as formed by the buccal and lingual cusp ridges and mesial and distal marginal ridges.
8. Central groove short in contrast with long central groove of first premolar. The central groove is centrally located buccolingually on the occlusal table and, depending on its length, may extend between the mesial or distal pit or be contained in a single central pit.
9. Other occlusal grooves: DBO groove and DLO groove originating from the distal pit and extending in a distobuccal and a distolingual direction respectively but do not cross the marginal ridge.
10. MBO groove and MLO groove originating from the mesial pit and extending in a mesiobuccal and mesiolingual direction respectively but do not cross the marginal ridge.
11. Buccal and lingual triangular ridges descending from the apex of their respective cusps toward the central groove.
12. Supplemental grooves are present and branch out from the central groove.
13. Proximal contact areas buccally located and contacting heights of contour of adjacent teeth.
15. Drawing is neatly accomplished.

Fig 5-28
MAXILLARY SECOND PREMOLAR #4

Fig. 5-29  Mesial View

Drawing Criteria

1. Crown and root drawn in correct proportions to each other.
2. Central sulcus located under the center of the root.
3. Buccal and lingual cusp apices respectively located approximately at the junction of the middle 1/4 and buccal 1/4 and junction of the middle 1/4 and lingual 1/4.
4. Buccal cusp only very slightly longer than the lingual cusp.
5. Buccal height of contour located on the cervical 1/3 of the crown; lingual height of contour on the middle 1/3.
6. Contact area located more to the buccal than to the lingual.
7. CEJ may be straight or only slightly curved occlusally.
8. Interradicular groove may occasionally be present, but there is no mesial concavity like the one seen on #5.
9. Drawing is neatly accomplished.
V. **SELF-TEST**

1. The maxillary first premolar is **not** characterized by:
   a. a deep mesial concavity
   b. bifurcated roots
   c. a continuous distal marginal ridge
   d. an octagonal occlusal outline
   e. a central pit

2. Identify C on Fig. 5-30 -I
   a. lingual groove
   b. buccal cusp
   c. lingual root
   d. lingual cusp
   e. central groove

3. Identify Fig. I above
   a. #12
   b. #4
   c. #13
   d. #5
4. The maxillary second premolar is generally identified by which of the following characteristics:

a. short central groove  
b. buccal cusp ridge parallel to the central groove  
c. lingual and buccal cusps are not equal in height  
d. prominent mesial marginal groove  
e. bifurcated roots

5. Which surface is indicated by B on this pulpal section?

a. labial  
b. lingual  
c. mesial  
d. distal  
e. occlusal

6. Identify II of Fig 5-31

a. mesiodistal section of #4 on the buccal  
b. labiolingual section of #5  
c. buccolinguinal section of #4  
d. mesiodistal section of #4 on the lingual

7. The distal triangular fossa on a premolar is bounded by which of the following?

a. distolinguinal groove, distobuccal groove, and distal marginal ridge  
b. distal marginal ridge, distal marginal groove, buccal cusp  
c. central groove, distal pit, distolinguinal groove  
d. distobuccal groove, distolinguinal groove, and distal marginal groove
8. The central sulcus is:
   a. centered over the root trunk on #12
   b. rectangular in shape on #13
   c. formed by the meeting of the inner inclines of the buccal and lingual cusps
   d. a and b
   e. a and c

9. Which of the following is located between the CEJ and the point of trifurcation or bifurcation?
   a. occlusal third
   b. root trunk
   c. apical third
   d. marginal groove

10. The lingual cusp of #4 normally occludes:
    a. on the distal marginal ridge of #28 and mesial marginal ridge of #29
    b. on the distal marginal ridge of #29 and mesial marginal ridge of #30
    c. on the distal fossa of #28
    d. on the mesial fossa of #29
    e. none of the above
CRITERIA EXPLANATION FOR TOOTH #4

1. FINISH OF MARGINS
   - **Margins:**
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)

2. FINISH OF EXTERNAL SURFACES:
   - **External Surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, “wavy” contours, or pits present

3. FINISH OF OCCLUSAL ANATOMY:
   - **Anatomy:**
     - Marginal ridges, triangular ridges, and cusp ridges should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All developmental and supplemental grooves should be smooth and polished with no scratches, pits, or waviness
     - All junctions between these structures must be smooth and flowing

4. OCCLUSAL VIEW:
   - **Outline Form:**
     - Occlusal outline ovoid
     - Buccal line angles more rounded than on first premolar
     - Distolingual line angle more rounded than any of the others
     - Mesiodistal dimension wider on buccal than lingual
     - Proximal contacts slightly buccal to midline 1.0 to 1.25 mm long
   - **Occlusal Table:**
     - Occlusal table is rectangular in shape

5. CUSP AND RIDGE ANATOMY:
   - **Ridges:**
     - Marginal ridges are thicker and wider than on first premolar
     - Triangular ridges apparent starting with their apex at cusp tip, ending with their bases at the central groove area
   - **Cusps:**
     - Buccal cusp slightly larger than lingual cusp
     - Lingual cusp larger than lingual cusp of maxillary first premolar

6. FOSSA AND GROOVE ANATOMY:
5-30

- **Size and Shape:**
  - Central groove very short, shorter than for first premolar
  - Small supplemental grooves are apparent running facially and lingually from the central groove/pit area
    - Groove pattern is variable

- **Position:**
  - Central groove, if present, in center of tooth faciolingually
  - Only one prominent pit near center or two pits close to each other near center depending on length of central groove
  - Lingual cusp apex slightly towards mesial

7. **FACIAL VIEW:**
   - **Outline:**
     - Buccal cusp centered and sharp
     - Buccal cusp ridges evenly convex
     - Correct proportion to adjacent teeth
     - Proximal contact 0.5 to 0.75 mm occlusogingivally
   - **M/D:**
     - M/D cusp ridges same length
     - Mesial and distal contours similar

8. **MESIAL/DISTAL VIEWS:**
   - **B/Li Outline:**
     - Buccal and lingual cusps located ¼ of the way in from the buccal and lingual HOC
     - Buccal cusp slightly longer than lingual cusp
   - **B/Li Contours:**
     - Buccal contour slightly more rounded than lingual contour
   - **HOCs:**
     - Lingual HOCs in middle 1/3
     - Buccal HOC in cervical 1/3
     - HOCs smoothly flow in an occlusal direction into the proximal contacts similar to #13

9. **LINGUAL OUTLINE:**
   - **Shape:**
     - Cusp apex sharp and slightly mesial of midline
     - Distal marginal ridge closer to cervical than the mesial one
     - From the lingual, the buccal outline is barely visible unlike the first premolar
   - **Outline:**
     - Marginal ridges at same level as adjacent teeth
• Proportioned correctly to rest of the tooth
• Correct proportion to adjacent teeth
• Lingual cusp close to same height and width as buccal cusp

- **HOCs:**
  - Proximal contacts 0.5 to 0.75 mm occlusogingivally
  - Proximal contacts contact adjacent teeth the same as when viewed from the facial
  - Mesial HOC in middle 1/3
  - Distal HOC in middle 1/3

10. **CONTACTS/EMBRASURES:**

- **Proximal Contacts:**
  - Mesial and distal contact areas at same height
  - Proximal contacts contacting adjacent teeth
  - Proximal contacts 0.5 to 0.75 mm occlusogingivally and 1.0 to 1.25 mm faciolingually

- **Embrasures:**
  - Occlusal embrasures distinct, but smallest of all embrasures
  - Lingual embrasures largest embrasures with DL being the largest
  - Gingival embrasures allows adequate room for gingival tissue
  - Facial embrasures distinct, but small
RESD 515 Autumn 2009

First Wax Up Exercise

Student Secret ID#: ________________________________________

<table>
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<th>Tooth # 4</th>
<th>Criteria</th>
<th>Comments</th>
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<tbody>
<tr>
<td>PASS</td>
<td>Occlusal Anatomy:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Appropriate and support the overall anatomical and esthetic requirements of the tooth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• In harmony with arch form and form an appropriate occlusal shape that provides correct overall tooth dimensions.</td>
<td></td>
</tr>
<tr>
<td>FAIL</td>
<td>Heights of contour, proximal contacts/areas, and embrasures:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Correct shape and height in relation to the adjacent teeth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• In the correct third and not over- or under-contoured on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Facial________Lingual_______Mesial________Distal_______</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outlines and Finish</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• In harmony with arch form and that provides correct overall tooth dimensions: Facial_______Mesial/Distal_______Lingual_______</td>
<td></td>
</tr>
</tbody>
</table>

POINTS: ____________
**WAXING CRITERIA FOR #4 FULL CROWN**

<table>
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<tr>
<th>Your evaluation</th>
<th>Partner’s evaluation</th>
<th>Consensus evaluation</th>
<th>Faculty evaluation</th>
<th>*Final evaluation</th>
</tr>
</thead>
</table>

**CRITERIA**

1. Finish of Margins:
   - Margins

2. Finish of External Surfaces:
   - External surfaces

3. Finish of Occlusal Anatomy:
   - Anatomy

4. Occlusal View:
   - Outline form
   - Occlusal table

5. Cusp and Ridge Anatomy:
   - Ridges
   - Cusps

6. Fossa and Groove Anatomy:
   - Size and Shape
   - Position

7. Facial View:
   - Outline
   - M/D

8. Mesial/Distal Views:
   - B/Li Outline
   - B/Li Contours
   - HOCs

9. Lingual View:
   - Shape
   - Outline
   - HOCs

10. Contact/Embrasures:
    - Proximal contacts
    - Embrasures

*Refer to syllabus for further explanation of criteria

**TOTAL _____

*NOTE: To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.*
UNIT 6
MANDIBULAR PREMOLARS

1. OBJECTIVES

Upon completion of this unit, be able to do the following:

a. Demonstrate your understanding of all terms listed in the glossary on written and verbal communication.

b. Identify all areas of mandibular first and second premolars that have names.

c. Identify and distinguish between mandibular right and left first and second premolars including normal variations.

d. Identify the maxillary teeth occluding with mandibular first and second premolars.

e. Draw the first and second premolars:
   1. singly, and in proper relation to adjacent teeth when shown
   2. according to given criteria

f. Identify and distinguish given sectional areas of the pulp in mandibular first and second premolars.

f. Satisfactorily complete:

   1. The identification exercise and satisfactorily complete the nomenclature test

   2. The self-test prior to the next class period
2. GENERAL PROCEDURE

A. ATTEND THE CLASSROOM LECTURE: “Mandibular Premolars.”

B. COMPLETE EXERCISES IN:
   1. Labeling and Pulp Study
   2. Identification
   3. Drawing

C. COMPLETE NOMENCLATURE AND SELF-TEST on Unit VI.

D. Review “3D INTERACTIVE TOOTH ATLAS”

3. GLOSSARY

Cusplet (Tubercle) - an elevation produced by an overcalcification of enamel. It is cusp-like in form and deviates from the anatomical norm. A cusplet may occasionally be found on the distal of the lingual cusp of a mandibular second premolar (U or H type) or on the mesiolingual of the ML cusp of maxillary first and second molars.

Lingual Groove - a linear depression generally found on a three-cusped mandibular second premolar extending lingually from the central pit and separating the two lingual cusps.

Mesiolinguinal Groove - a linear depression generally found on a mandibular first premolar extending cervically from the mesial pit, and often cutting across the junction of the mesiolingual cusp ridge and mesial marginal ridge.

*Transverse Ridge - a continuous elevation found on the occlusal surface of a mandibular first premolar, extending buccolingually and uniting the triangular ridge of the buccal cusp and the triangular ridge of the lingual cusp.

*This term is defined differently for primary teeth.
IV. LABELING EXERCISE AND PULP STUDY

1. Labeling Exercise

Directions: Label Fig. 6-1 to 6-10

MANDIBULAR FIRST PREMOLAR #21

TERMS

1. Buccal cusp
2. Buccal triangular ridge
3. Cervical line
4. Distal contact area
5. Distal marginal ridge
6. Distal pit
7. Distobuccal cusp ridge
8. Height of contour
9. Lingual cusp
10. Mesial contact area
11. Mesial marginal ridge
12. Mesial pit
13. Mesiobuccal cusp ridge
14. Mesiolingual groove
15. Root apex
16. Transverse ridge

Fig 6-1
Buccal view

Fig 6-2
Lingual view
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Buccolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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<td>7.0</td>
<td>7.5</td>
<td>22.5</td>
<td>10</td>
</tr>
<tr>
<td>Second</td>
<td>8.0</td>
<td>7.0</td>
<td>8.0</td>
<td>22.5</td>
<td>10.75</td>
</tr>
</tbody>
</table>

After Kraus

---

**Fig 6-3**
Occlusal View

**Fig 6-4**
Mesial view

**Fig 6-5**
Distal View
MANDIBULAR SECOND PREMOLAR #20

TERMS

1. Buccal cusp
2. Buccal triangular ridge
3. Central groove
4. Central pit
5. Cervical line
6. Distal contact area
7. Distobuccal cusp ridge
8. Distal groove
9. Distal marginal ridge
10. Distal pit
11. Distolingual cusp
12. Distolingual ridge
13. Height of contour
14. Lingual cusp
15. Lingual groove
16. Lingual triangular ridge
17. Mesial contact area
18. Mesiobuccal cusp ridge
19. Mesial marginal ridge
20. Mesial groove
21. Mesial pit
22. Mesiolingual cusp
23. Mesiolingual ridge
24. Root apex

Fig 6-6
Buccal view

Fig 6-7
Lingual view
Fig 6-8 a, b, c, Occlusal views

a. “U” shaped occlusal

b. “H” shaped occlusal

c. “Y” shaped occlusal

Fig 6-9
Mesial view

Fig 6-10
Distal view
2. PULP STUDY

Study the morphology of pulpal sections of the mandibular first premolar and mandibular second premolar as illustrated on Fig. 6-11 to 6-20. Note the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of mandibular first and second premolars that influence the shape and configuration of their pulpal sections.

PULPAL SECTIONS OF A MANDIBULAR FIRST PREMOLAR

Fig. 6-11
Mesiodistal Section
From Buccal

Fig. 6-12
Mesiodistal Section
From Lingual
Fig 6-14
Transverse Section at Cervix

Fig 6-13
Buccolingual Section
Mesial Surface

Fig 6-15
Transverse Section at Midroot
PULPAL SECTIONS OF A MANDIBULAR SECOND PREMOLAR

Fig 6-16
Mesiodistal Section

Fig 6-17
Mesiodistal Section From Lingual

Fig 6-18
Buccolingual Section From Mesial

Fig 6-19
Transverse Section at the CEJ

Fig 6-20
Transverse Section at midroot
PULPAL SECTIONS OF A MANDIBULAR FIRST PREMOLAR

B. IDENTIFICATION EXERCISE

1. Use 2½ x mandibular premolars for this exercise.

2. Refer to Identifying Characteristics of Mandibular Premolars below for help in identifying these teeth.

3. Study the occlusal relationships of mandibular first and second premolars with opposing teeth in the maxillary arch (Fig. 3-21).

IDENTIFYING CHARACTERISTICS OF MANDIBULAR PREMOLARS (BICUSPIDS)

1. MANDIBULAR FIRST PREMOLAR:

A. Distinguishing Mandibular First Premolars From Other Premolars

1. Cusp Size

This premolar has one large buccal cusp and one very small (nonfunctional) lingual cusp.

2. Occlusal Table at 45° Angle

The occlusal table forms an approximate 45° angle with the long axis of the tooth.

B. Distinguishing Mandibular First Premolars From Canines

1. Two cusps

Like the maxillary premolars, the mandibular first premolar has two cusps: a buccal cusp, and a lingual cusp.

2. Two Pits

The occlusal surface of the mandibular first premolar has two distinct pits (mesio-occlusal and disto-occlusal).

3. Mesiolingual Groove

A distinct mesiolingual groove is often present on the occlusal surface of the mandibular first premolar.
C. Distinguishing Mandibular Right and Left First Premolars

1. Flat Mesiolingual Line Angle

When viewed from the occlusal, the crown outline form is quite round except the mesiolingual line angle is flattened.

2. Mesiolingual Groove

The mesiolingual groove extends from the mesial pit and crosses over the marginal ridge in the area of the mesiolingual line angle.

3. Mesial Pit is closest to the buccal cusp ridge

D. Other Characteristics:

1. Transverse Ridge

The mandibular first premolar is the only permanent tooth that has a transverse ridge, a prominent ridge that extends straight from the buccal cusp apex to the lingual cusp apex dividing the occlusal surface somewhat in half with sharply distinguished mesial and distal fossas.

2. Centrally Located Buccal Cusp

The buccal cusp is usually centrally located over the root.

3. Height of Contour

The lingual height of contour is located in the middle 1/3 while the buccal HOC is in the cervical 1/3.

4. Lingually Tipped Crown

The crown appears lingually tipped or oriented as observed from the mesial or distal due to a centrally located buccal cusp and the lingual height of contour being on the occlusal 1/3 of the height of the lingual cusp.

5. Larger Distal fossa

The distal fossa is usually larger than the mesial fossa.
6. Proximal Root Depression

When present, it is found most frequently on the mesial root surface.

7. Mesial Marginal Ridge Closer to Cervical

The mesial marginal ridge is usually closer to the cervical than the distal marginal ridge. This is the only posterior tooth in which this occurs.

8. Small Triangular Occlusal Table

Of all posterior teeth, this premolar has the smallest occlusal table. It is triangular in shape with the buccal cusp ridge at the base of the triangle.

MANDIBULAR SECOND PREMOLAR

A. Major characteristics:

1. Three Cusps

The mandibular second premolar usually has three cusps, but it may have only two. It is the only three-cusped single-rooted tooth in the mouth.

2. Rounded Occlusal Outline Form

3. Tipped crown

4. Larger Lingual Cusp(s)

5. The lingual or mesiolingual cusp is greater in size and occlusal height than the lingual cusp of the mandibular first premolar but not as large as the lingual cusp of a maxillary first premolar.

Lingual Cusp to Mesial

This one factor can help distinguish a mandibular right from a mandibular left second premolar. If the lingual has one cusp, it is located closer to the mesial. If the lingual has two cusps, the larger cusp is the mesiolingual one.
B. Other Characteristics:

1. Buccal Cusp and Central Groove Location

When viewing from the mesial, the buccal cusp apex is located at the junction of the middle and buccal third while the central groove is located at the junction of the middle and lingual thirds. The central groove is not found on the occlusal center of the crown as in maxillary premolars. A central groove on the occlusal surface exists in only the “two” cusp variety. A mesial and distal groove on the occlusal surface takes its place in the three cusp configuration.

2. Distal Marginal Ridge Closer to Cervical

The distal marginal ridge is closer to the cervical than the mesial marginal ridge. This is typical of all posterior teeth except mandibular first premolars.

3. Lingual groove

A three-cusped mandibular second premolar often has a lingual groove. It is the only mandibular premolar that may have a lingual groove.

4. Y-, H-, U-, shaped Occlusal Grooves

The occlusal grooves of a mandibular second premolar may be in the shape of U, Y, or H. H and U-shaped occlusal grooves are generally found on two-cusped mandibular second premolars whereas Y-shaped grooves are found on three-cusped mandibular second premolars. Cusp-like enamel formations occasionally seen on H- and U-shaped mandibular second premolars are generally considered cusplets or tubercles.

5. Occlusal Table Perpendicular to Long Axis

The occlusal table is closer to being perpendicular to the long axis of the tooth than is the occlusal table of the first premolar.

6. Height of Contour

The buccal HOC is in the cervical 1/3 while the lingual HOC is in the middle 1/3.

7. Root grooves similar to mandibular first premolar.
C. DISTINGUISHING BETWEEN MANDIBULAR FIRST AND SECOND PREMOLARS

1. From the buccal, first premolar crown is bilaterally asymmetrical while second premolar is more symmetrical.

2. From the lingual, almost all the occlusal surface of the first premolar.

3. From the mesial, occlusal plane of first premolar is tilted lingually. Second premolar’s occlusal plane is horizontal.

4. From the mesial, mesial marginal ridge of the first premolar inclines cervically about 45°. Mesial marginal ridge is almost horizontal on second premolar.

5. From the mesial, a mesiolingual groove is present on the first premolar. None is observed on the second premolar.

6. From the occlusal, the occlusal outline of the first premolar is round with a flat mesial, while the second premolar is more round or square.

7. From the occlusal, the occlusal table of the first premolar is triangular while the second premolar’s occlusal table is square.

8. From the occlusal, the mesial marginal ridge is shorter and less prominent than the distal marginal ridge on the first premolar. The second’s ridges are about the same length and prominence.

9. From the occlusal, there is no central pit on the first premolar while there is a central pit on the second premolar if it is a 3-cusp tooth.
V. DRAWING EXERCISE

MANDIBULAR FIRST PREMOLAR #21

Dimensions:

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Buccolingual Crown Width ______ mm

Fig. 6-21 Buccal View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Buccal cusp apex centered over the root.
4. Mesiobuccal and distobuccal cusp ridges relatively equal in length.
5. Mesial and distal heights of contour relatively equal and in contact with heights of contour of adjacent teeth.
6. CEJ slightly curved apically.
7. Drawing is neatly accomplished.

Fig 6-21
MANDIBULAR FIRST PREMOLAR #21

Fig. 6-22  Lingual View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Buccal cusp apex centered over the root mesiodistally with the buccal cusp ridges relatively equal in length.
4. Lingual cusp considerably smaller than the buccal cusp.
5. The transverse ridge extending from the buccal cusp to the lingual cusp is generally visible from this view due to the size of the lingual cusp.
6. Mesiolinguinal groove is shown extending cervically in the area of the mesiolingual line angle.
7. Mesial marginal ridge closer to the cervical than distal marginal ridge.
8. Mesial and distal heights of contour relatively equal. (Distal height of contour may be slightly further from the cervical.) Heights of contour should contact those of adjacent teeth.
9. CEJ slightly curved apically.
10. Buccal root profile may be visible from this view due to narrower root width on the lingual (and also usually due to the presence of proximal root depression particularly on the mesial).
11. Drawing is neatly accomplished.

Fig 6-22
MANDIBULAR FIRST PREMOLAR #21

Fig. 6-23 Occlusal view

DRAWING CRITERIA

1. Crown is drawn in correct proportion to adjacent crowns.
2. Crown outline round in shape with a flattened ML line angle.
3. The occlusal table appears triangular as a result of the comparative sizes of the buccal and lingual cusps.
4. Buccal cusp apex centrally located mesiodistally.
5. Lingual cusp apex located close to the lingual surface within the center of the crown mesiodistally.
6. A prominent transverse ridge connects the buccal and lingual cusps dividing the occlusal surface into mesial and distal sections.
7. The distal fossa is larger than the mesial fossa.
8. The mesial fossa is located closer to the buccal cusp ridge than the distal fossa.
9. The mesiolingual groove originates from the mesial pit and usually cuts across the junction of the mesial marginal ridge and the mesiolingual cusp ridge ending on the mesiolingual proximal surface.
10. Proximal heights of contour located buccally and contacting heights of contour of adjacent teeth.
11. Drawing is neatly accomplished.
MANDIBULAR FIRST PREMOLAR #21

Fig. 6-24  Mesial view

1. Crown and root drawn in correct proportion to each other.
2. Buccal cusp apex centered buccolingually over the root.
3. Lingual cusp apex situated close to the lingual surface.
4. Lingual cusp considerably smaller than the buccal cusp.
5. Buccal height of contour located in the cervical 1/3 of the crown near the junction of the middle 1/3; lingual height of contour in the middle 1/3 near junction of occlusal 1/3.
6. A prominent transverse ridge extending from the buccal cusp apex to the lingual cusp triangular ridge visible from this view.
7. The mesiolingual groove cuts through the mesial marginal ridge and moves cervically a short distance along the mesiolingual line angle.
8. Root groove may be present on the mesial root surface.
9. CEJ slightly curved occlusally.
10. Contact area located to the buccal.
11. Drawing is neatly accomplished.
MANDIBULAR SECOND PREMOLAR #20

Dimensions:

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Buccolingual Crown Width ______ mm

Fig. 6-25   Facial View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are in correct proportion to adjacent teeth.
3. Buccal cusp apex centered over the root.
4. Mesiobuccal and distobuccal cusp ridges relatively equal in length.
5. Mesial and distal heights of contour relatively equal and contacting those of adjacent teeth.
6. CEJ slightly curved apically.
7. Root centered under crown.
8. Drawing is neatly accomplished.
MANDIBULAR SECOND PREMOLAR #20 (Y-TYPE)

Fig. 6-26  Lingual View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. The crown and root are drawn in correct proportion to adjacent teeth.
3. Buccal cusp apex centered over the root with the MB and DB cusp ridges relatively equal in length.
4. Two lingual cusps present; the ML cusp which is smaller than the buccal cusp (but bigger than the lingual cusp of mandibular first premolar) and the DL cusp which is the smallest of the three cusps.
5. The ML cusp apex is mesially located while the DL cusp is located more to the distal of the lingual surface.
6. Mesial and distal heights of contour relatively equal and contacting heights of contour of adjacent teeth.
7. CEJ slightly curved apically.
8. The lingual developmental groove extends over onto the lingual surface from the occlusal table separating the mesiolingual and distolinguinal cusps.
9. Mesiolingual takes up 2/3 of lingual surface while distolinguinal comprises 1/3.
10. Drawing is neatly accomplished.
MANDIBULAR SECOND PREMOLAR #20 (Y-TYPE)

Fig. 6-27 Occlusal View

DRAWING CRITERIA

2. Mesial and distal occlusal outlines symmetrical in contrast with #21.
3. Buccal cusp apex centrally located mesiodistally.
4. Location of ML and DL cusp apices should reflect the relative sizes of these cusps (ML cusp located further inward than DL cusp).
5. The occlusal table is outlined by: the buccal cusp ridges and the cusp ridges of the two lingual cusps, and the mesial and distal marginal ridges.
6-9. Three occlusal pits present on the occlusal surface: The central pit is centrally located faciolingually on the occlusal table, but is located slightly to the distal in a mesiodistal direction. The mesial and distal pits are located more facially in respect to the central pit.

10-12. Three main occlusal grooves found on the occlusal surface: the mesial groove extending between the mesial pit and the central pit; the distal groove extending between the central pit and the distal pit; the lingual groove originating from the central pit and extending lingually between the ML and DL cusps just onto the lingual surface of the tooth.

13. Proximal heights of contour located toward the buccal and contacting heights of contour of adjacent teeth.


15. Drawing is neatly accomplished.

Fig 6-27
MANDIBULAR SECOND PREMOLAR #20 (Y-TYPE)

Fig. 6-28 Mesial View

DRAWING CRITERIA

1. Crown and root drawn in correct proportion to each other.
2. Buccal cusp apex located at the junction of the middle 1/3 and buccal 1/3.
3. The central sulcus is located over the junction of the middle 1/3 and the lingual 1/3.
4. The ML cusp will be the only lingual cusp visible from this view.
5. Buccal height of contour located in the gingival 1/3 and lingual height of contour in the middle third.
6. Contact area located to the buccal.
7. CEJ relatively straight.
8. Drawing is neatly accomplished.
V. SELF-TEST

1. In comparing #20 and #21, which of the following is false?
   a. Mesial marginal ridge is less prominent on #21 than it is on #20.
   b. Only one root is generally present on both #20 and #21.
   c. Lingual cusp of #21 is generally smaller than the lingual cusp of #20.
   d. #20 may have three cusps.
   e. none of the above

2. The third and smallest cusp on a mandibular second premolar is called:
   a. mesiobuccal cusp
   b. distobuccal cusp
   c. distolingual cusp
   d. mesiolingual cusp
   e. none of the above

3. The transverse ridge is most prominent on:
   a. #20
   b. #21
   c. #28
   d. a and c
   e. b and c

4. Which statement correctly compares #21 and #5?
   a. The buccal height of contour on #21 and on #5 is located on the middle 1/3 of the crown.
   b. The lingual profile is visible when viewing #5 and #21 from the buccal aspect.
   c. #21 has a much smaller lingual cusp than #5 has.
   d. a and c
   e. b and c
5. The transverse ridge on #28 extends:
   a. from the buccal cusp to the lingual cusp
   b. from the buccal cusp apex to the central groove
   c. from the mesiolingual cusp to the apex of the distolingual
   d. from the central groove to the mesiolingual and mesiobuccal groove

6. Choose the occlusal view that does not belong to a mandibular second premolar.

   ![Occlusal views](image)
   a. I
   b. II
   c. III
   d. IV
   e. none of the above

7. On Fig. 6-32, the arrow points to which landmark?
   a. distolingual groove
   b. mesial marginal ridge
   c. mesiolingual cusp
   d. mesiolingual groove
   e. distolingual cusp ridge
8. Identify C (Fig. 6-33)
   a. #20
   b. #19
   c. #27
   d. #28
   e. #29

[Images of three dental crowns labeled A, B, and C]

9. The figure on the right is most probably the pulpal section of which tooth on Fig. 6-33 above?
   a. A
   b. B
   c. C
   d. A or C
   e. none of the above

[Image of a pulpal section]

10. The mandibular second premolar occludes with the:
    a. maxillary second premolar and first molar
    b. maxillary first and second premolars
    c. mandibular second premolar and first molar
    d. mandibular canine and first premolar
CRITERIA EXPLANATION FOR TOOTH #29

1. **FINISH OF MARGINS**
   - **Margins:**
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)

2. **FINISH OF EXTERNAL SURFACES:**
   - **External Surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, “wavy” contours, or pits present

3. **FINISH OF OCCLUSAL ANATOMY:**
   - **Anatomy:**
     - Marginal ridges, triangular ridges, and cusp ridges should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All developmental and supplemental grooves should be smooth and polished with no scratches, pits, or waviness
     - All junctions between these structures must be smooth and flowing

4. **OCCLUSAL VIEW:**
   - **Outline Form:**
     - Rounded or square occlusal outline form
     - Proximal contacts contact adjacent teeth just buccal to the midline
     - Contacts 1.0 to 1.25 mm long
   - **Occlusal Table:**
     - Occlusal table is square

5. **CUSP AND RIDGE ANATOMY:**
   - **Ridges:**
     - Marginal ridges are the same length and prominence
   - **Cusps:**
     - Three cusps – two lingual and one buccal
       - Buccal centrally located (M/D) is the largest one and is located at the junction of the buccal and middle thirds
       - Mesiolingual cusp larger than distolingual cusp and takes up about 2/3 of lingual surface. Distolingual exists in the other 1/3 of the lingual
6. **FOSSA AND GROOVE ANATOMY:**
   - **Size and Shape:**
     - Three fossae (pits) exist - mesial, distal, and central
       - Central pit is more lingual than mesial or distal
   - **Position and Shape:**
     - Central pit is centrally located faciolingually on the occlusal table
       - Correct proportion to the rest of the tooth
       - Occlusal grooves exhibit a “Y” pattern
         - Mesial groove connects mesial pit with central pit
         - Distal groove connects distal pit with central pit
         - Lingual groove extends from the central pit onto the lingual surface separating the two lingual cusps
         - Mesial and distal grooves at junction of middle and lingual thirds

7. **FACIAL VIEW:**
   - **Outline:**
     - Mesial and distal halves are relatively symmetrical
     - Buccal cusp centered over root
   - **M/D:**
     - Distal marginal ridge closer to cervical than the mesial marginal ridge
   - **HOCs:**
     - Mesial and distal contacting adjacent teeth and at same height in the middle 1/3
     - Occlusogingival size of contacts 0.5 to 0.75 mm

8. **MESIAL/DISTAL VIEWS:**
   - **B/Li Outline:**
     - Buccal cusp tip located at junction of buccal and middle 1/3
     - From the mesial, the occlusal plane is horizontal
     - Mesial marginal ridge is horizontal
   - **B/Li Contours:**
     - From the mesial, only the ML cusp is visible, not the DL
     - Lingual contour “more upright” than buccal contour
     - From the distal, the ML cusp is visible above the DL cusp
   - **HOCs:**
     - Buccal HOCs in cervical 1/3
     - Lingual HOC in the middle 1/3
     - Mesial and distal HOCs at the same level
     - HOCs smoothly flow in an occlusal direction into the proximal contact area similar to #29
9. **LINGUAL OUTLINE:**
   - **Shape:**
     - Mesiolingual cusp takes up about 2/3 of lingual view
     - Is also taller than distolingual cusp
     - Mesiobuccal profile is not visible from the lingual
   - **Outline:**
     - Lingual groove extends on to the lingual surface separating the two lingual cusps
     - Proportioned correctly to rest of the tooth
     - Exhibits correct size and shape in relation to adjacent teeth
   - **HOCs:**
     - Proximal contacts contact adjacent teeth the same as when viewed from the facial
     - Proximal contacts 0.5 to 0.75 mm occlusogingivally

10. **CONTACTS/EMBRASURES:**
   - **Proximal Contacts:**
     - Disto-occlusal and mesio-occlusal proximal contacts 0.5 to 0.75 mm occlusogingivally and 1.0 to 1.25 mm faciolingually
   - **Embrasures:**
     - Occlusal embrasures small
     - Lingual embrasures similar in size and shape to each other
     - Buccal embrasures small but distinct
     - Gingival embrasures allows adequate room for gingival tissue
First Wax Up Exercise

Student Secret ID#: ________________________________

<table>
<thead>
<tr>
<th>Tooth # 29</th>
<th>Criteria</th>
<th>Comments</th>
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</table>
| PASS       | **Occlusal Anatomy:**  
  • Appropriate and support the overall anatomical and esthetic requirements of the tooth.  
  • In harmony with arch form and form an appropriate occlusal shape that provides correct overall tooth dimensions. |          |
| FAIL       | **Heights of contour, proximal contacts/areas, and embrasures:**  
  • Correct shape and height in relation to the adjacent teeth.  
  • In the correct third and not over- or under-contoured on  
  Facial L Lingual M Mesial D Distal |          |
|            | **Outlines and Finish**  
  • In harmony with arch form and that provides correct overall tooth dimensions:  
  Facial M Mesial/Distal L Lingual |          |

POINTS: ______________
### WAXING CRITERIA FOR #29 (Y-TYPE)

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Your evaluation</th>
<th>Partner’s evaluation</th>
<th>Concensus evaluation</th>
<th>Faculty evaluation</th>
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*Refer to syllabus for further explanation of criteria

**TOTAL ________**

*NOTE: To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.*
UNIT 7
MANDIBULAR MOLARS

1. OBJECTIVES

Upon completing this unit, you should be able to:

a. Demonstrate your understanding of all the terms listed in the glossary in verbal and written communication.

b. Identify all areas of mandibular molars.

c. Identify and distinguish between right and left mandibular first, second, and third molars including normal variations.

d. Draw the mandibular first and second molars:
   1. singly, and in proper relation to adjacent teeth, when shown according to given criteria

e. Identify and distinguish given sectional views of the pulp in mandibular first and second molars.
   1. the identification exercise and satisfactorily complete the nomenclature test
   2. the self-test prior to the next class period

2. GENERAL PROCEDURE

A. ATTEND THE CLASSROOM LECTURE, “Mandibular Molars”

B. COMPLETE EXERCISES IN:
   1. Labeling and pulp study
   2. Identification
   3. Drawing

C. COMPLETE NOMENCLATURE AND SELF-TEST on Unit 7

D. Review “3D INTERACTIVE TOOTH ATLAS”
3. **GLOSSARY**

**Buccal Pit** - a pin-point depression found on the middle third of the buccal surface of a mandibular first molar marking the end of the mesiobuccal groove

**Distobuccal Groove** - a linear depression which runs between the distobuccal cusp and the distal cusp of a mandibular first molar

**Mesiobuccal Groove** - a linear depression originating from the central groove and extending buccally between the mesiobuccal cusp and the distobuccal cusp of a mandibular first molar

**Pentagonal** - similar to or approximating a polygon of five sides (generally used to describe the occlusal outline of #19 and #30)

**Root Trunk** - that portion of the root of multirooted teeth between the cervical line and bifurcation of the roots
4. **LABELING EXERCISE AND PULP STUDY**

1. **Labeling Exercise**  
   Direction: Label Fig. 7-1 to 7-12

**MANDIBULAR FIRST MOLAR #30**

**TERMS**

<table>
<thead>
<tr>
<th>1.</th>
<th>Bifurcation</th>
<th>17. Distobuccal triangular ridge</th>
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<tbody>
<tr>
<td>2.</td>
<td>Buccal pit</td>
<td>18. Distolingual cusp</td>
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<td>3.</td>
<td>Central fossa</td>
<td>19. Distolingual triangular ridge</td>
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<td>5.</td>
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<td>21. Lingual groove</td>
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<td>22. Mesial contact area</td>
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<td>7.</td>
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<td>23. Mesial marginal ridge</td>
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<td>24. Mesial pit</td>
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<td>25. Mesial root</td>
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<tr>
<td>10.</td>
<td>Distal pit</td>
<td>26. Mesial root apex</td>
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<tr>
<td>11.</td>
<td>Distal root</td>
<td>27. Mesial fossa</td>
</tr>
<tr>
<td>13.</td>
<td>Distal fossa</td>
<td>29. Mesiobuccal groove</td>
</tr>
<tr>
<td>15.</td>
<td>Distobuccal cusp</td>
<td>31. Mesiolingual cusp</td>
</tr>
<tr>
<td>16.</td>
<td>Distobuccal groove</td>
<td>32. Mesiolingual triangular ridge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33. Proximal root concavity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34. Root trunk</td>
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**Fig 7-1**  
Buccal view

**Fig 7-2**  
Lingual view
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Labiolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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<tr>
<td>First Molar</td>
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<td>11</td>
<td>10.5</td>
<td>21.5</td>
<td>6</td>
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<tr>
<td>Second</td>
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<td>10.5</td>
<td>10.5</td>
<td>20</td>
<td>11.75</td>
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After Kraus

![Fig 7-3&4](image)

Occlusal view

![Fig 7-6](image)

Mesial View

![Fig 7-7](image)

Distal View
### TERMS

<table>
<thead>
<tr>
<th>Number</th>
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<th>Term</th>
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<td>Distolingual triangular ridge</td>
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<td>2</td>
<td>Buccal groove</td>
<td>13</td>
<td>Height of contour</td>
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<td>Lingual groove</td>
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<td>Distal contact area</td>
<td>16</td>
<td>Mesial marginal ridge</td>
</tr>
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<td>6</td>
<td>Distal marginal ridge</td>
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<td>Distobuccal triangular ridge</td>
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<td>Proximal root concavity</td>
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<td>Distolingual cusp</td>
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<td>Root trunk</td>
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<td>Height of contour</td>
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<td>Mesiobuccal triangular ridge</td>
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**Fig 7-8**
Buccal View

**Fig 7-9**
Lingual View
Fig 7-10
Occlusal View

Fig 7-11
Mesial View

Fig 7-12
Distal View
2. Pulp Study

Study the morphology of pulpal sections of the mandibular first molar and mandibular second molar as illustrated on Fig. 7-13 to 7-24. Note the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of mandibular first and second molars that influence the shape or configuration of their pulpal sections.

PULPAL SECTIONS OF A MANDIBULAR FIRST MOLAR

Fig 7-13
Mesiodistal Section – From Facial

Fig 7-14
Mesiodistal Section- From Lingual
MANDIBULAR FIRST MOLAR #30

Fig 7-15
Transverse View at Cervix (#30)

Fig 7-16
Transverse View at Midroot (#19)

Fig 7-17
Buccolingual Section-From Mesial

Fig 7-18
Buccolingual Section-From Distal
PULPAL SECTIONS OF A MANDIBULAR SECOND MOLAR #31

Fig 7-19
Mesiodistal Section From Buccal

Fig 7-20
Mesiodistal Section From Lingual

Fig 7-21
Transverse View at Cervix

Fig 7-22
Transverse View at Midroot
MANDIBULAR SECOND MOLAR #31

Fig 7-23
Buccolingual Section-
From Mesial

Fig 7-24
Buccolingual Section-
From Distal
IDENTIFYING CHARACTERISTICS OF MANDIBULAR MOLARS

MANDIBULAR FIRST MOLAR

1. Major Characteristics

1. Five Cusps

This molar has five well developed cusps with the fifth cusp (distal cusp) located in the area of the distobuccal line angle, consequently creating surfaces towards the distal and giving the occlusal outline form a pentagonal shape, Fig 7-25.

2. Two Roots

The root area of this tooth is bifurcated close to the crown into two well developed widespread roots, each root having a blunt apex and a slight distal curvature.

Both roots often have longitudinal grooves (root concavities) on the mesial and distal surfaces. These grooves are highly developed on the mesial root while they are less prominent and may be absent on the distal root. When the grooves are present and well developed, the midroot horizontal section appears “I” beam in shape, especially for the mesial root.

Comparing mesial and distal views, the distal root is slightly narrower and has the sharper apex. It can be slightly shorter than the mesial root. While the mesial root most often curves to the distal, the distal root is nearly straight most of the time. The distal root apex occasionally curves to either the mesial or distal.

3. Largest cusps

The cusps of the mandibular first molar in order of size, largest to smallest is as follows: mesiofacial, mesiolingual, distolingual, distofacial, and distal.

4. Longest cusps

The five cusps of the mandibular first molar in order of height, longest to shortest is as follows: mesiolingual, distolingual, distofacial, mesiofacial, and distal.
5. **Lingually Tipped Crown**

The crown is lingually tipped or oriented with the buccal cusps closer to the center of the tooth. This is characteristic of all mandibular posterior teeth.

6. **Flat Mesial With Sharper Lines**

The occlusal outline on the mesial is flatter than on the distal and the mesiobucco-occlusal angle on the buccal is sharper than the distobucco-occlusal angle.

7. **Height of Contour**

The buccal height of contour is located on the cervical 1/3 of the crown while the lingual height of contour is found on the middle 1/3. The occlusal 2/3 of the buccal surface is flat while the lingual surface is evenly convex. The contact areas are towards the buccal just cervical to the junction of the occlusal and middle thirds of the crown.

B. **Other Characteristics:**

1. **Mesial Marginal Ridge**

The mesial marginal ridge is further from the cervical than the distal marginal ridge.

2. **Larger Mesial Root**

The mesial root is broader buccolingually and larger in size than the distal root and frequently has mesial and distal concavities. The smaller distal root is more oval and may also have a shallow root depression on either surface.

3. **Well Defined Occlusal Anatomy**

The mandibular first molar has a well defined occlusal anatomy in contrast with a mandibular third molar which may have five cusps but whose anatomy is often irregular with numerous supplemental grooves.

4. **Sharp Mesiolingual Cusp**

The mesiolingual cusp is smaller in total size than the mesiobuccal cusp, but is higher or further from the cervical and sharper or more pointed at the cusp apex.
5. Greatest Mesiodistal Width

The mandibular first molar is wider mesiodistally than it is buccolingually. It is the widest of all teeth mesiodistally.

6. Mesial and distal root grooves are common on both roots with the mesial grooves being more highly developed. Distal grooves may even be absent.

2. **MANDIBULAR SECOND MOLAR**

a. Major Characteristics

1. This molar usually has four prominent cusps whose locations and positions result in a rectangular occlusal outline.

2. Two Roots

The roots of the second molar are more variable than those of the mandibular first molar. The mesial root is larger than the distal root and is similar in shape to the mesial root of the mandibular first molar. The root trunk is usually wider and the point of bifurcation not as close to the crown as on the first molar. Mesiodistally, roots may spread out wider than the roots of the first molar, or they may be so close together that they appear fused. Generally, however, the mesial and distal roots are more nearly parallel than the first molar’s roots.

3. Shaped Occlusal Grooves

The intersecting buccal, lingual, and central grooves on the occlusal surface form a distinct cross on the occlusal surface.

4. Largest Cusps On The Mesial

As on the first, the mesiobuccal and mesiolingual cusps are the largest cusps on a mandibular second molar.
5. Lingually Tipped Crown

As on the first molar, the buccal cusps of the second incline towards the center of the crown.

6. Heights of Contour

Buccal height of contour is located on the cervical 1/3 of the crown; lingual height of contour on the middle 1/3.

7. More Rounded Disto-occlusal Outline

As on the mandibular first molar, the mesio-occlusal outline is flatter with sharper mesio-occlusal angles, making the disto-occlusal outline appear more rounded.

B. Other Characteristics:

1. Mesial Marginal Ridge Further From Cervical

2. Well Defined Occlusal Anatomy

This tooth has a well calcified crown, and supplemental grooves are few, if present at all.

3. Greater Mesiodistal Width

Although Kraus states that the mesiodistal and buccolingual measurements are equal on this tooth, other texts indicate that 2nd molars generally are ½ mm wider mesiodistally than buccolingually. This difference appears even greater because the rectangular occlusal table is much narrower buccolingually than mesiodistally.

4. Smaller Dimensions

Generally the mandibular 2nd molar is smaller in all dimensions than the first molar. Even its occlusocervical dimension is narrower than on the first.

5. Root grooves are similar to first mandibular molars.
3. MANDIBULAR THIRD MOLAR

a. General Characteristics:

1. Extremely Variable Anatomy
2. Four or Five cusps
   Both types are common.
3. Smaller Size
   Generally smaller in size than first or second molars.
4. Supplemental Grooves
   The occlusal anatomy frequently is not well defined, often having numerous supplemental grooves.
5. Rounded Lines on Occlusal Outline
6. Narrowest Occlusal Table
   This is most evident buccolingually.
7. Roots
   a. fused
   b. irregularly curved
   c. root apices sharp
   d. smaller in proportion to crown
8. Poorly calcified
   This condition occurs either:
   a. during the process of growth and development of this tooth or,
   b. as decalcified white areas on the tooth which, due to the position and location of this molar, generally create an environment for disease in the mouth.
4. **OTHER DISTINGUISHING CHARACTERISTICS BETWEEN MANDIBULAR MOLARS**

1. For first molars, roots are widely separated and relatively vertical. Second molars have distally inclined roots which are closer together. Third molars have short, fused roots with a marked distal inclination.

2. From the lingual, the buccal profiles and proximal surfaces are somewhat visible on the first molar but not on the second or third molars.

3. From the lingual, the crown cervix is often narrower on the first molar than the second or third molars.

4. From the occlusal, the first molar has a pentagonal outline, the second molar has a rectangular outline and the third molar has an ovoid outline.

5. From the occlusal, the mesial and distal profiles are straight and converge lingually on first molars. The mesial and distal profiles are curved on the second molar with no lingual convergence while the third molar has highly curved mesial and distal curvatures with no lingual convergence.

6. From the occlusal, the first molar’s main grooves form a modified Y pattern, the second molar grooves form a + pattern and there is no set pattern for third molars.
5. **DRAWING EXERCISE**

**MANDIBULAR FIRST MOLAR #30**

Dimensions:

- Crown Height ______ mm
- Root Length (Mesial) ______ mm
- Root Length (Distal) ______ mm
- Total Tooth Length ______ mm
- Mediodistal Crown Width ______ mm
- Buccolingual Crown Width ______ mm

**Fig. 7-25  Buccal View**

**Remarks**

**DRAWING CRITERIA**

1. Crown and roots drawn in correct proportion to each other.

2. Crown and roots are drawn in correct proportion to adjacent teeth.

3. Three cusps visible: MB, DB and D. DB cusp is slightly longer than MB, with D being the shortest (approximately \( \frac{1}{2} \) the size of the DB cusp).

4. The cusp apices of the buccal cusps are flatter or blunt in comparison with those of the lingual cusps (or any of the maxillary posterior cusps).

5. L cusp apex visible between DB and distal cusps; D cusp ridge of ML cusp visible just above and parallel to D cusp ridge of MB cusp.

6. Mesial and distal heights of contour are at relatively equal distances from the cervical and contacting those of adjacent teeth.

7. MB groove extending from the junction of the MB and DB cusps toward the middle 1/3 of the crown and terminating into a buccal pit.

8. DB groove extending from the junction of the DB and distal cusps toward the cervical 1/3 of the crown.

9. CEJ relatively straight except for tiny apical dip in the center of the tooth over the bifurcation.
10. Height of bifurcation slightly closer to the crown than that of the adjacent mandibular second molar.

11. Two roots: mesial and distal. The mesial root curves to the distal; the distal root, while inclined to the distal, is straight in comparison to the mesial root and very slightly shorter.

12. Drawing is neatly accomplished.
MANDIBULAR FIRST MOLAR #30

Remarks

1. Crown and roots drawn in correct proportion to each other.
2. Crown and roots are drawn in correct proportion to adjacent teeth.
3. Two lingual cusps: ML cusp the tallest (furthest from the cervical) of the cusps of this tooth. DL cusp almost equal in height and width to ML cusp. Both cusps have sharp apices. (Distal cusp may be partly visible on this view. DB cusp apex and DB triangular ridge also partly visible between ML and DL cusps).
4. CEJ relatively straight except for tiny apical dip over bifurcation.
5. Proximal heights of contour located at relatively equal distances from the cervical and contacting those of adjacent teeth.
6. Root trunk narrower than that of the adjacent mandibular second molar.
7. Mesial root curves to the distal; the distal root, while inclined to the distal, is straight in comparison with the mesial root.
8. Drawing is neatly accomplished.
MANDIBULAR FIRST MOLAR #30

Fig. 7-27 Occlusal View

DRAWING CRITERIA

2-3. Occlusal outline pentagonal in form with the following characteristics:
   a. Crown width greater mesiodistally than buccolingually
   b. Disto-occlusal outline appears slightly more rounded than the mesio-occlusal outline
4. Five cusps positioned as follows:
   ML cusp apex is located just mesial to the MB cusp buccolingually; DL cusp apex is more to distal than DB cusp apex; distal cusp located opposite the distal pit in the area of DB line angle.
5. Three main occlusal pits: the central pit, the point of intersection of the grooves separating the ML, MB, DL, and DB cusps; the mesial pit and distal pit located in the central sulcus opposite the mesial marginal ridge and distal marginal ridge respectively. Two minor occlusal pits are also present (distal and central).
6. Four main occlusal grooves: the central groove extending between the mesial and distal pits, separating the MB and DB cusps from the ML and DL cusps; the MB groove originating from the central pit and extending buccally between and beyond the MB and DB cusps about 1/3 the way down the buccal surface; the DB groove extending distobuccally, separating the DB and D cusps; and the lingual groove extending lingually from the central pit and separating ML and DL cusps.
7. Triangular ridges extending from the cusp apex of each cusp toward the central sulcus.
8. Proximal contact areas located slightly toward the buccal and contacting heights of contour of adjacent teeth.
9. Drawing is neatly accomplished.

Fig 7-27
MANDIBULAR FIRST MOLAR #30

Fig. 7-28  Mesial View

DRAWING CRITERIA

2. ML cusp slightly higher than MB cusp.
3. Buccal height of contour located on the cervical third; lingual height of contour in middle third.
4. MB cusp apex located closer buccolingually to the central sulcus than ML cusp apex.
5. Contact area located more buccally than lingually.
6. Mesial root only root visible from this view due to its large size.
7. Mesial root apex rounded.
8. Proximal root concavity present on this surface.
9. Drawing is neatly accomplished.

Fig 7-28
MANDIBULAR SECOND MOLAR #31

Dimensions:

Crown Height ______ mm
Root Length (Mesial) ______ mm
Root Length (Distal) ______ mm
Total Tooth Length ______ mm
Mediodistal Crown Width ______ mm
Buccolingual Crown Width ______ mm

Fig. 7-29 Buccal View

DRAWING CRITERIA

1. Crown and roots drawn in correct proportion to each other.

2. Crown and roots are drawn in correct proportion to adjacent teeth.

3. Two buccal cusps: the MB cusp slightly higher than the DB cusp. Both MB and DB cusp apices appear blunt in comparison with lingual cusp apices (visible just above buccal cusp apices).

4. CEJ relatively straight.

5. Distal height of contour slightly closer to the cervical than the mesial height of contour. Contact of the heights of contour with those of adjacent teeth.

6. Buccal groove separating the MB and DB cusps extends onto the occlusal, extending 1/3 of the way down the buccal surface.

7. Two roots: mesial root and distal root; mesial root curved distally.

8. Root trunk wider (from cervical line to bifurcation) than that of the adjacent mandibular first molar.

9. Drawing is neatly accomplished.
Fig 7-29
MANDIBULAR SECOND MOLAR #31

Fig. 7-30  Lingual View

DRAWING CRITERIA

1. Crown and roots drawn in correct proportion to each other.
2. Crown and roots are drawn in correct proportion to adjacent teeth.
3. Two lingual cusps: ML cusp and DL cusp. ML is slightly longer.
4. Distal height of contour slightly closer to the cervical than mesial height of contour. Heights of contour should contact those of adjacent molars.
5. Mesial and distal roots closer together than roots of #30 and slightly shorter.
6. Height of bifurcation further from the crown than on the adjacent mandibular first molar.
7. Drawing is neatly accomplished.
MANDIBULAR SECOND MOLAR #31

Fig. 7-31  Occlusal View

DRAWING CRITERIA

1. Crown is in correct proportion to adjacent crowns.

2. Occlusal outline rectangular in shape with the following characteristics

3. Crown width slightly greater mesiodistally than buccolingually.

4. Distal occlusal outline slightly more rounded than mesial outline.

5. Occlusal line angles more rounded than those of #30 and disto-occlusal line angles more rounded than mesio-occlusal line angles.

6. Crown outline slightly wider buccolingually on the mesial than on the distal.

7. Four cusps: each cusp comprising a quadrant of the occlusal surface with the MB and ML cusps only slightly larger than the DB and DL cusps.

8. Three main occlusal pits: the central pit, located approximately at the center of the occlusal surface buccolingually and mesiodistally; the mesial pit and distal pit located on the mesial and on the distal of the central pit, opposite their respective marginal ridges.

9. Three main occlusal grooves: central groove spanning the mesiodistal width of the occlusal surface between the mesial and distal pits; the buccal groove originating from the central pit and extending 1/3 the distance beyond the buccal cusp ridges onto the buccal surface and the lingual groove, also originating from the central pit and extending up to the junction of the lingual cusp ridges.

10. Triangular ridges extending from the cusp apex of each cusp toward the central sulcus.

11. Proximal heights of contour in contact with heights of contour of adjacent teeth slightly towards the buccal.

12. Drawing neatly accomplished.
MANDIBULAR SECOND MOLAR #31

Fig. 7-32 Mesial View

DRAWING CRITERIA

1. Crown and roots drawn in correct proportion to each other.
2. Central sulcus located over the center of the crown and root.
3. ML cusp slightly higher than MB cusp.
4. Buccal height of contour located within the cervical 1/3 of the crown; lingual height of contour within the middle 1/3.
5. Proximal root concavity present on mesial root.
6. Distal root not visible due to larger size of mesial root.
7. Drawing is neatly accomplished.
8. Contact area in occlusal 1/3 and buccal to the center of the tooth buccolingually.
5. SELF-TEST

1. Which of the following is false about the mandibular first molar?
   a. root concavity generally present on the mesial of the mesial root
   b. mesiodistal crown dimension widest among all molars
   c. five cusps present, including the cusp of Carabelli
   d. occlusal outline pentagonal in shape
   e. bifurcation closer to the crown than that of a mandibular second molar

2. Which of the following teeth may all normally have five cusps?
   a. #31, #15, #14
   b. #14, #30, #18
   c. #19, #29, #3
   d. #30, #14, #3

3. When comparing the maxillary molars with the mandibular molars, which of the following is/are true?
   a. Mandibular and maxillary molars may decrease in size from first to third.
   b. Mandibular molars have bifurcated roots.
   c. Buccal cusps of mandibular molars are inclined lingually.
   d. In maxillary molars, the DB and ML cusps are connected by an oblique ridge.
   e. All of the above.

4. Identify this pulp section (Fig. 7-33).
   a. buccolingual section on the mesial of #30
   b. mesiodistal section on the buccal of #31
   c. mesiodistal section on the lingual of #31
   d. transverse section on the mesial of #30

Fig 7-33
5. Which root in a mandibular first or second molar has two pulp canals?
   a. lingual
   b. mesial root
   c. distal root
   d. mesiobuccal root
   e. distobuccal root

6. Match the pulp sections in Fig. 7-36 with the correct tooth:

   Fig 7-36

   a.  b.       c.          d.  e.

   _____________ 1. maxillary first premolar
   _____________ 2. maxillary first molar
   _____________ 3. maxillary second molar
   _____________ 4. mandibular first molar
   _____________ 5. mandibular second molar

7. Compare the buccal and lingual heights of contour on a mandibular first or second molar.
   a. buccal on cervical 1/3
   b. lingual on cervical 1/3
   c. lingual on middle 1/3
   d. a and b
   e. a and c
8. Identify the distobuccal cusps of these teeth.

- a. A on I and A on II
- b. D on I and C on II
- c. C on I and D on II
- d. B on I and B on II
- e. E on I and A on II
9. Which of the following statements are true concerning maxillary and mandibular third molars?

a. Both have extremely variable and atypical anatomy.
b. Both can look similar to either a first or second molar.
c. Maxillary third molars normally occlude with mandibular third molars only.
d. Both have curved, sharply pointed, shortened, or fused roots.
e. Both are generally larger in total size than a first or second molar.

1. 1, 2, 3, and 5
2. 1, 2, 3, and 4
3. 1, 2, and 3
4. 2, 3, and 4
5. all of the above

10. #19 normally occludes with:

a. #14 and #15
b. #15 and #16
c. #13 and #14
d. #14 only
CRITERIA EXPLANATION FOR TOOTH #30

1. FINISH OF MARGINS
   - Margins:
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)

2. FINISH OF EXTERNAL SURFACES:
   - External Surfaces:
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, "wavy" contours, or pits present

3. FINISH OF OCCLUSAL ANATOMY:
   - Anatomy:
     - Marginal ridges, triangular ridges, and cusp ridges should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All developmental and supplemental grooves should be smooth and polished with no scratches, pits, or waviness
     - All junctions between these structures must be smooth and flowing

4. OCCLUSAL VIEW:
   - Outline Form:
     - Outline form is pentagonal
     - Mesial and distal profiles are straight and converge towards the lingual
     - Correct proportion with adjacent teeth
     - Disto-occlusal angle slightly more rounded than mesio-occlusal angle
     - Proximal contacts just buccal to M/D midline and 1.0 to 1.25 mm in length
   - Occlusal Table:
     - Occlusal table is more rectangular than pentagonal

5. CUSP AND RIDGE ANATOMY:
   - Ridges:
     - Triangular ridges flow from each cusp apex (apex) to central groove (base)
     - Cusp ridges separate from triangular ridges
       - Pay attention to distal cusp
     - Marginal ridges straight, connecting buccal cusp ridges with lingual cusp ridges
Cusps:
- Five cusps are present
  - Sizes from smallest to largest: D, DB, DL, ML, MB
  - Height from shortest to longest: D, MB, DB, DL, ML
  - MB and ML opposite each other in a buccolingual direction
  - DL cusp apex more distal than DB cusp apex
  - Distal cusp apex located slightly distal to the distal pit near the DB line angle, just buccal and separate from the distal marginal ridge

6. FOSSA AND GROOVE ANATOMY:
   - Size and Shape:
     - Occlusal grooves form a modified “Y” pattern
     - Occlusal anatomy is well defined
   - Position:
     - Five occlusal pits – three main and two minor
       - Main pits – central, mesial, and distal
         - Central connects grooves separating all cusps but D
         - Distal and mesial pits opposite respective marginal ridges in central sulcus
       - Minor pits – distal, central
         - Distal connects DB groove to central groove
         - Central near main central, connected to MB groove
     - Four main grooves
       - MB, DB, Central, and Lingual
         - MB, DB grooves extend well onto buccal surface
         - Central stays on occlusal surface
         - Lingual extends just onto the lingual surface

7. FACIAL VIEW:
   - Outline:
     - MB, DB, and D cusps visible
       - DB longest, D cusp shortest (1/2 size of DB)
     - Cusp apices “blunt” compared to lingual cusps
     - ML cusp position slightly mesial to MB cusp
     - Lingual cusp apex visible between DB and D cusps
     - ML cusp position slightly mesial to MB cusp
     - Distal cusp ridge of ML cusp parallel to and just visible above distal cusp ridge of MB cusp
     - MB groove extends onto buccal surface separating MB and DB cusps
       - Extends to middle 1/3 of crown ending in a buccal pit
     - DB groove extends onto buccal surface separating DB and D cusps
       - Extends towards gingival 1/3 of crown disappearing
M/D:
- M/D outlines similar in contour

HOCs:
- Mesial marginal ridge is further from CEJ than distal marginal ridge
- Occlusogingival contact height 0.5 to 0.75 mm

8. MESIAL/DISTAL VIEWS:
   B/Li Outline:
   - ML slightly longer than the MB cusp
   B/Li Contours:
   - Buccal more rounded into occlusal while lingual straighter
   - MB cusp apex closer to central sulcus than ML cusp apex
   - Lingual contour is evenly convex
   - Occlusal 2/3 of buccal surface is flat or nearly flat
   HOCs:
   - Buccal HOCs in cervical 1/3
   - Lingual HOC in the middle 1/3
   - HOCs smoothly flow in an occlusal direction into the proximal contact area similar to #19

9. LINGUAL OUTLINE:
   Shape:
   - ML cusp is smaller in total size than the MB cusp but is taller and cusp apex is more pointed than the MB cusp
   - From the lingual the buccal profiles are visible
   - Correct proportions to adjacent teeth
   - Two lingual cusps ML and DL
     - ML tallest, but DL almost equal in height and width
     - Both cusps have more pointed apices than buccal cusps
   - DB cusp apex and triangular ridge visible between ML and DL cusps
   - Proportioned correctly to rest of the tooth
   - Exhibits correct size and shape
   HOCs:
   - Proximal contacts 0.5 to 0.75 mm occlusogingivally
   - Proximal contacts contact adjacent teeth the same as when viewed from the facial
   - Distal and mesial HOCs in middle 1/3
10. CONTACTS/EMBRASURES:

- **Proximal Contacts:**
  - Contacts contact adjacent teeth just buccal to buccolingual midline
  - Disto-occlusal and mesio-occlusal contact areas are 0.5 to 0.75 mm occlusogingivally and 1.0 to 1.25 mm faciolingually

- **Embrasures:**
  - Lingual embrasures largest embrasures and similar in size and shape to each other
  - Occlusal embrasures small but present
  - Gingival embrasures allows adequate room for gingival tissue
  - Facial embrasures distinct, but small
# First Wax Up Exercise

## Criteria

<table>
<thead>
<tr>
<th>Tooth # 30</th>
<th>Criteria</th>
<th>Comments</th>
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</table>

- **PASS**
  - **Occlusal Anatomy:**
    - Appropriate and support the overall anatomical and esthetic requirements of the tooth.
    - In harmony with arch form and form an appropriate occlusal shape that provides correct overall tooth dimensions.

- **FAIL**
  - **Heights of contour, proximal contacts/areas, and embrasures:**
    - Correct shape and height in relation to the adjacent teeth.
    - In the correct third and not over- or under-contoured on
      - Facial
      - Lingual
      - Mesial
      - Distal

- **Outlines and Finish**
  - In harmony with arch form and that provides correct overall tooth dimensions:
    - Facial
    - Mesial/Distal
    - Lingual

## Points

POINTS: ____________
### WAXING CRITERIA FOR #30 FULL CROWN

**X = meets criteria**

**0 = needs correction**

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<thead>
<tr>
<th>Your evaluation</th>
<th>Partner’s evaluation</th>
<th>Your evaluation</th>
<th>Faculty evaluation</th>
<th>*Final evaluation</th>
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<td>10. Contacts/Embrasures:</td>
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<td>- Proximal contacts</td>
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*Refer to syllabus for further explanation of criteria*

**TOTAL ____**

**NOTE:** To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.
UNIT 8
MAXILLARY MOLARS

1. OBJECTIVES

Upon completion of this unit, you should be able to:

a. Demonstrate your understanding of all terms listed in the glossary in written and verbal communication.
b. Identify all areas of maxillary molars that have names.
c. Identify and distinguish between right and left first, second, and third maxillary molars including normal variations.
d. Identify the mandibular teeth occluding with maxillary first, second, and third molars.
e. Draw the maxillary first and second molars
   1. singly, and in proper relation to adjacent teeth
   2. according to given criteria
f. Identify and distinguish given sectional views of the pulp in maxillary first and second molars.
h. Satisfactorily complete:
   1. the identification exercise and satisfactorily complete the nomenclature test
   2. the self-test prior to the next class period

2. GENERAL PROCEDURE

A. ATTEND THE CLASSROOM LECTURE titled, “Maxillary Molars.”

B. COMPLETE EXERCISES IN:

   1. Labeling and Pulp Study
   2. Identification
   3. Drawing

C. COMPLETE NOMENCLATURE AND SELF-TEST on Unit 8

D. Review “3D INTERACTIVE TOOTH ATLAS”
3. GLOSSARY

**Curve of Spee** (compensating curve) - a term that refers to the curvature of the occlusal surfaces of teeth from the tip of the mandibular canine to the tip of the distobuccal cusp of the mandibular second molar.

![Curve of Spee](image)

**Cusp of Carabelli** - a fifth cusp found on the lingual surface of the mesiolingual cusp of #3 and #14.

**Oblique Ridge** - an elevation extending diagonally across the occlusal surface, uniting the triangular ridge of the distobuccal cusp and the distal cusp ridge of the mesiolingual cusp.

**Parallelogram** - a four sided figure with parallel opposite sides generally used to describe the occlusal table of a maxillary molar.

![Parallelogram](image)

**Rhombooidal** - similar to a parallelogram but having one set of unequal adjacent sides and oblique angles (generally used to describe the occlusal outline of a maxillary molar).
Trigon - also known as the “primary cusp triangle” is present on maxillary molars and formed by lines drawn between the mesiobuccal, mesiolingual, and distobuccal cusp tips as viewed from the occlusal.

Wisdom Teeth - another name of the third molars, probably attributed to the late eruption of these teeth (usually after 18 years)

Trifurcation - having three branches (roots). The root trifurcation refers to the point where the three roots leave the root trunk. The trifurcation level is measured as the distance this point is from the cervical line on the facial surface.
4. LABELING EXERCISE AND PULP STUDY

1. Labeling exercise

Directions: Label Fig.8-2 to 8-6

MAXILLARY FIRST MOLAR #3

TERMS

1. Buccal groove
2. Central fossa
3. Central groove
4. Central pit
5. Cervical line
6. Distal contact area
7. Distal triangular fossa
8. Distal marginal ridge
9. Distal pit
10. Distobuccal cusp
11. Distobuccal ridge
12. Distobuccal root
13. Distolingual cusp
14. Distolingual triangular ridge
15. Distolingual groove
16. Cusp of Carabelli
17. Height of contour
18. Lingual root
19. Lingual groove
20. Mesial contact area
21. Mesial marginal ridge
22. Mesial pit
23. Mesial triangular fossa
24. Mesiobuccal cusp
25. Mesiobuccal triangular ridge
26. Mesiobuccal root
27. Mesiolingual cusp
28. Mesiolingual triangular ridge
29. Oblique ridge
30. Root trunk
31. Trifurcation

ResD 515 Dental Anatomy 2009, Page 248
## SIZE AND ERUPTION

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Height (mm)</th>
<th>Mesiodistal Crown (mm)</th>
<th>Buccolingual Crown (mm)</th>
<th>Tooth Length (mm)</th>
<th>Age at Eruption (yr)</th>
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<td>11.0</td>
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<td>Maxillary Second Molar</td>
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<td>9.0</td>
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After Kraus

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Fig 8-4 Occlusal View

Fig 8-5 Mesial View

Fig 8-6 Distal View
# MAXILLARY SECOND MOLAR #2

## TERMS

1. Buccal groove
2. Central groove
3. Central pit
4. Cervical line
5. Distal contact area
6. Distal marginal ridge
7. Distal pit
8. Distobuccal cusp
9. Distobuccal ridge
10. Distobuccal root
11. Distolingual cusp
12. Distolingual groove
13. Height of contour
14. Lingual root
15. Lingual groove
16. Mesial contact area
17. Mesial marginal ridge
18. Mesial pit
19. Mesiobuccal cusp
20. Mesiobuccal triangular ridge
21. Mesiolingual cusp
22. Mesiolingual triangular ridge
23. Oblique ridge
24. Root trunk
25. Mesiobuccal root
26. Mesiolingual groove

---

*Fig 8-7 Buccal View*  
*Fig 8-8 Lingual View*
MAXILLARY SECOND MOLAR #2

Fig 8-9  Occlusal View

Fig 8-10  Mesial View

Fig 8-11  Distal View
2. Pulp Study

Study the morphology of pulpal sections of the maxillary first molar and maxillary second molar as illustrated on Fig. 8-12 to 8-23. Note the close relationship between the pulpal and external morphology of these teeth. Be able to identify the characteristics of the maxillary first and second molars that influence the shape or configuration of their pulpal sections.

PULPAL SECTIONS OF A MAXILLARY FIRST MOLAR

Figure 8-12 – Mesiodistal From Buccal

Figure 8-13 - Mesiodistal Section – From Lingual
Fig 8-14 Transverse View at Cervix

Fig 8-15 Transverse View at Midroot

Fig 8-16 Buccolingual Section – From Mesial

Fig 8-17 - Buccolingual Section – From Distal
PULPAL SECTIONS OF A MAXILLARY FIRST MOLAR

Fig 8-18 Mesiodistal Section – From Facial

Fig 8-19 Mesiodistal Section – From Lingual

Fig 8-20 Transverse View at Cervix
PULPAL SECTIONS OF A MAXILLARY SECOND MOLAR

Fig 8-21 Transverse Section at Midroot

Fig 8-22 Buccolingual Section – From Mesial

Fig 8-23 Buccolingual Section – From Distal
B. IDENTIFICATION EXERCISE

1. Use 2½ x Maxillary Molars to complete this exercise.

2. Refer to Characteristics of Maxillary Molars below for help in identifying these teeth.

3. Study the occlusal relationships of maxillary molars with opposing teeth in the mandibular arch.

IDENTIFYING CHARACTERISTICS OF MAXILLARY MOLARS

1. Maxillary First Molar

   a. Major Characteristics

      1. Five Cusps (if cusp of Carabelli is present)

      2. Three Roots

      3. Prominent Oblique Ridge

         This ridge is continuous, i.e., it is not crossed by a central groove.

      4. Prominent Lingual Groove

         From an occlusal aspect, the lingual groove can be seen cutting a depression into the lingual height of contour and extending down towards the lingual root. Note that the lingual root tip is in line with the lingual groove.

      5. Buccal and Lingual Heights of Contour

         The buccal height of contour is found on the cervical 1/3 of the crown and the lingual height of contour is found in the middle 1/3. The lingual surface is more evenly convex than the buccal surface.

      6. Broad and Flat Mesiobuccal Root

         The mesiobuccal root is the broadest and flattest of the three roots of this molar.
7. **Sharper Line Angles**

The occlusal line angles of the maxillary first molar are generally sharper than those of the maxillary second and the third molars.

8. **When viewed from the occlusal, the mesiodistal dimension on the lingual is most often wider than this dimension on the buccal.**

B. **Other Characteristics**

1. **Cusp of Carabelli**

This cusp is present in varying prominence attached to the mesiolingual cusp. This cusp is absent in about 30% of maxillary first molars.

2. **Trifurcation Close to Crown**

The point of trifurcation on the maxillary first molar is situated closer to the crown than on the maxillary second or third molar.

3. **The roots of the maxillary first molar (particularly the lingual root) are usually spread outside a cylinder created by extending the outline of the crown.**

4. **Blunt Root Apices**

The root apices of this molar are not as sharp as those of a maxillary second molar.

5. **Well-Rounded Crown**

There are few variations in the basic anatomy of the maxillary first molar and there are few, if any, supplemental grooves present. Poorly calcified or developed enamel areas may occasionally be found on the crown as opaque or white spots.

6. **Relative Cusp Size**

Mesiolingual cusp: largest cusp
Mesiobuccal cusp is slightly larger than the distobuccal cusp
Distolinguinal cusp: smallest cusp
7. **Relative Cusp Heights**

Mesiolingual: longest cusp  
Distolingual: shortest cusp  
Mesiobuccal and distobuccal are usually of equal length. On occasion, the mesiobuccal is longer, while the distal buccal is often more pointed.

8. The lingual root often has a pronounced root groove on the lingual surface near the cervical line.

9. **Root Structure Differences Between the Maxillary First and Second Molars**
   
a. The terminal portion (closer to apicies) of the roots of the maxillary second molar lie closer together both faciolingually and mesiodistally than for the first molar.
   
b. The root structure is also more slender on second molars.
   
c. From the **lingual view**, the apex of the lingual root is centered over the distolingual developmental groove of the crown of the maxillary first molar. On the second molar, the apex of this root is centered over the distolingual cusp.
   
d. The second molar more often has a root form that deviates from the average than the root form of the maxillary first molar.

10. **Root Forms for Maxillary First Molar**
   
a. The **mesiofacial root** is inclined toward the mesial and facial for approximately 2/3 of its length and then toward the distal in the apical third.
   
b. The cervical 2/3 of the **distofacial root** diverges in both a facial and distal direction. It’s apex tends to parallel the midline of the crown when viewed from the distal, but from a facial view it curves towards the mesial.
   
c. The **lingual root** is somewhat banana shaped when viewed from the mesial or distal. However, it is straight when viewed from the lingual. When viewed from the mesial or distal, the cervical portion diverges in a lingual direction while the apical third inclines slightly towards the facial.
10. **Relative Root Sizes**

**Lingual root:** longest, round at the apical ½. This root is widest in the mesiodistal dimension.

**Mesiobuccal:** broad and flat, more highly developed and sometimes longer than the distobuccal root. This root is also wider faciolingually than the distobuccal root.

**Distobuccal:** smallest, shortest, and ovoid in shape.

11. **Rounded Distobuccal Line Angle on Cervical 1/3 of Crown**

The distobuccal line angle is distinctly convex along the cervical 1/3 of the crown. This is not characteristic of the other line angles of this tooth.

2. **Maxillary Second Molar**

A. **Major Characteristics**

1. **Four Cusps**

2. **Three Roots**

3. **Smaller Distolingual Cusp**

   The distolingual cusp on a maxillary second molar is comparatively smaller than the distolingual cusp of the maxillary first molar. The mesiofacial cusp is also often smaller than on the first molar.

4. **Oblique Ridge Crossed by Groove**

   The oblique ridge on a maxillary second molar is not as prominent as that of a maxillary first molar and is frequently crossed by a groove.

5. **Less Prominent Lingual Groove**

   Although present, the lingual groove does not cross the lingual height of contour or extend down the lingual surface of the lingual root.
6. **Buccal and Lingual Heights of Contour**

   The buccal height of contour is located in the cervical 1/3 of the crown and the lingual height of contours found in the middle 1/3. The lingual surface is evenly convex.

7. **Broad Flat Mesiobuccal Root**

8. **More Rounded Line Angles**

   From an occlusal aspect the line angles of a maxillary second molar appear relatively more rounded than the line angles of a maxillary first molar.

9. **The mesiodistal dimension on the buccal, viewed from the occlusal, is generally as wide or wider than this dimension on the lingual.**

B. **Other Characteristics**

1. **Cusp of Carabelli Rarely Present**

2. **Longer Root Trunk**

   The point of trifurcation of a maxillary second molar is situated further from the crown than on a maxillary first molar. The root trunk of a maxillary second molar is also comparatively longer than the root trunk of a maxillary first molar.

3. **Roots Closer Together**

   The roots of a maxillary second molar are generally not as divergent from the crown as the roots of a maxillary first molar, and occasionally may be fused together.

4. **Relative Cusp Sizes**

   - **Mesiolingual Cusp:** largest
   - **Mesiobuccal cusp:** slightly larger than distobuccal cusp
   - **Distolingual cusp:** smallest

5. **Crown Narrower Mesiodistally**

   On the average, the maxillary second molar is usually narrower mesiodistally than a maxillary first molar. The buccolingual widths of both teeth, however, are relatively equal.
6. **Root Form For Maxillary Second Molar**
   a. The facial roots (mesial and distal) of the maxillary second molar have more surface irregularities than the maxillary first molar.
   b. The second molar has an overall cervicoapical curvature that is less divergent from the crown midline than the first molar.
   c. The mesiofacial root is initially straight but curves to the distal in its apical 1/3.
   d. The apical third of the distofacial root can have a slight mesial deviation.
   e. From the proximal view, the mesiofacial root is nearly vertical in the cervicoapical direction. The distofacial root has a slight deviation to the facial.
   f. The cervicoapical curvature of the second molar’s lingual root viewed form the proximal is roughly similar to that of the maxillary first molar. However, viewed from the lingual, this root has a slight deflection toward the distal, although it is relatively straight.

7. **Rounded Distobuccal Line Angle of Cervical 1/3 of Crown**

8. The lingual root has a pronounced root groove on the lingual surface near the cervical line.

3. **How to Distinguish Maxillary Second From First Molars**

Second molars:

- both distal cusps are smaller
- crowns appear to dip distally on roots (buccal view)
- crowns are narrower on the lingual side and on the distal side
- crowns appear more oblong buccolingually because of the reduction of mesiodistal dimension
- roots seem as long but are less spread apart mediodistally and faciolingually
- roots bend more to the distal and have a longer root trunk
- mesial marginal ridge less often has tubercles (1sts 86%, 2nds 67%)
- cusp of Carbelli is absent (not totally reliable, since 30% of first molars have no fifth cusp)
- mesial marginal ridge less often has groove (1st 78%, 2nd 67%)
- buccal groove is shorter and without a pit
- occlusal parallelogram is twisted more – looks oblong faciolingually (first molar is wider and more square)
- greater difference in size of buccal cusps (mesiobuccal is widest 92%)
♦ smaller oblique ridge and a more varied pit and groove pattern (more wrinkles)
♦ more prominent mesiobuccal cervical ridge
♦ occlusal groove often extends across oblique ridge to distal pit
♦ grooves occur on all molars where bifurcations or trifurcations exist

3. **Maxillary Third Molars**

A. **Major Characteristics**

1. **Three Cusps**
2. **Three Roots, though often fused**
3. **Extremely Atypical Anatomy**
   
   An atypical maxillary first or second molar is most likely a third.
4. **Smaller Size**

   The third molar is generally the smallest of the maxillary molars.
5. **Heart-Shaped Occlusal Outline**

   A maxillary third molar is frequently heart-shaped in its occlusal outline as a result of a tiny or missing distolingual cusp.
6. **Poorly Developed Crown**

   The occlusal anatomy of maxillary third molar is often marked by numerous supplemental grooves and whitish areas evident of poor enamel development.
7. **Atypical Root Morphology**

   Maxillary third molar roots are frequently:
   
   a. smaller in proportion to the crown
   b. fused
   c. sharply curved towards the distal
   d. very sharp at the apex
8. **Heights of Contours As On Maxillary First and Second Molars**

9. **Mesiobuccal Root Dimensions As On First and Second Molars**

Although this root is broad and flat even on the third molar, it may be difficult to determine when roots are fused.

### B. Other Characteristics

1. **No Distal Contact Area**

2. **Occlusal Table Narrowest Buccolingually**

3. **Occlusal Outline More Rounded on Distal**

   The mesial surface is flatter in comparison with the distal.

4. **Mesiobuccal Cusp Larger Than Distobuccal Cusp**

   The distobuccal root which is the smallest is also frequently found “tucked” under the crown.

5. **Distobuccal Root Smallest**

6. **Oblique Ridge Rarely Visible**
5. **DRAWING EXERCISE**

### MAXILLARY FIRST MOLAR #3

Dimensions:

- Crown Height ______ mm
- Root Length ______ mm
- Total Tooth Length ______ mm
- Mediodistal Crown width ______ mm
- Buccolingual Crown Width ______ mm

![Fig 8-24](image)

**Buccal View**

**DRAWING CRITERIA**

1. Crown roots drawn in proportion to each other and to adjacent teeth.
2. Two buccal cusps of relatively equal width (although the MB cusp may be slightly wider than the DB cusp).
3. DL cusp ridge of ML cusp visible just below and parallel to the DB cusp ridge of MB cusp.
4. Buccal groove extending from the junction of the MB and DB cusps toward the middle 1/3 of the crown (but not over the height of contour).
5. Mesial and distal heights of contour may appear relatively equal. (Mesial height of contour is actually closer to the occlusal but is not evident from this view). There should be contact between the heights of contour of #3 and adjacent teeth.
6. CEJ relatively straight as is the case on all molars.
7. Two buccal roots of relatively equal length (MB root may be slightly longer). MB root curving distally along the apical 1/3; DB root may curve slightly mesially.
8. Lingual root visible between the two buccal roots and the longest of the three roots.
9. Root trunk is less than ½ of the total root length.
10. Drawing is neatly accomplished.
11. Root converges correctly into crown.
MAXILLARY FIRST MOLAR #3

Fig. 8-25  Lingual View

DRAWING CRITERIA

1. Crown and roots drawn in proportion to each other and to the crown and roots of adjacent teeth.
2. Two lingual cusps: ML cusp and DL cusp.
3. Cusp of Carabelli is present and is attached to the ML cusp.
4. Mesial height of contour closer to the occlusal than distal height of contour (located on the middle 1/3). Maintain contact of heights of contour with adjacent teeth.
5. Lingual groove extends cervically between the ML and DL cusps (initially in a slightly diagonal direction toward the mesial, then gradually turning back toward the mesiodistal center of the lingual surface as it nears the height of contour).
6. Lingual root centered over the crown. Buccal roots partly visible one each side of lingual root. MB root is curved distally on the apical 1/3. (DB root may curve slightly to the mesial.)
7. Apex of lingual root centered over the distolingual groove.
8. Root apices more rounded than those of second molar.
9. Lingual root is longest followed by mesiofacial and distofacial.
10. Drawing is neatly accomplished.

Fig 8 - 25
MAXILLARY FIRST MOLAR #3

Fig 8-26  Occlusal View

DRAWING CRITERIA
1. Occlusal outline form rhomboidal with sharper line angles in comparison with most maxillary second molars.
2. Buccolingual crown width greater than mesiodistal width.
3. Mesiodistal dimension greater on lingual than on buccal (occlusal view).
4. Occlusal table outlined by the cusp ridges of the ML, MB, DB, and DL cusps, and the proximal marginal ridges.
5. Occlusal surface characterized by four main cusps: MB and DB cusps each occupying approximately 1/2 of the occlusal surface mesiodistally; ML cusp occupying approximately 2/3 of the occlusal surface on the lingual; and the DL cusp occupying the remaining 1/3.
6. Oblique ridge extends diagonally across the occlusal surface joining the distolingual cusp ridge of the ML cusp and the triangular ridge of the DB cusp. Is not crossed by central groove.
7. Three major occlusal grooves: the central groove spanning 2/3 of the occlusal surface mesiodistally from the mesial side of the oblique ridge into the mesial pit; the buccal groove originating from the central pit and extending buccally between the MB and DB cusps; the distolingual groove emerging from the distal pit and crossing the occlusal surface toward the lingual, separating the oblique ridge from the distolingual cusp.
8. Three main occlusal pits: Central pit; the point of intersection of the central and buccal grooves, located at the mesial of the oblique ridge slightly toward the buccal of the central sulcus. Mesial pit: the mesial terminal point of the central groove, located below the mesial marginal ridge. Distal pit: the point of origin of the distolingual groove, located at the center of the occlusal surface buccolingually, between the oblique ridge and the distal marginal ridge.
9. Triangular ridges descending in a widening manner from the cusp apex of the MB, ML, DB, and DL cusps toward the central sulcus.
10. Cusp of Carabelli usually present (please draw) extending along the mesiolingual of the ML cusp.
11. Proximal heights of contour contacting adjacent heights of contour.
12. Drawing is neatly accomplished.
MAXILLARY FIRST MOLAR #3

Fig. 8-27  Mesial View

DRAWING CRITERIA

2. Central sulcus centered under the root.
3. Two major cusps: ML cusp slightly longer than MB cusp. (DL cusp apex and crown profile also partly visible, alongside and parallel to ML cusp and crown outline).
4. Cusp of Carabelli a small convexity attached to the ML cusp.
5. Buccal height of contour located on the cervical 1/3 of the crown, lingual height of contour at the middle 1/3.
6. Buccal surface appears flatter in contrast with more rounded lingual surface.
7. MB root appears broader and straighter than the lingual root.
8. Lingual root extends lingually 2/3 the distance from the crown to the root apex then curves towards the buccal along the apical 1/3.
9. Contact area located toward the buccal and at junction of occlusal and middle third of the crown.
10. Drawing is neatly accomplished.

Fig. 8 - 27
MAXILLARY SECOND MOLAR #2

Dimensions:

Crown Height ______ mm
Root Length ______ mm
Total Tooth Length ______ mm
Mediodistal Crown width ______ mm
Buccolingual Crown Width ______ mm

Fig. 8-28  Buccal View

DRAWING CRITERIA

1. Crown and root drawn in proportion to each other and to the crown and roots of adjacent teeth.
2. Two buccal cusps of equal height although the MB cusp is wider than the DB cusp.
3. Buccal groove does not extend cervically as far as the buccal groove of the maxillary first molar.
4. Buccal roots of relatively equal lengths, mesiofacial root is initially straight then curves slightly to distal in apical 1/3. Distofacial root's apical 1/3 has a mesial deviation.
5. Root trunk wider than that of the adjacent maxillary first molar.
6. Mesial height of contour located slightly closer to the occlusal than distal height of contour. (Heights of contour on maxillary molars vary in relation to the Curve of Spee.) Mesial surface also appears less rounded than distal surface. Contact heights of contour with those of adjacent teeth.
MAXILLARY SECOND MOLAR #2

Fig. 8-29 Lingual View

DRAWING CRITERIA

1. Crown and roots drawn in proportion to each other and to the crown and roots of adjacent teeth.
2. Two lingual cusps: ML cusp larger and longer than DL cusp.
3. Lingual groove visible between the ML and DL cusps but considerably shorter than the lingual groove of the maxillary first molar.
4. Mesial height of contour located closer to the occlusal than distal height of contour; mesial surface also appears flatter in contrast with more rounded distal surface. Heights of contour should contact heights of contour of adjacent teeth.
5. Lingual root appears inclined to the distal (DB root not as visible as DB root of #3). It is centered under the distolinguinal cusp.
6. Lingual root is longer, followed by mesiofacial, then distofacial.
7. Apices of roots more pointed than first molars and closer together at their apices.
8. Roots slightly shorter than first molar.
9. Drawing is neatly accomplished.
MAXILLARY SECOND MOLAR #2

Fig. 8-30  Occlusal View

DRAWING CRITERIA

1. Occlusal outline rhomboidal in form with occlusal line angles being more rounded than those of the maxillary first molar.
2. Buccolingual crown width greater than mesiodistal crown width.
3. Mesiodistal width equal to or wider towards buccal than on lingual when viewed from the occlusal
4. Occlusal table outlined by the ML, MB, DB, DL cusp ridges and the proximal marginal ridges.
5. Occlusal surface characterized by four cusps: ML, MB, DB, DL, each cusp similar in size and position to its counterpart in the maxillary first molar but slightly narrower in width mesiodistally.
6. Oblique ridge similar in position to the oblique ridge of the maxillary first molar but crossed by the central groove.
7. Three occlusal grooves: Central, Buccal, and DL, all similar in position to their counterparts in the adjacent maxillary first molar.
8. Three occlusal pits: Mesial, Distal, and Central, each similar in position to its counterpart in the maxillary first molar, except for the central groove which crosses the oblique ridge and ends in the distal pit.
9. Triangular ridges descending toward the central sulcus from the cusp apex of each of the ML, MB, DB, and DL cusps.
10. Proximal heights of contour contacting adjacent heights of contour.
11. Drawing is neatly accomplished.
MAXILLARY SECOND MOLAR #2

Fig. 8-31  **Mesial View**

**DRAWING CRITERIA**

2. Central sulcus centered under the root approximately in line with trifurcation.
3. MB and ML cusps present, of relatively equal heights.
4. Buccal height of contour located in the cervical 1/3 of the crown; lingual height of contour at the junction of the middle 1/3 and cervical 1/3.
5. Buccal surface appears slightly flatter in contrast with more rounded lingual surface.
6. Contact area located toward the buccal.
7. MB root broader and straighter than the lingual root.
8. Lingual root less divergent and less curved towards the buccal than the lingual root of the adjacent maxillary first molar.
9. Furcation slightly greater distance from cervical line than from apex of lingual root.
10. Lingual root slightly longer than mesiofacial root.
11. Mesiolingual cusp slightly longer than mesiobuccal cusp.
12. Drawing is neatly accomplished.
SELF-TEST

1. A maxillary first molar may be identified through which of the following characteristics?
   a. a concavity on the lingual root
   b. a fifth cusp
   c. a prominently divergent lingual root
   d. all of the above
   e. none of the above

2. Which characteristics accurately distinguish maxillary first and second molars?
   a. roots more divergent on the first than on the second
   b. mesiodistal crown dimension narrower on the first than on the second
   c. DL cusp larger than on the first than on the second
   d. a and c
   e. b and c

3. How would you arrange these occlusal views to identify the maxillary molars in their proper sequence?
   a. II, I, III
   b. I, II, III
   c. III, I, II
   d. II, III, I
   e. I, III, II
4. Which group of cusps on #2 or #3 correctly arranged in order of decreasing size?
   a. ML, DL, MB, DB
   b. DL, ML, MB, DB
   c. ML, MB, DB, DL
   d. MB, ML, DB, DL
   e. none of the above

5. Which of these is the buccal view of #2?

   ![Diagram of teeth]

   a. I
   b. II
   c. III
   d. I and III
   e. None of the above

6. Identify the area marked by B on Fig. III above.

   a. mesiobuccal cusp
   b. distobuccal cusp
   c. mesiolingual cusp
   d. distolingual cusp
   f. Carabelli cusp
7. II is a transverse section of the cervix of tooth number:

8. Which of these is the midroot section of #14:

   a. #1
   b. #2
   c. #3
   d. #4
   e. #5

   a. B
   b. A
   c. All of the above
9. The oblique ridge on a maxillary molar runs or extends:
   a. from the MB root to the ML root
   b. across a transverse ridge
   c. from the ML cusp to the DL cusp
   d. from the triangular ridge of the DB cusp to the distolingual
cusp ridge of the ML cusp

10. In normal occlusion, the maxillary first molar occludes with which of
these teeth?
   a. mandibular first and second premolars
   b. mandibular second and third molars
   c. mandibular first and second molars
   d. none of the above
CRITERIA EXPLANATION FOR TOOTH #3

1. FINISH OF MARGINS
   - **Margins:**
     - Wax should be flush with margin, neither over (overhang) nor under (submarginal) waxed
     - The wax should also be smooth with no under (flat) or over (bulbous contour)

2. FINISH OF EXTERNAL SURFACES:
   - **External Surfaces:**
     - All external surfaces (mesial, distal, facial, lingual) should be smooth, even, and polished with no scratches, “wavy” contours, or pits present

3. FINISH OF OCCLUSAL ANATOMY:
   - **Anatomy:**
     - Marginal ridges, triangular ridges, and cusp ridges should exhibit smooth, polished surfaces with no scratches, pits or waviness
     - All developmental and supplemental grooves should be smooth and polished with no scratches, pits, or waviness
     - All junctions between these structures must be smooth and flowing

4. OCCLUSAL VIEW:
   - **Outline Form:**
     - Rhomboidal in shape
     - Occlusal line angles are sharper than for second molar
     - Mesiodistal dimension of the lingual is equal to or greater than the same dimension on the buccal
     - Proximal contacts slightly to buccal although distal contact may be at center of tooth buccolingually
     - Proximal contacts 1.0 to 1.25 mm in length
   - **Occlusal Table:**
     - Somewhat square

5. CUSP AND RIDGE ANATOMY:
   - **Ridges:**
     - Prominent oblique ridge running from the distal cusp ridge of the ML cusp to the triangular ridge of the DB cusp
     - Cusp ridges distinct and separate from triangular or marginal ridges
     - Triangular ridges distinct with their apices starting at the cusp apexes, ending with their bases in the appropriate grooves
Cusps:
- Five cusps are present
  - MB, ML, DB, DL, Cusp of Carabelli
  - Sizes of cusps (from smallest to largest), Cusp of Carabelli, DL, DB, MB, ML
  - Tallest cusps (from shortest to tallest) – Cusp of Carabelli, DL, MB, DB, ML
- Two B cusps about equal width, ML cusp occupies 2/3 of lingual while DL occupies 1/3
- Cusp of Carabelli is located on the lingual cusp just below the cusp apex

6. FOSSA, PIT, AND GROOVE ANATOMY:
- Size and Shape:
  - Few if any supplemental grooves are present
  - Three major grooves – central, distolingual, and buccal
    - Central extends from the mesial pit to the oblique ridge centrally located (buccolingually)
      - Does NOT cross the oblique ridge
    - Buccal extends from the central pit between the two buccal cusps onto the buccal surface, stopping just short of the buccal HOC
    - Distolingual extends from the distal pit onto the lingual surface separating the DL cusp and oblique ridge
      - Stops just short of the lingual HOC
- Position:
  - Prominent lingual groove extending onto the lingual surface bisecting the mesiodistal dimension of the lingual outline
  - ML groove separates the Cusp of Carabelli and the ML cusp and runs into the lingual groove
  - Three pits – mesial, distal, and central
    - Central is at junction of central and buccal groove located mesial to the oblique ridge just buccal to the central fossa
    - Distal located at the center (buccolingually) of the occlusal surface as the origin of the distolingual groove between the oblique ridge and the distal marginal ridge
    - Mesial is the terminal point of the central groove located just distal to the mesial marginal ridge at the center (buccolingually) of the tooth
7. **FACIAL VIEW:**
   - **Outline:**
     - Buccal cusps of equal width
     - MB cusp is equal to or slightly taller than DB
     - DL cusp ridge of ML cusp just below and parallel to DB cusp
     - Ridge of MB cusp
     - Buccal groove separates the buccal cusps extending 1/3 of the way onto the buccal surface
     - Outline correct proportion to adjacent teeth
   - **M/D:**
     - Contours similar for both mesial and distal aspects
   - **HOCs:**
     - Mesial and distal HOCs appear equal in height
     - HOCs contact adjacent teeth at their HOCs
     - Proximal contacts 0.5 to 0.75 mm occlusogingivally

8. **MESIAL/DISTAL VIEWS:**
   - **B/Li Outline:**
     - Lingual more rounded than buccal outline with the ML cusp closer to midline than MB cusp
     - ML cusp slightly longer than MB cusp
     - DL cusp apex visible from mesial view and parallel to ML cusp outline but slightly lingual to ML cusp apex
   - **B/Li Contours:**
     - Lingual contour is more rounded than buccal which is “straighter” although more evenly convex
   - **HOCs:**
     - Buccal HOCs in cervical 1/3
     - Lingual HOC in the middle 1/3
     - HOCs smoothly flow in an occlusal direction into the proximal contact area similar to #3

9. **LINGUAL OUTLINE:**
   - **Shape:**
     - Lingual groove starts diagonally towards mesial, then turns towards center near lingual HOC
   - **Outline:**
     - Three cusps are visible, ML, DL, and Cusp of Carabelli
     - Cusp of Carabelli attached to ML cusp
     - Proportioned correctly to rest of the tooth
     - Exhibits correct size and shape
HOCs:
- Proximal contacts contact adjacent teeth the same as when viewed from the facial
- HOCs in the middle 1/3
- Mesial HOC closer to occlusal than distal HOC
- Proximal contacts 0.5 to 0.75 mm occlusogingivally

10. CONTACTS/EMBRASURES:

   Proximal Contacts:
   - Proximal contact area is 0.5 to 0.75 mm occlusogingivally and 1.0 to 1.25 mm faciolingually
   - HOCs contact adjacent teeth

   Embrasures:
   - Occlusal embrasures small
   - Lingual embrasures similar in size and shape to each other
   - Gingival embrasures allow adequate room for gingival tissue
   - Facial embrasures distinct, but small
   - Lingual embrasures largest and equal in size
**RESD 515 Autumn 2009**

**First Wax Up Exercise**

Student Secret ID#: ________________________________

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<tr>
<th>Tooth # 3</th>
<th>Criteria</th>
<th>Comments</th>
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| **PASS** | □ Occlusal Anatomy:  
• Appropriate and support the overall anatomical and esthetic requirements of the tooth.  
• In harmony with arch form and form an appropriate occlusal shape that provides correct overall tooth dimensions. | |
| **FAIL** | □ Heights of contour, proximal contacts/areas, and embrasures:  
• Correct shape and height in relation to the adjacent teeth.  
• In the correct third and not over- or under-contoured on  
  Facial________Lingual________Mesial________Distal________ | |
| □ Outlines and Finish  
• In harmony with arch form and that provides correct overall tooth dimensions: Facial________Mesial/Distal________Lingual________ | |

POINTS: ____________
### WAXING CRITERIA FOR #3 FULL CROWN

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<th>X = meets criteria</th>
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<tr>
<td>Your evaluation</td>
<td>Partner’s evaluation</td>
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<tr>
<td><strong>CRITERIA</strong></td>
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<td>1. Finish of Margins:</td>
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<td>2. Finish of External Surfaces:</td>
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<td>3. Finish of Occlusal Anatomy:</td>
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<td>4. Occlusal View:</td>
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<td>5. Cusp and Ridge Anatomy:</td>
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<td>6. Fossa, Pit and Groove Anatomy:</td>
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*Refer to syllabus for further explanation of criteria

TOTAL ______

**NOTE:** To receive credit for discrepancies, deficient criteria must be met without altering already properly achieved criteria. In other words ALL criteria must be acceptable when final evaluation is given.
APPENDIX FOR DRAWINGS

The following completed drawings are included so that students will be able to check to make sure that their drawings are correct. To determine this, use the completed drawing as an overlay over the drawing just accomplished. Single view drawing will not be included in the Appendix since the view is already illustrated on the same page as the drawing exercise.

The drawings will be identified by figure number, NOT page number, so be sure to use the correct overlay.

Fig 2-20

Fig 2-21
Fig 2-25

Fig 3-22
Fig 7-30

Fig 7-31
APPENDIX FOR ROOT GROOVES  
(Longitudinal Grooves)

ANTERIOR TEETH

1. **Maxillary lateral incisors**: May have mesial and/or distal root grooves. Most often on the distal.

2. **Mandibular central incisors**: May have root grooves on the mesial and/or distal.

3. **Mandibular lateral incisors**: May have mesial root groove, but ALWAYS have a distal root groove.

4. **Maxillary central incisors**: are LEAST likely of maxillary and mandibular incisors to have longitudinal root grooves.

5. **Maxillary canines**: May have mesial and/or distal root grooves. Most often on the distal.

6. **Mandibular canines**: Root grooves are generally present on both the mesial and distal root surfaces.

Of the anterior teeth, mandibular canines are MOST LIKELY to have root grooves and the maxillary central incisors are LEAST LIKELY to have them.

PREMOLARS (BICUSPIDS)

1. **Maxillary 1st premolar**: Deep mesial root groove is present from bifurcation up onto mesial enamel. Distal root groove, if present, is much smaller.

2. **Maxillary 2nd premolar**: Root grooves are similar to the first premolar except the key is that the mesial root groove is NOT as highly developed as on the 1st premolar. Can have BOTH mesial and distal root grooves.

3. **Mandibular 1st and 2nd premolars**: May have shallow mesial and distal root grooves. Most frequently found on the mesial.

**SUMMARY**: Maxillary premolars have more distinct root grooves than mandibular premolars.
MOLARS

1. **Maxillary molars:** The lingual root may have a root groove more pronounced at the cervical than at the apical area.

2. Grooves occur on all molars where bifurcations and trifurcations exist.

3. **Mandibular molars:** Each of the terminal roots of mandibular molars has root grooves on the mesial and distal surfaces.
   a. **MESIAL ROOT GROOVES** are more highly developed than on the distal surfaces. Distal grooves may even be absent.

MISCELLANEOUS INFORMATION:

1. From the lingual view – the apex of the lingual root of the first maxillary molar is centered approximately over the **DISTOLINGUAL GROOVE**.

2. From the lingual view – the apex of the lingual root of the second maxillary molar is centered approximately over the **DISTOLINGUAL CUSP**.

3. The maxillary 2\textsuperscript{nd} molar has more root form deviation than the maxillary 1\textsuperscript{st} molar.