Teaching Endodontic Microscopy to Pre-Doctoral Students

Samuel Dorn DDS
Renato Silva DDS, MS, PhD
Rebeca Weisleder DDS

ADEA annual meeting, Seattle 2013
BACKGROUND
OBJECTIVE

Survey the extent of use of the dental operating microscope as an educational aid at the pre-doctoral level in dental schools within the United States.

METHODS

• Fifty-three dental schools.
• Seven question survey about availability of microscopes and their utilization by pre-doctoral dental students.
RESULTS

• Ninety-five percent responses, 85% have at least one microscope available.
• Thirty-five percent made available to pre-doctoral students. (18 schools)
Frequency of use

- Seldom: 61.11%
- Occasional: 27.77%
- Often: 11.11%
Advocated the use of magnification and illumination during apical surgery.

Gartner AH, Dorn SO
Advances in Endodontic Surgery.
Dent Clin AM 1992 April;36(2):357-78
OBJECTIVE

To assess the benefit of the OM in improving undergraduate students’ performance in endodontics.

Rampado ME, Tjaderhane L, Friedman S, Hamstra SJ
The benefit of the Operating Microscope for access cavity preparation by undergraduate students.
J Endod 2004 Dec;30(12):863-7
Materials & Methods

- Thirty-six dental students.
- Twenty minute slide presentation on maxillary molar anatomy and access cavity preparation.
- Forty-five minute training on OM.
Materials & Methods

Groups:

1. Control (Lectures only)
2. Standard (Lecture/Practice)
3. Microscope (Lecture/Practice)
RESULTS:

The group using the OM improved significantly in access cavity preparation and significantly outperformed both standard and control groups in accuracy of identifying canals.
OBJECTIVE

The purpose of this study was to evaluate the influence of using the dental operating microscope (DOM) for detection of the mesiolingual (ML) canal orifice in extracted maxillary molars compared with unaided vision (no loupes or headlamps).

Materials & Methods

- Mounted 39 maxillary molars in a dentoform.
- Two attempts were made to locate the ML canal with unaided vision.
- Teeth were examined by using a DOM.
RESULTS:

ML canal orifices were detected in 20 of the teeth with a sharp explorer and mirror. In the remaining teeth, 12 ML canal orifice were located by using the DOM.
In 1995 a workshop for endodontic program directors sponsored by the American Association of Endodontists on teaching microscopy. And that led to the AAE formally recommended to CODA that microscopy training be included in the new Accreditation Standards for Advanced Specialty Education Programs in Endodontics.
The new standards making microscopy training mandatory, became effective in January 1997.

Selden, H S.
The Dental-Operating Microscope and Its Slow Acceptance.
J Endod 2002 March;30(3):206-7
Our survey was sent by the AAE to all Pre-doctoral programs in US and Canada
Do you teach the use of the microscope in endodontics to pre-doctoral students?

- Yes: 47.22%
- No: 52.78%
Do you teach the whole class or just selected pre-doctoral students?
Do your pre-doctoral students have microscopes available in the clinic?
Do all pre-doctoral students have to use microscopes in the endodontic clinic?

![Bar chart showing 21.74% Yes and 78.26% No.](chart.png)
What brand(s) of microscope do the pre-doctoral students use? (Select all that apply)?
The Predoctoral Endodontic Clinic
ENDODONTICS/GRADUATE ENDODONTICS CLINIC
Floor Mounting is more sturdy
Microscopes

Getting started:
0 Dental School (pre-doctoral level)
0 Slowly
0 Learning Curve (about 90 days)
All Microscopes are connected to the 4 Faculty station computers
Introduction to the Operating Microscope

• 45 Minute Lecture
• 15 Minute Demonstration
• 1 Hour Hands On in groups of 3
6.1.6. Magnification Selection
Both Global Surgical™ G3 and G6 microscopes have two Magnification Factor Selector Knobs one on each side of the microscope body. Either of these knobs should be turned until the desired magnification factor is facing the indicator arrow on the side of the microscope body. See Table 6-1 for magnification selections for the different microscope systems.

<table>
<thead>
<tr>
<th>Table 6-1. Global Microscope Total Magnification Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Surgical™ G3 Microscope</strong></td>
</tr>
<tr>
<td>Binocular Focal Length (MM)</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>160</td>
</tr>
<tr>
<td>160</td>
</tr>
<tr>
<td>160</td>
</tr>
</tbody>
</table>

6.1.7. Finding Total Magnification
The following formula is used to calculate the total magnification of the system:

\[
\text{Total Magnification} = \left( \frac{\text{Binocular Focal Length}}{\text{Objective Focal Length}} \right) \times \left( \frac{\text{Eyepiece Magnification}}{\text{Magnification Factor}} \right)
\]

For example:
- Binocular Focal Length = 125 mm
- Objective Lens Focal Length = 250 mm
- Eyepiece Magnification = 10X
- Magnification Factor = 0.5

\[
\text{Total Magnification} = \left( \frac{125\text{mm}}{250\text{mm}} \right) \times \left( \frac{10X}{0.5} \right)
\]

Therefore: Total Magnification = 2.5X

The focal length is printed on each objective lens and the magnification factor is marked on each eyepiece. The Magnification Selector Knob on the microscopes shows the selected magnification factor.

For the binocular, the model number is printed on the bottom of the dovetail mount and the focal length of each model number is shown in Table 6-2.
Microscopes
Table 6.2. Binocular Focal Lengths

<table>
<thead>
<tr>
<th>Binocular Model</th>
<th>Focal Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1002GA10</td>
<td>Straight Binocular</td>
</tr>
<tr>
<td>M1001GA10</td>
<td>45°-Inclined Binocular</td>
</tr>
<tr>
<td>M10022GA10</td>
<td>220°-Inclined Binocular</td>
</tr>
</tbody>
</table>

6.1.8. Effects of Changing Components

The following chart lists the effects of changing components to the microscope system. For further information, contact Global Surgical™ Technical Services Department.

Table 6.3. Effects of Changing Microscope Components

<table>
<thead>
<tr>
<th>Binocular (Focal Length)</th>
<th>Magnification</th>
<th>Field of View</th>
<th>Intensity of Illumination</th>
<th>Working Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 125mm to 160mm</td>
<td>Increases</td>
<td>Decreases</td>
<td>No Change</td>
<td>No Change</td>
</tr>
<tr>
<td>From 180mm to 125mm</td>
<td>Decreases</td>
<td>Increases</td>
<td>No Change</td>
<td>No Change</td>
</tr>
<tr>
<td>Objective Lens (Focal Length)</td>
<td>Increases</td>
<td>Decreases</td>
<td>Increases</td>
<td>Decreases</td>
</tr>
<tr>
<td>From longer to shorter (i.e. 250mm to 200mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From shorter to longer (i.e. 200mm to 250mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnification (Manual Change)</td>
<td>Decreases</td>
<td>Increases</td>
<td>No Change</td>
<td>No Change</td>
</tr>
<tr>
<td>From higher to lower (i.e. 2X to 1X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From lower to higher (i.e. 1X to 2X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyepiece (Power)</td>
<td>Decreases</td>
<td>Increases</td>
<td>No Change</td>
<td>No Change</td>
</tr>
<tr>
<td>From higher to lower (i.e. 12.5X to 10X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From lower to higher (i.e. 10X to 12.5X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.1.9. “Roll” Angle Tension Adjustment

The amount of tension required to rotate the microscope right or left can be adjusted by tightening or loosening the roll angle tension knob. This knob is located at the rear of the angled coupler. See Figure 6-4.

6.1.10. “Pitch” Angle Adjustment

The amount of tension required to rotate the microscope forward or backward is adjusted by tightening or loosening the pitch angle tension knob. This knob is located on the right side of the microscope behind the Magnification Factor Selector Knob. See Figure 6-4.
2.1.1. PAR-FOCAL PROCEDURE

The *par-focal procedure* of the microscope allows the user to adjust the eyepieces to correct for nearsightedness or farsightedness of the user. It is essential to perform the par-focal procedure prior to using any still or video camera applications. Follow the steps listed below to complete the par-focal procedure.

1. Use the maneuvering handle(s) to position the microscope above a flat stationary surface, with the bottom of the objective lens parallel to the surface.
2. Using a pen or pencil, mark an "X" on a piece of white paper for a focusing target and place it within the center of the illumination field of the microscope.
3. Ensure the rubber eyecups are installed.
4. Set the dioptr rings on both eyepieces to "0".
5. Without looking through the binoculars, adjust the Fine Focus Device to its approximate midpoint.
6. Hold your eyes against the eyecups, or eyeglasses against low eyecups.
7. With one hand on each side of binocular body, adjust the bodies until you see one circle, not two.
8. Set the magnification changer to the highest setting. Raise or lower the microscope vertically with the maneuvering handle(s) until the "X" is in optimum focus.
9. Adjust the Fine Focus Device until a sharp focus is acquired.
10. Tighten the Tension/Lock Knob on the Piston Arm Assembly to prevent the microscope from moving. Set the magnification to the lowest setting. Focus each eyepiece, one at a time, with the opposite eye closed, by turning the Diopter Ring until the image is clear and sharp. Record the setting for future use. The Tension/Lock Knob can now be loosened.
11. Each operator of the microscope will require his or her own diopter settings which should be set before any procedures are performed. Due to changes in vision associated with age, it is recommended that this procedure be performed by each operator a minimum of one time per year.

**Figure 2-3 Microscope Par-Focal Procedure**

**NOTE:** It is particularly important to perform the par-focal procedure when an image through the microscope is clear but the same image through a still or video camera is not focused, or vice-versa.
2.2. OPERATION

The INITIAL SETTINGS procedure (below) should be performed after installation of the COLOR VIDEO CAMERA and WILL NOT have to be performed after each power up. The WHITE BALANCE procedure (below) should be performed after each power up. It is strongly recommended to inspect the cable condition and routing before each use of the Microscope. See CABLE MANAGEMENT (paragraph 3.1.2.) for more information.

1. Turn the power ON to all other video system components, such as Monitor, Video Printer, VCR, etc.

2. Set the Microscope Light Source Power Switch to ON.

3. Apply power to the COLOR VIDEO CAMERA by plugging the POWER ADAPTER into an AC outlet.  
   NOTE: This camera does not have a power "On / Off" switch. The camera will be "On" when the POWER ADAPTER is plugged in and all power cables are attached to the camera.

4. Perform INITIAL SETTINGS procedure if necessary.

5. Perform WHITE BALANCE procedure.

6. The POWER ADAPTER should be disconnected from the AC outlet if the COLOR VIDEO CAMERA is not going to be used for extended periods of time.

2.2.1. INITIAL SETTINGS

1. Set the A.E. combination switches as follows; 1 ON, 2 OFF, 3 OFF, 4 ON.

2. Set the SHUTTER SPEED selector to "8."

3. Set the BACK LIGHT switch to "OFF."

2.2.2. WHITE BALANCE

1. Set the WHITE BALANCE selector to "P.W.B."

2. Ensure the Microscope Light Source is on.

3. Place a white sheet of paper under the objective lens to fill the Color Video Camera field of view.

4. Set the White Balance by pressing the (B) button.
It’s more than just a light!
Survey of the Pre-Doctoral Students

9 months after microscope training
How important do you think the use of microscopes is in the endodontic clinic?
Teaching the use of microscopes in endodontic treatment for pre-doctoral students is an important added benefit of attending UTHouston.
The use of the microscope could make a difference in your career.
By using the microscope do you feel that you can deliver a better treatment to your patient?

- **Totally Agree**: 35%
- **Agree**: 39%
- **Neutral**: 21%
- **Disagree**: 5%
Remember: We should have only one standard of treatment for all patients
QUESTIONS?