The Use of Case-Based Assessments in Endodontic Education

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Reforming Dental Health Professions Education: A White Paper

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Assumption

Academic environments of most health professions education (dentistry, medicine, pharmacy, nursing, allied health sciences) all too often are not interdisciplinary, whereas health care clinical practice and clinical research often require explicit interdisciplinary efforts.
Assumption

There is no one model of dental education that will suffice for all fifty-six dental schools to address all issues.
The four primary competencies are:

- Communication skills
- Ability for self-reflection
- Critical thinking and problem solving skills
- Ethics, professionalism, and social responsibility
Courses should be...

- Large ones that integrate knowledge
- Problem-based and case-based
- Multi-disciplinary
- Applications oriented
- At the developing edge of the biologic science that supports the discipline
Pedagogy for learning in Dental School “creating uncertainty”

- Active student participation
- Students report on their cases
- Active interaction to extrapolate, query, pushing for explanations, clarifications, generalizations.
- Always asking “now what are you going to do”...relating treatments to human beings
Pedagogy for active student participation

- A protocol that is fixed, ritualized, pervasive, routine.
- Create uncertainty in the discussions
- Make the pedagogy habitual
A signature pedagogy should make it impossible for students to become “invisible”
Signature Pedagogies

- Students feel engaged or “could be” at a moments notice
- Process of learning produces a natural accountability
- Accountability → anxiety
- Anxiety ↑ learning
- Everyone learns to manage anxiety
Critical Thinking
Paradigms in Teaching

• Interdisciplinary interactions (case based) with multiple instructors (different disciplines)

• Assessment of endodontic dossier of cases with a mentor

• Competency test case assessment in ritualized format
Critical Thinking
Paradigms in Teaching

• Full faculty participation
• Infrastructure of the curriculum may need re-thinking
New 2nd Year Integrated Clinical Science Course at Pacific

**Theme**

**Lead Department**

- Pulpal and periradicular diagnosis
- Critical thinking in radiographic interpretation
- Success and healing in Endodontics
- Case assessment in Endodontics
Integrated Clinical Sciences Second Year

Success and Healing in Endodontics
Consequences of and strategies to deal with residual post-treatment root canal infection

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\textbf{Abstract}


Bacterial sampling of prepared root canals is used to determine the presence and character of the remaining microbiota. However, it is likely that current sampling techniques only identify organisms in the main bran to other sites of the body. Histologic observation of root apices with surrounding bone removed from either patients or human cadavers has demonstrated that post-treatment apical periodontitis is associated with 50–90\% of root filled human teeth. Thus, if the objective of root canal treatment is to eliminate apical periodontitis at a histological level, current treatment procedures are inadequate. It is essential that our knowledge of the local and systemic consequences of
The effect of surgical exposure of dental pulps in germ free and conventional laboratory rats

Oral Surg 1965
Bacteria and their Products

- Antigens
- Lipoteichoic acid
- Exotoxins
- Endotoxins

Enzymes
- Collagenases
- Proteases
- Hyaluronidases

Metabolites
- Organic Acid
- H2O2
- Ammonia
- Indole
Host Response

- Prostanoids
- HETE
- Leukotrienes
- Lipoxins
- Neuropeptides
- Bradykinin
- Growth Factors
- Reactive Oxygen Metabolites
- Immunoglobulins
- Complement
- Cytokines

Histamine    Seratonin
Criteria for Success/Failure
AAE Quality Assurance Guidelines

• **Successful**: if no signs or symptoms

• **Questionable**: if symptoms vague, prolonged, chronic, or low grade

• **Non-healed**: if persistent, recurring problems
Case-Based Exercise
Case 1

A 45 year old man presents with no chief complaint and a dental history that includes root canal treatment of the mandibular left first molar. Upon radiographic evaluation, three silver cones are observed and the tooth is restored with a full veneer crown. The mesial root shows a thickening of the periodontal ligament space as well as loss of lamina dura on the distal root. The patient is asymptomatic and, as stated, has no chief complaint. The tooth was treated ten years ago.
1. Is the endodontics successful? Why or why not? **Support your opinions with evidence from your reading.**

2. Is retreatment warranted? Why or why not.

Given the following alternative situations, how would your approach differ relative to the above questions:

1. The tooth hurts when chewing hard foods.
2. The tooth was just treated three weeks ago and continues to give the patient low grade discomfort.
3. The tooth needs a new crown
Case 2

Mandibular right second and third molars were treated endodontically 6 months ago. The patient is asymptomatic. Radiographic evaluation reveals narrow canals with poor density fillings. Little shaping of the canals is evident. A decision has to be made as to the acceptability of the root canal treatment prior to restoration. Some might accept the treatment as clinically successful; consider the following factors individually, and how they may impact on the decision-making process. **Cite your reading as evidence for your decisions.**
1. Describe the technique you feel was used to obturate these root canals? Can this impact on long term success? Are the voids present a cause for concern? How would you restore these teeth?

2. If the tooth has not been restored for 6 months, what is the possibility of bacterial leakage through the temporary coronal restoration into the canal system? Why do you believe your answer?

3. The patient claims there is occasional, prolonged sensitivity to cold and heat in these teeth. What might this mean? Evidence for your answer?

4. Instead of asymptomatic, the patient has symptoms to chewing; however, the radiograph shows no discernible problem. What might this mean?
New 3rd Year Integrated Clinical Science Course at Pacific

**Theme**

**Lead Department**

**Contributing Departments**

- **A** Trauma and rehabilitation of the young dentition
- **B** Infections and the acute odontogenic emergency
- **C** Endo/Perio Disease
- **G** The Endodontic/Restorative Continuum
- **F** The case for Endodontics or Implants
Endo Perio Disease
ICS Theme C
Cementum is an Effective Barrier To Bacterial Penetration
Case #1

65 year old female

Oral bisphosphonates as replacement for hormone therapy

Osteoporosis
• How would you treat an acute pulpitis in #19

• Describe the mechanisms of disease spread. Endo vs. Perio

• Perio to Pulp vs. Pulp to Perio

• Concentration vs. Potency of irritants

• How does attachment loss occur in both diseases

• Appearance of lesions; Endo vs. Perio

• Clinical assessment?
1. 22 year old male, non significant medical history.
2. Dental history includes multiple extractions for pain-related emergencies.
3. Patient is non-compliant with oral hygiene.
Case #4
• 63 year old woman
• History of breast cancer (mastectomy)
• No history chemotherapy or radiation
• Bridge is 24 years old
• Lower right quadrant is asymptomatic

• Differential diagnosis
• Treatment options
• Treatment course?
Restorative Rehabilitation of Endodontically Treated Teeth

ICS Theme G
“Let’s talk about this”.....
Changes in Endodontically Treated teeth

- Loss of coronal tissue
- Loss of intracoronal and intraradicular dentin
- Change in composition of remaining structure
Gutmann, JL  1992

The dentin-root complex: anatomic and biologic considerations in restoring endodontically treated teeth
Discuss...

- Moisture loss
- Architectural changes
- Biomechanical behavior
- Dentinal toughness
- Collagen alteration
Third Year Assessment (didactic)
Trauma: Case 2

Fig 2: Clinical photographs of Patient P.O. during emergency treatment, seen from facial (a) and occlusal (b).
The 11-year-old patient P.O. fell off his kickboard and hit his upper anterior teeth against a fence. He felt bits of his tooth #8 in his mouth but didn’t save them. He presented at his dentist’s office 25 min after the trauma. The initial examination revealed a complicated crown fracture of tooth #8 with grade 2 mobility and percussion sensitivity. Tooth #9 had a chipped incisal edge involving the dentin, grade 1 mobility and slight percussion sensitivity.

**Question 6: Considering the time elapsed since the trauma:**

A. tooth # 8 should be extracted immediately.
B. the pulp is likely to have become necrotic and should be extirpated.
C. the pulp tissue in this case is superficially contaminated.
D. the pulp tissue is unaltered and no treatment is necessary.
E. treatment can be delayed without consequences.
Question 7: Unaltered tooth position and grade 2 mobility combined with percussion sensitivity will most likely be diagnosed as:

A. lateral luxation.
B. concussion.
C. intrusion grade 1.
D. alveolar fracture limited to the facial cortical plate.
E. chronic apical periodontitis.
Question 8: Generally, the most adequate treatment in this case is.

A. build-up and crown placement as soon as possible.
B. pulpectomy and immediate root canal filling to avoid secondary contamination.
C. partial pulpotomy and composite build-up.
D. pulpotomy followed by a minimum of 90 days of Ca(OH)$_2$.
E. pulpectomy followed by a minimum of 90 days of Ca(OH)$_2$ dressing.
Question 9: **In a hypothetical situation**, if vital pulp therapy was attempted on #8 and at a two week recall the patient gives no indication of sensitivity to pulp testing with endo ice at #8; and teeth #7 and #9 respond normally. This is:

A. a sign that the pulp is definitively necrotic.
B. transient loss of sensitivity and further evaluation is needed.
C. indicative of incorrect treatment with faulty diagnoses.
D. suggestive of inferior reliability of cold test vs. the electric pulp tester.
E. shows evidence of total pulpal degeneration.
Question 10: Specific conditions are necessary to favor re-organization of a severed neuro-vascular bundle supplying the pulp of tooth #8.

A. the apical foramen should be at least 0.5 mm in diameter and nerve re-growth may occur at a speed of 1 mm/day.
B. revascularization will not occur.
C. the apical foramen should be at least 1 mm in diameter and nerve re-growth may occur at a speed of 1 cm/day.
D. the apical foramen should be 1.2 mm in diameter and nerve re-growth may occur at a speed of 1 µm/day.
E. the apical foramen should be 1 mm in diameter and nerve re-growth may occur at a speed of 1 mm/day.
Trauma: Case 3

Fig. 3: Clinical photographs of patient J.B., at the emergency treatment (a) and after 3 years (b). Note the unrestored incisal edge of #9.
The 11-year old patient J.B. was tackled playing soccer and fell against a goal post. After finishing the game, he went home by himself. His mother noticed that his upper right central incisor had been pushed into the tissues and there were sharp edges on the adjacent incisor. The next day, he contacted his dentist where he was seen approximately 24h after the injury.

**Question 11:** Intraoral examination revealed that tooth #8 was moved into a buccal and apical direction. Tooth #9 showed exposed dentin with no pulpal involvement and tested sensitive to cold, grade 1 mobility. What should initial treatment for this patient consist of?

A. surgical repositioning of tooth #8, smoothing sharp edges on tooth #9.
B. orthodontic extrusion of tooth #8, pulpectomy #9.
C. monitoring #8 for re-eruption, partial pulpotomy and composite edge buildup #9.
D. monitoring #8 for re-eruption, composite edge restoration #9.
E. extraction of #8, PFM crown preparation and impression #9.
Question 12: How would you describe the diagnosis for patient J. B.:

A. intrusion #8, incisal chipping #9.
B. displacement #8, crown fracture #9.
C. lateral luxation #8, crown-root fracture #9.
D. intrusion #8, abfraction #9.
E. intrusion #8, crown fracture #9.
Assessment of Student Case Presentations on Theme

- How student incorporated theme into their discussion
- Students utilization of the literature assigned for the theme
- Quality of the powerpoint presentation and public speaking skills
- Treatment plan and options
Third Year Assessment (clinical portfolio)
## TEST CASES

### Non-surgical Endodontic Therapy

<table>
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<tr>
<th>Observed</th>
<th>Not Observed</th>
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- Diagnosis
- Access Anterior
- Access Posterior
- Cleaning and Shaping
- Obturation
- Radiographic Technique
Chart Data / Diagnosis

**Excellent**
- Thorough chart entries made
- Etiology correctly identified
- Correct diagnosis made

**Satisfactory**
- Minor data uncharted
- Etiology misinterpreted
- Slight inaccuracies in diagnosis

**Unsatisfactory**
- Chart poorly executed
- Etiology not recognized
- Diagnosis poorly understood

Comments_________________
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## Radiographic Interpretation

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
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<tbody>
<tr>
<td>❑ Thorough understanding of images</td>
<td></td>
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<tr>
<td>❑ Risk factors identified</td>
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<tr>
<td>❑ Correct strategies determined</td>
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<td></td>
</tr>
<tr>
<td>❑ Minor misinterpretations of image</td>
<td></td>
<td></td>
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<tr>
<td>❑ Some risks not seen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>❑ Strategies not interpreted fully</td>
<td></td>
<td></td>
</tr>
<tr>
<td>❑ Image poorly interpreted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>❑ Risks not recognized</td>
<td></td>
<td></td>
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<tr>
<td>❑ Strategies not defined</td>
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</table>

Comments:

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☐ Excellent
☐ Satisfactory
☐ Unsatisfactory
### Access Anterior

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
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</thead>
<tbody>
<tr>
<td>- Appropriate outline cut in dentin</td>
<td>- Minor outline errors</td>
<td>- Outline poorly executed</td>
</tr>
<tr>
<td>- Chamber penetrated on long access</td>
<td>- Chamber penetration off access</td>
<td>- Unnecessary structure cut on access</td>
</tr>
<tr>
<td>- Straight line access accomplished</td>
<td>- Slight irregularities in access</td>
<td>- Access poorly accomplished</td>
</tr>
</tbody>
</table>

Comments: ____________________
__________________________________________________________
__________________________________________________________
Access Posterior

- Excellent
  - Appropriate outline cut in dentin
  - Chamber penetrated on long access
  - Straight line access accomplished

- Satisfactory
  - Minor outline errors
  - Chamber penetration off access
  - Slight irregularities in access

- Unsatisfactory
  - Outline poorly executed
  - Unnecessary structure cut on access
  - Access poorly accomplished

Comments

- Excellent
- Satisfactory
- Unsatisfactory
Anesthesia

Excellent
- Thorough knowledge
- Effective administration
- No compromise of patient care

Satisfactory
- Appropriate knowledge
- Appropriate use
- Minor compromises of patient care

Unsatisfactory
- Inadequate knowledge
- Inappropriate technique
- Major compromise of patient care

Comments

- Excellent
- Satisfactory
- Unsatisfactory
Cleaning and Shaping

- **Excellent**
  - Thorough debridement
  - Length determination accomplished
  - Apical constriction developed

- **Satisfactory**
  - Appropriate debridement
  - Some length difficulties
  - Constriction acceptable

- **Unsatisfactory**
  - Tissue poorly debrided
  - Difficulties achieving length
  - Inappropriate constriction developed

Comments_________________
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## Canal flow and position

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Root canal shape flows to terminus</td>
<td>- Shape has minor ledges; lacks some flow</td>
<td>- Root canal is ledged, blocked</td>
</tr>
<tr>
<td>- Terminus patent</td>
<td>- Issues with patency</td>
<td>- Probable loss of patency</td>
</tr>
<tr>
<td>- Taper created and original canal position maintained</td>
<td>- Minor changes in canal position; taper acceptable</td>
<td>- Major transportation of canal position; inadequate taper</td>
</tr>
</tbody>
</table>

Comments

- Excellent
- Satisfactory
- Unsatisfactory
Master Cone and Sealer

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Cone at length with tugback</td>
<td>Minor tugback; cone requires some adjustment</td>
<td>Cone fit poor; taper or tugback issues</td>
</tr>
<tr>
<td>Sealer properly mixed</td>
<td>Sealer too thin</td>
<td>Sealer improperly mixed</td>
</tr>
<tr>
<td>Canals adequately coated with sealer</td>
<td>Minor sealer application issues</td>
<td>Sealer applied poorly to canal walls</td>
</tr>
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Comments____________________

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Condensation and Seal

Excellent
- Apical condensation verified and well sealed
- Gutta percha well condensed to terminus
- Coronal seal well done

Satisfactory
- Minor adjustments to apical condensation
- Some minor voids in condensation
- Coronal seal may leak over time

Unsatisfactory
- Apical seal is inadequate and needs to be redone
- Obturation poorly condensed
- Coronal seal poorly executed

Comments

- Excellent
- Satisfactory
- Unsatisfactory
Radiographic Technique

Excellent
- Tooth centered on image; proper angulation
- Majority of images are diagnostic
- Image data appropriately utilized

Satisfactory
- Minor errors in sensor placement or angulation
- Some minor image issues
- Some data misinterpreted

Unsatisfactory
- Poor sensor placement and angulations
- Many poor and non-diagnostic images
- Image data ignored or mismanaged

Comments_____________________
_____________________
_____________________

- Excellent
- Satisfactory
- Unsatisfactory
Radiographic Hygiene

**Excellent**
- Minimum images; majority diagnostic
- Patient exposed to minimum radiation
- Radiographs archived appropriately.

**Satisfactory**
- Some poor images non-diagnostic
- Some minor additional exposures
- Some minor archival issues

**Unsatisfactory**
- Many poor non-diagnostic images
- Excessive patient exposures
- Radiographs improperly archived and stored

Comments________________
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- Excellent
- Satisfactory
- Unsatisfactory
Endodontic Portfolio

Some of the best endodontic outcomes of the Class of 2009.
Assessments to measure student attainment of clinical competency

• Evaluation of case management
• Engagement in clinic & number of procedures
• Daily work evaluation by faculty (AxiUm)
• Chart audits (AxiUm)
• Test cases (competency exams which evaluate various stages of endodontic care)
• Portfolio of patient cases
• Extramural rotation assessment by supervising faculty
• Mock boards in Endodontics
• Evaluations of case presentations (ICS course)
• Professionalism assessment
Questions to ask ourselves

1. What are students’ complaints about assessment?
2. Are we measuring the right things in endodontics?
3. To what extent is critical thinking assessed?
4. How intentional is the connection of assessments with learning objectives?
5. Have you looked at what other schools are doing to assess students’ performance?
6. What are your concerns about assessment in endodontics?
7. What improvements would you like to see in student assessment in endodontics?
Issues we are facing at Pacific

• Faculty development needed to expand case-based teaching & assessment.
• Faculty “buy-in” is needed throughout school about case-based teaching & assessment.
• Modify institutional culture & students’ study habits with less MCQ & more case-based assessment.
• Expand OSCE’s in ICS & other curriculum components.
• Implement portfolio system in more departments where students track & self-evaluate their work.
THANK YOU !