Evidence-based dentistry (EBD) is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient’s oral and medical condition and history, with the dentist’s clinical expertise and the patient’s treatment needs and preferences.
**Evidence Based Practice**

- **Operator**
- **Experience**
- **Skill**

**Evidence Based Dentistry**

**Step 1**
- Formulate a clinically relevant and focused question
- **Patient Population**
- **Intervention**
- **Comparison intervention**
- **Outcome**

**Step 2**
- Systematically collect the relevant evidence
- Evidence is graded
- Analyze and Appraise

**Step 3**
- Integration of the evidence
- one's clinical expertise
- patient preference and values

**Decision**

**Step 4**
- Evaluate the practice decision or outcome
- Re-evaluation: integrated into our practices

**Pre-operative** → **Follow-up**
Diabetes

- Well-controlled: fasting blood glucose between 70 mg/dL and 200 mg/dL
- HbA1C: Average level of blood sugar over the previous 3 months
  - poor control: Greater than 7%

Cardiac

<table>
<thead>
<tr>
<th></th>
<th>Maximum Dose (mg)</th>
<th>Carpules 1:50k Epinephrine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Patient</td>
<td>0.2</td>
<td>5.5</td>
</tr>
<tr>
<td>Cardiac Patient</td>
<td>&lt;0.2</td>
<td>&lt;5.5</td>
</tr>
<tr>
<td></td>
<td>0.04</td>
<td>1</td>
</tr>
</tbody>
</table>

**Absolute Contraindications:**
- Hyperthyroidism
- Pheochromocytoma
- high blood pressure
- cardiac dysrhythmias
- unstable angina
- < 6mos myocardial infarction/cerebrovascular accident/cardiovascular disease

**EVIDENCE BASED PRACTICE**

**PATIENT**

- **Medical Hx**
  - Diabetes
  - Cardiac
  - Drugs
    - Bisphosphonates
    - Aspirin
    - Anticoagulants

- **Tooth**

**BisPhosphonates**

Anti-resorptive drugs
Anti-angiogenic drugs
PATIENT

Low risk: < 4 years oral BP with no clinical risk factors
 Medium risk < 4 years oral BP with corticosteroids/antiangiogenic medication
 Medium risk > 4 years
 Drug holiday 2 months prior and 3 months following

High risk - IV Drugs
Refer to an Endodontist

Nonsurgical endodontic treatment should be favored

CHX 1 minute rinse
Necrotic pulp - single-dose amoxicillin prophylaxis (Actinomyces common in BRONJ)
Avoid anesthesia with vasoconstrictors, patency, overfill and overextension of filling material,
Use wedges instead of rubber dam clamp on bone

Drugs
Aspirin - Anti platelet effect.
Platelet life span is 10 days.
5 - 7 days cessation

Aspirin - Low-dose aspirin therapy complicate oral surgical procedures?

Normal INR 1
Therapeutic INR with anticoagulants can be as high as 3.5
Surgical INR 1.5
Heparine (6-12hrs) Warfarin (5 days)

EVIDENCE BASED PRACTICE

Tooth
**Prognosis of initial endodontic therapy**

**Success ≠ survival**

**Strict**

**Loose**

<table>
<thead>
<tr>
<th>Study</th>
<th>Case observed</th>
<th>Follow up years</th>
<th>Healed</th>
<th>Healing</th>
<th>Functional</th>
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</thead>
<tbody>
<tr>
<td>Grossman et al. 1964</td>
<td>98</td>
<td>1-5</td>
<td>62</td>
<td>25</td>
<td>86</td>
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<tr>
<td>Storms 1969</td>
<td>102</td>
<td>1</td>
<td>81</td>
<td>109</td>
<td>93</td>
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<tr>
<td>Adenschi &amp; Bole 1976</td>
<td>271</td>
<td>0.5-7</td>
<td>82</td>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>Jakob et al. 1978</td>
<td>2459</td>
<td>2-7</td>
<td>38</td>
<td>20</td>
<td>58</td>
</tr>
<tr>
<td>Babakow et al. 1981</td>
<td>124</td>
<td>1-9</td>
<td>59</td>
<td>29</td>
<td>88</td>
</tr>
<tr>
<td>Byström et al. 1987</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Eriksen et al. 1988</td>
<td>121</td>
<td>1</td>
<td>81</td>
<td>13</td>
<td>88</td>
</tr>
<tr>
<td>Murphy et al. 1991</td>
<td>89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friedman et al. 1995</td>
<td>113</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caliskan &amp; Sen 1996</td>
<td>172</td>
<td>2-5</td>
<td>87</td>
<td>6</td>
<td>97</td>
</tr>
<tr>
<td>Orstavik 1996</td>
<td>126</td>
<td>4</td>
<td>75</td>
<td>13</td>
<td>88</td>
</tr>
<tr>
<td>Weiger et al. 2000</td>
<td>67</td>
<td>1-5</td>
<td>78</td>
<td>16</td>
<td>94</td>
</tr>
<tr>
<td>Ahlborg 2001</td>
<td>72</td>
<td>4-6</td>
<td>74</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>Peters &amp; Wessellink</td>
<td>38</td>
<td>1-4-5</td>
<td>76</td>
<td>21</td>
<td>97</td>
</tr>
</tbody>
</table>

*asymptomatic, lesion size unchanged or reduced

97% (1,126,288 / 1,462,936) of the teeth were retained in the oral cavity 8 years after initial non-surgical root canal treatment.

— Salehrabi & Rotstein 2004 J Endod

**… to name a few**

*Courtesy Dr. Stephanie Chen*

---

**Intraradicular infection**

**Microbial Control**

90-95%

- Primary Infection
- Healing
- Persistent / Recurrent Infection

<table>
<thead>
<tr>
<th>Number of Microbial Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Threshold</td>
</tr>
<tr>
<td>Above Threshold</td>
</tr>
<tr>
<td>Treatment (+)</td>
</tr>
<tr>
<td>Treatment (-)</td>
</tr>
</tbody>
</table>

---

**This complexity will not change in our lifetime!**

*Takahashi & Kishi*

---

**200?**

*Hess*

---

**1925**
Apical periodontitis is an inflammatory lesion caused mostly by bacterial elements derived from the infected root canal system.

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apical Periodontitis</td>
<td></td>
</tr>
<tr>
<td>Abscess</td>
<td>12%</td>
</tr>
<tr>
<td>Bacteroida</td>
<td>73%</td>
</tr>
<tr>
<td>True Cyst</td>
<td>9%</td>
</tr>
<tr>
<td>Pocket Cyst</td>
<td>6%</td>
</tr>
<tr>
<td>Intraradicular infection</td>
<td>90-95%</td>
</tr>
<tr>
<td>Extraradicular infection</td>
<td>2-5%</td>
</tr>
<tr>
<td>Foreign body reaction</td>
<td>very few</td>
</tr>
</tbody>
</table>

Actinomycosis
Proprionibacterium propionica

NON SURGICAL

SURGICAL

CBCT EVALUATION

PennEndo - Dr Rina Campbell

Courtesy Dr. S Kratchman
Apical periodontitis is an inflammatory lesion caused mostly by bacterial elements derived from the infected root canal system.

- Intraradicular infection - 90-95%
- Cyst - 5%
- Extraradicular infection - 2-5%
- Foreign body reaction - very few

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess</td>
<td>12%</td>
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<td>Granuloma</td>
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<td>Pocket Cyst</td>
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</tr>
<tr>
<td>Actinomycosis</td>
<td></td>
</tr>
<tr>
<td>Propionibacterium</td>
<td></td>
</tr>
<tr>
<td>proprionica</td>
<td></td>
</tr>
</tbody>
</table>

**Actinomycosis**

Pre-op Sept 2013
Sept 2013
Jan 2014
April 2014
Oct 2015

**HISTOLOGICAL DX - CYST**

Pre-op
Post surgery
1 year follow-up
2 year follow-up
Intra-radicular infection

RCT 2 year follow-up: ideal endodontic outcome

PERSISTENT APICAL PERIODONTITIS

6 months

2 months later

6 month follow up
Apical periodontitis is an inflammatory lesion caused mostly by bacterial elements derived from the infected root canal system.
DEFICIENT CROWN

Pre-op 2006
Follow up 2011
Pre-op 2016
Follow up 2017

ADEQUATE RESTORATION

Pre-op
Post-op
1 year
6 year

Post Removal - Ultrasonics

Photoshop
Non-Surgical Retreatment?
Reality

Post Removal - Ultrasonics

Reality
### CASE EVALUATION

<table>
<thead>
<tr>
<th></th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration/Post</td>
<td>S</td>
</tr>
<tr>
<td>Working Length</td>
<td>NS</td>
</tr>
<tr>
<td>Apical Size</td>
<td>S</td>
</tr>
<tr>
<td>Filling Density</td>
<td>S</td>
</tr>
<tr>
<td>Missed canal</td>
<td>S</td>
</tr>
<tr>
<td>Procedural Errors/</td>
<td>Both</td>
</tr>
<tr>
<td>Inaccessible anatomy</td>
<td></td>
</tr>
<tr>
<td>Periodontal health</td>
<td>Both</td>
</tr>
</tbody>
</table>

### CBCT EVALUATION

![CBCT images]

### TREATMENT DECISION

![Treatment decisions]

Courtesy Dr. Ilya Mer
Restoration/Post | S  
Working Length | NS  
Apical Size | S  
Filling Density | S  
Missed canal | S  
Procedural Errors/Inaccessible anatomy | Both  
Periodontal health | Both  

| RCMA | Internal or external transportation  
Apical resorption  
Perforation  
Stripping  
Internal resorption |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47%</td>
<td>53%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| RCMR | Calcification  
Apical Stop  
Broken Instrument  
Under-filled with gutta-percha |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>87%</td>
<td>13%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Outcome of endodontic retreatment: A 2 year follow up

Gorni & Gagliani, JOE 2004

Non-Surgical Retreatment

<table>
<thead>
<tr>
<th>RCMA</th>
<th>Success (%)</th>
<th>Failure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-PAP</td>
<td>84.4</td>
<td>15.6</td>
</tr>
<tr>
<td>PAP</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

Accessibility of Root Canal System for Non-Surgical Retreatment

Apical PA & Root Canals non-negotiable: 60%!!! Four different groups PAP/Access 7%-60% failure
Gorni & Gagliani, JOE, 2004
1 year follow-up after ReRCT

INACCESSIBLE ANATOMY

Nonsurg Retreatment

Post surgery

2007

1 year follow-up

INACCESSIBLE ANATOMY

INACCESSIBLE ANATOMY

Follow up - 2015

INACCESSIBLE ANATOMY

FAILURES
Crown root ratio (CRR)

Apical root resection does NOT significantly affect the biomechanical parameters until it reaches 6mm.

Jang et al. 2014 J Endod

→ 4 mm of root-end resection = 1 mm of marginal bone loss

Apical root resection does NOT significantly affect the biomechanical parameters until it reaches 6mm.
Every case is unique and should be evaluated individually!!

<p>| | |</p>
<table>
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<td>Both</td>
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<tr>
<td>Periodontal health</td>
<td>Both</td>
</tr>
</tbody>
</table>

MY FIRST MOLAR SURGERY

Pre-op 2005

Post-op 2005

2007

2010

2015

THANK YOU

mkohli@upenn.edu