Evaluation of Endodontic Outcomes

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Objectives of the root canal treatment

- comfort
- Function
- Longevity
- esthetic

Achieved by

- Elimination of bacteria
- Prevention of recontamination
- Esthetic and functional restoration
The way to have an excellent root canal filling

- Diagnosis (i.e. fractures, perio)
- Judge your skills/competence/technical background
- Access preparation
- Accessory canals
- Proper cleaning and shaping technique (preparation errors, separated instruments)
- Obturation
DENTIST
Elimination of disease (clinically and radiographically)

PATIENT
No pain, Function, esthetic

PAYERS (e.g. insurance company): cost, survival

Success
Measures of success

• Vital Pulp therapy
  – Remain asymptomatic
  – Does not form periapical lesion

• Non-vital pulp
  – No clinical symptoms
  – Does not form periapical lesion
  – Periapical lesion heals

DO NO HARM!
Errors in treatment planning

• Dentist skills
• Poor prognosis
• Root fracture
Operative causes

• Cleaning and shaping
  – Straight line access
    • Missed canal
    • Shaping errors
    • Instrument fracture
    • Pulp remnants left
    • Excess preparation: perforation, crown fracture
  – Overinstrumentation
  – No apical stop
  – Desinfection: at least DO NO HARM (vital pulp)

• Obturation
  – Overfilling (gutta-percha, sealer)
  – Poorly condensed filling
    • Leakage
  – Underfilling
Aetiology of root canal treatment failure: why well-treated teeth can fail


• Microbiological factors:
  – Intraradicular infection
  – Extraradicular

• Non-microbiological factors:
  – Extrinsic
  – Intrinsic

1. Quality of cleaning/shaping and obturation
2. Extent of the cleaning/shaping and the obturation
3. Coronal restoration: leakage
1. Quality of cleaning/shaping and obturation (intraradicular infection)

Another Look at Root Canal Obturation
Written by William L. Wildey, DDS, and E. Steve Senia, DDS, MS
Friday, 01 March 2002
Dentistry Today
1. Quality of cleaning/shaping and obturation (extraradicular infection)

- Bacteria vs endotoxin
- Ineffective disinfection procedures
- Resistance
- Biofilm (4%)

*Figure 2* Host defence against endodontic infection. A dense wall composed of defence cells is observed at the apical foramen of this rat tooth associated with a periradicular lesion (original magnification ×40).

Leucocytes „defense barrier“
2. The problem to define the apical end-point for the cleaning and obturation.
2. The problem to define the apical end-point for the cleaning and obturation (intraradicular infection)

Necrotic debris

Too short?
2. The problem to define the apical point of cleaning and obturation (extraradicular infection)

Overfilled + Biofilm due to the debris and filling material

Figure 4: Scanning electron micrograph of extruded gutta-percha cone in an overfilled tooth. Note the voids between the cone and the root canal walls (original magnification ×90).
Overpreparation

- NOT RESULT IN COMPLETE CLEANING but increase the chance of the fracture

Vital tissue at the apex

Bacteria in the tubules
3. Coronal sealing (the most frequent post-treatment cause)

- The sealer can be resolved by the saliva
- The saliva can leak in between the sealer and dentine (smear layer!)
- And/or in between the sealer and guttapercha
- Leakage: Crown, filling, cracks
Non-microbiological factors

• Intrinsic:
  – Cyst and theories:
    • -True cyst
    • -Bay or periradicular cyst: non-surgical endodontic therapy

• Extrinsic:
  – Foreign body reaction: talc contaminated gutta-percha cones, cellulose component of paper points, cotton wool, and some food material of vegetable origin
  – may also carry microorganisms
Resolution of intraradicular infection

- **Disinfection**: Kill them all!
- **Good sealing (obturation)**: enclosed the survival and seal the gap against the nutritive tissue fluid (Bacterial are excellent survivals)
Methods of Evaluation

- Clinical
  - Absence of pain and swelling
  - Disappearance of sinus tract
  - No evidence of soft tissue destruction, including probing depths
Methods for evaluation

• Radiographic Findings
  – Parallel x-ray reproducible
  – success, failure, or questionable:
    • What can be seen
    • And when
Cases classified as functional teeth with uncertain prognosis

Clinically asymptomatic

Little radiolucency without progression

Scar formation?

„Must be treated”

Clinically symptomatic

No sign of failure or inflammation on the x-ray
Success rates
Factors affecting the long-term results of endodontic treatment

Journal of Endodontics

- 356 patients 8 to 10 yr after the treatment.
- The predictability from clinical and radiographic signs of the treatment-outcome in individual cases with preoperative periapical lesions cases was found to be low.
- Thus, factors which were not measured or identified may be critical to the outcome of endodontic treatment.

86+14x0.62=95
• Inflammation in 93% of cases at root canal filled tooth (Brynolf 1967)
• Histologically inflammation can be observed 30% of the treated teeth with no periapical radiolucency (Barthel 2004)
• Lesion up to 8 mm in diameter can be present without radiolucency (Wu et al. 2006)
Elemam RF, Pretty I. Comparison of the success rate of endodontic treatment and implant treatment. ISRN Dent. 2011

In conclusion, choice between implant and endodontic therapy cannot be exclusively based on outcome as both treatments differ in the biological process, diagnostic modalities, failure patterns, and patients preferences.

Table 1

<table>
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<tr>
<th>Treatment</th>
<th>Number of studies (inclusion and exclusion)</th>
<th>Number of teeth/implant</th>
<th>Average followup</th>
<th>SD of mean followup</th>
<th>Mean survival</th>
<th>SD of mean survival</th>
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</thead>
<tbody>
<tr>
<td>Primary endodontic treatment</td>
<td>5/3</td>
<td>1,465,158</td>
<td>6.7</td>
<td>2.8</td>
<td>86.02%</td>
<td>9.7</td>
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<tr>
<td>Secondary endodontic treatment</td>
<td>6/8</td>
<td>1561</td>
<td>8.7</td>
<td>7.5</td>
<td>78.2%</td>
<td>14.7</td>
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<tr>
<td>Surgical endodontic treatment</td>
<td>4/10</td>
<td>3,1005</td>
<td>7.5</td>
<td>3</td>
<td>63.4%</td>
<td>23.9</td>
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<tr>
<td>Implant treatment</td>
<td>8/5</td>
<td>1,047</td>
<td>6.8</td>
<td>2.5</td>
<td>90.9%</td>
<td>7.6</td>
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