

Evaluation of Endodontic Outcomes

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Mahmoud Torabinejad, Richard E. Walton, ENDODONTICS: PRINCIPLES AND PRACTICE 4th edition, Chapter 21 Evaluation of Endodontic Outcomes

Objectives of the root canal treatment

- comfort
- Function
- Longevity
- esthetic

Achieved by

- Elimination of bacteria
- Prevention of recontamination
- Esthetic and functional restoration

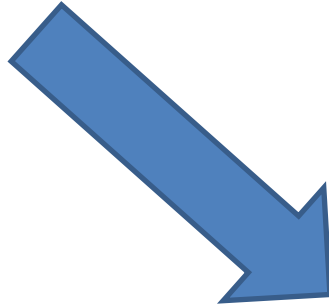
The way to have an excellent root canal filling

- 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

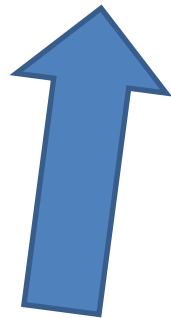


DENTIST
Elimination of disease (clinically and radiographically)

PATIENT
No pain, Function, esthetic



Success



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

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 (guttapercha, sealer)
 - Poorly condensed filling
 - Leakage
 - underfilling

Aetiology of root canal treatment failure: why well-treated teeth can fail

J. F. Siqueira Jr International
Endodontic Journal **34**, 1–10, 2001.

- Microbiological factors:
 - Intraradicular infection
 - extraradicular
- Non-microbiological factors:
 - extrinsic
 - intrinsic

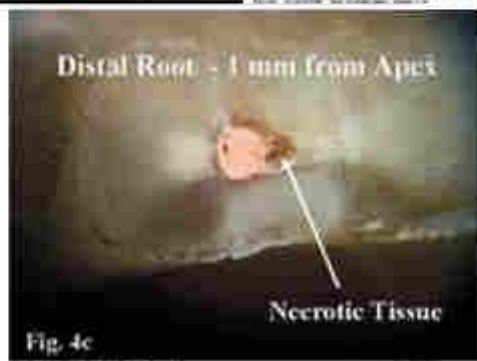


1. Quality of cleaning/shaping and obturation
2. Extent of the cleaning/shaping and the obturation
3. Coronal restoration: leakage

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, MSFriday, 01 March 2002
Dentistry Today



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1. Quality of cleaning/shaping and obturation (extraradicular infection)



Leucocytes
„defense barrier”

- 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 $\times 40$).

2. The problem to define the apical end-point for the cleaning and obturation

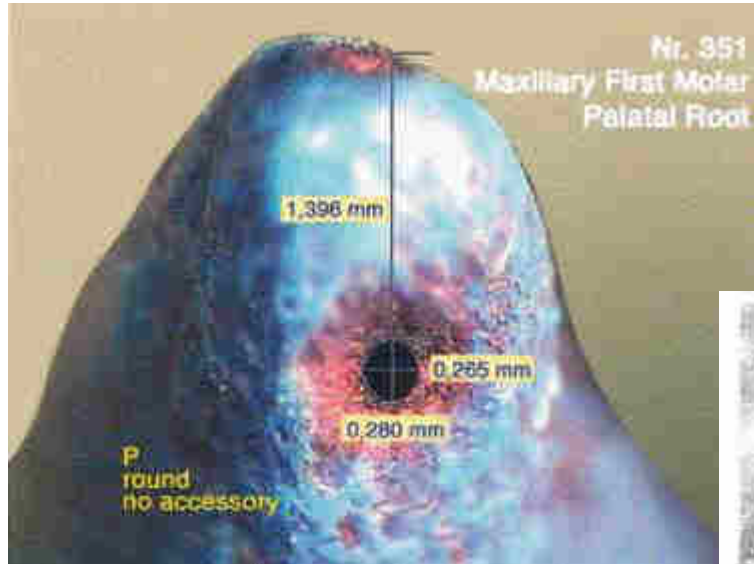
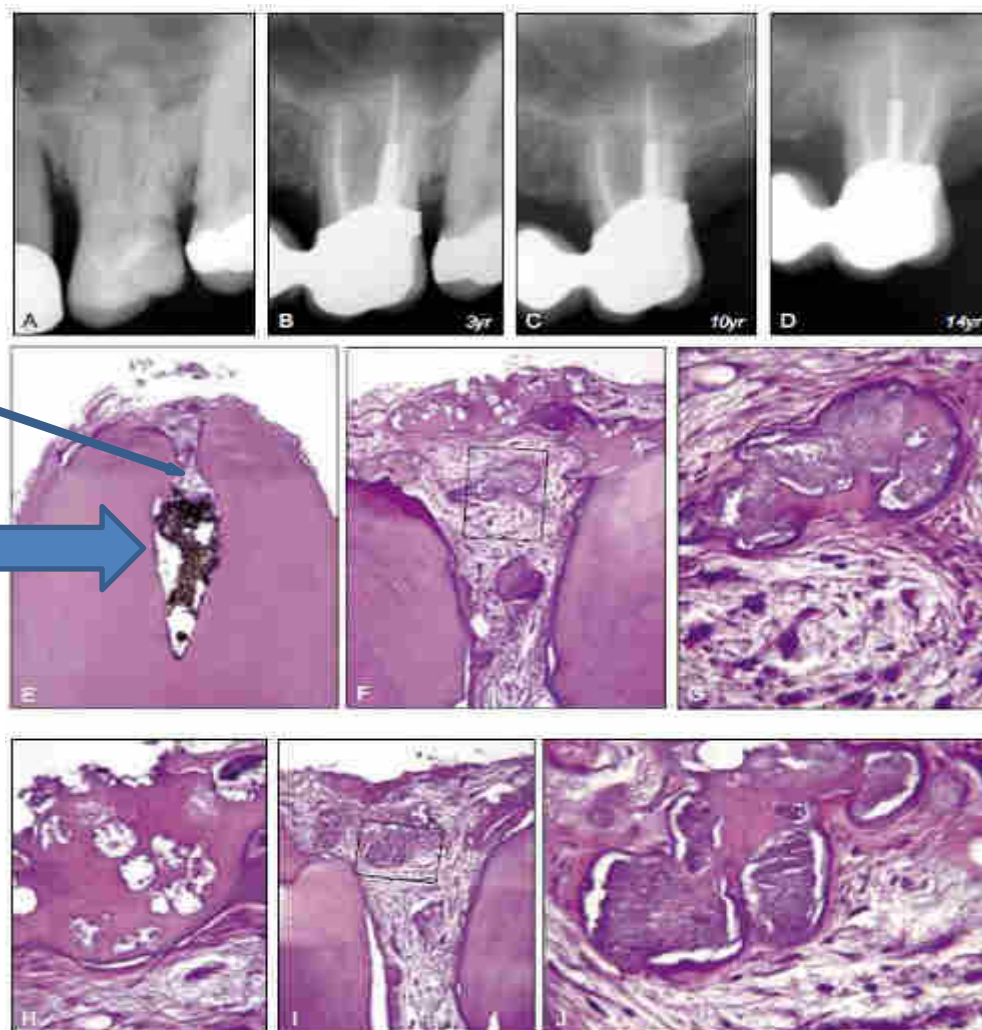


FIGURE 5- Focal hypercementosis. (A) Morphologic aspects of the foramina located in the distobuccal root of a maxillary molar. (B) Openings of the foramina at the middle third at the mesio Buccal surface of a maxillary canine. Original magnifications: (A) $\times 100$, (B) $\times 50$.

2. The problem to define the apical end-point for the cleaning and obturation (intraradicular infection)



Too short?

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

Overfilled

Gap

+ Biofilm due to the debris and filling material

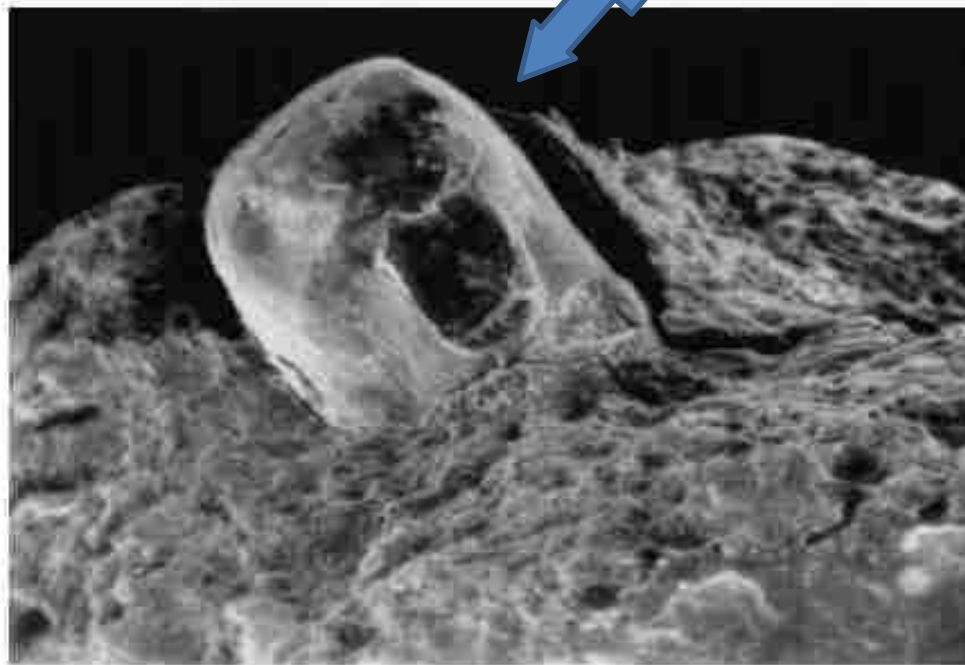
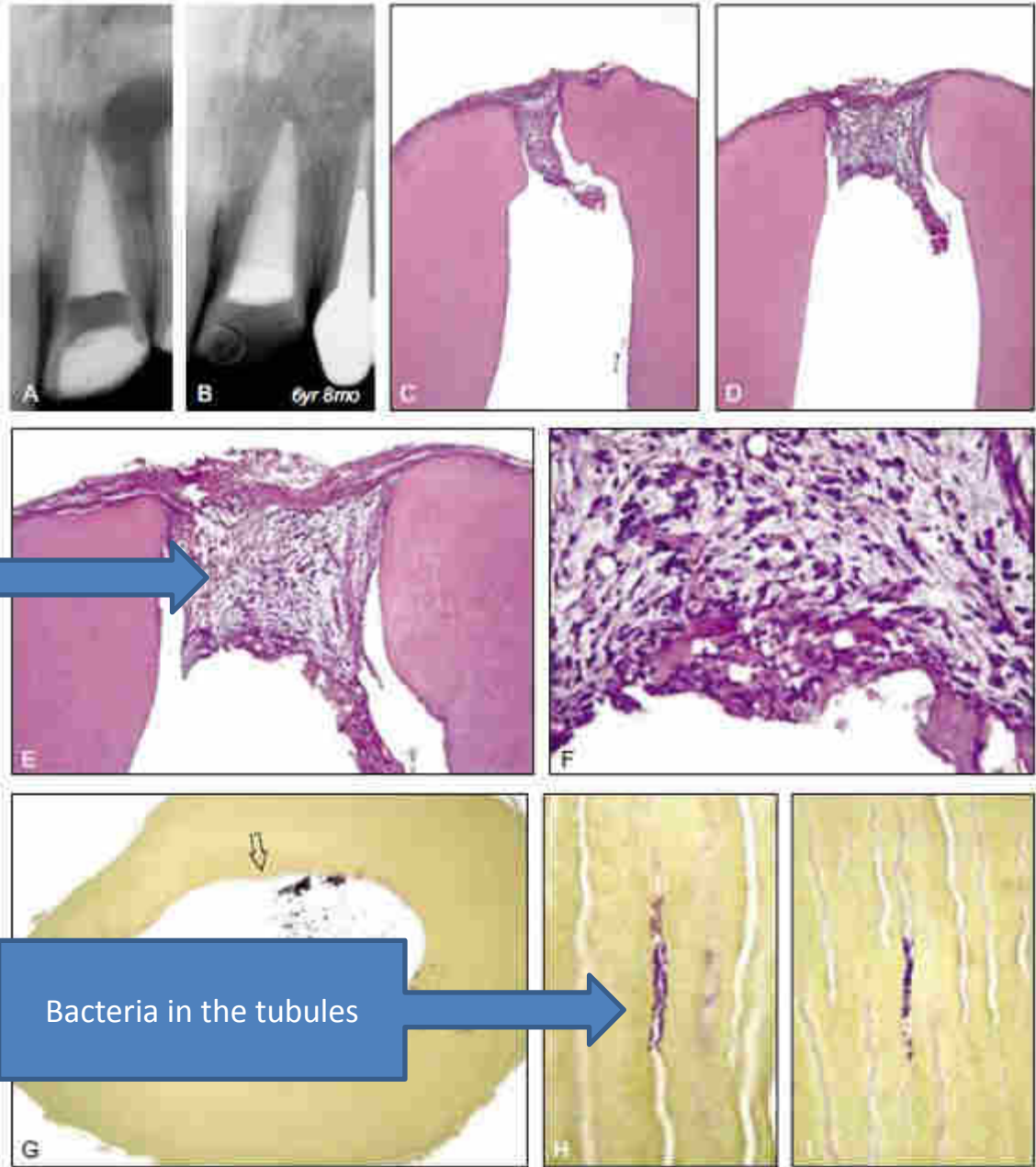


Figure 4 Scanning electron micrograph of extruded gutta-percha cone in an overfilled tooth. Note the voids between the cone and the root canal walls (original magnification $\times 90$).

Overpreparation

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



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



Figure 5 Cholesterol crystals in a periradicular cyst (original magnification $\times 10$). Crystals can accumulate in a periradicular lesion and possibly sustain the inflammatory process.

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

6 months / 5 years

failure

success

questionable



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

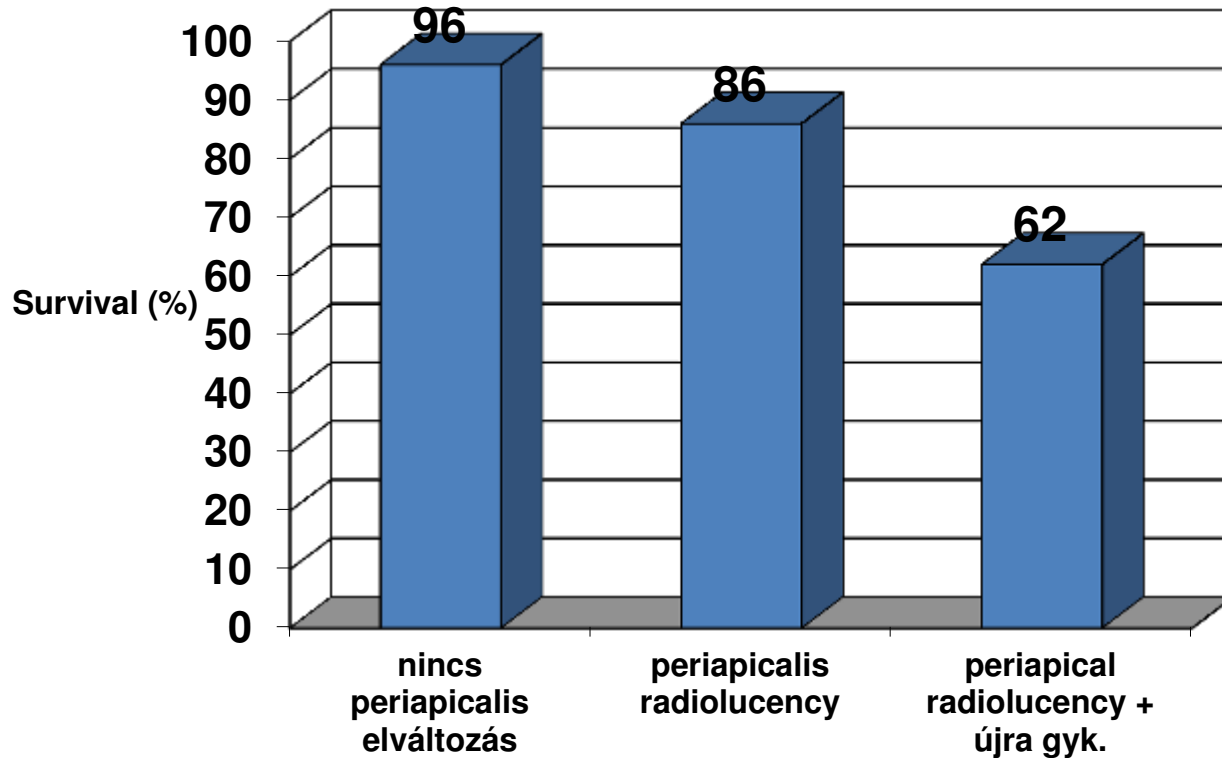


Success rates

Factors affecting the long-term results of endodontic treatment

Journal of Endodontics

Volume 16, Issue 10 , Pages 498-504, **October 1990.**



$$86 + 14 \times 0.62 = 95$$

- 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.

- 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

Table 1

Treatment	Number of studies (inclusion and exclusion)	Number of teeth/implant	Average followup	SD of mean followup	Mean survival	SD of mean survival
Primary endodontic treatment	5/3	1,465,158	6.7	2.8	86.02%	9.7
Secondary endodontic treatment	6/8	1561	8.7	7.5	78.2%	14.7
Surgical endodontic treatment	4/10	1005	7.5	3	63.4%	23.9
Implant treatment	8/5	1047	6.8	2.5	90.9%	7.6

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.