

# Outcome in endodontology

+ Retreatment

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Amsterdam

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## Outcome studies in Endodontology

- Importance and general concepts
- Definitions

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## Why are OUTCOME studies so important ?

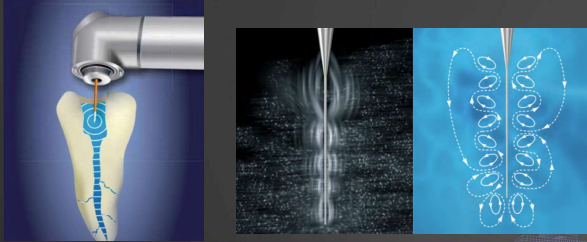
Which irrigation protocol?	Ultrasonic irrigation necessary?	Pulpotomy or direct pulp capping ?
Which file should I use?	Screening before bone marrow transplantation	
Which obturation ?	Use calcium hydroxide?	MTA or Biodentine?
Which sealer?	Which concentration of hypochloride?	Bleaching with which material ?
Microscope necessary?	Follow up period ?	Perforations- what to do?
Pulpotomy or pulpectomy?	CBCT before every treatment?	Full crown of composite ?
To re-treat or not to re-treat?	Broken instruments- what to do ?	

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- Outcome studies show us sometimes how careful we must be when making clinical recommendations based on in-vitro studies

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- The most extensively studied
- Surge of enthusiasm in the early '2000s



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Căpuță PE et al. J Endod. 2019

...no strong clinical recommendations could be formulated.



Silva EJNL et al. Br Dent J. 2019

...there was no evidence of effective improvement on periapical healing ...that supports the use of ultrasonic irrigation...

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Outcome was mostly determined by radiographs.

Evidence shows that radiographs show only half of the truth...

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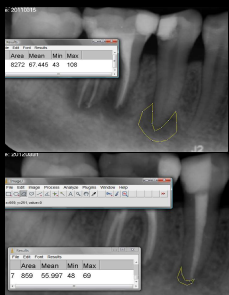
- **Radiographic success: half true half false**

- **Evidence:**

- Absence of AP on radiograph: half true half false or 2/3 true 1/3 false (Brynolf 1967, Barthel et al. 2004)..
- Absence of AP on radiograph: 60% true 40% false (Estrela et al. 2008, Christiansen et al. 2009).

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How do we measure/ determine healing?

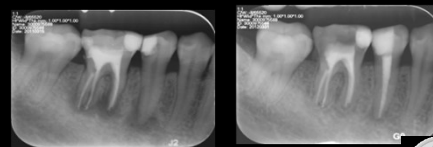


- Qualitative (strict)
- Simple measurements
- Scoring systems
- PAI
- CBCT-PAI
- 3D measurements

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### Qualitative assessment

- Healed or not healed ("strict criteria") –
- no measurement of the lesion, just present or absent.



Who used this system ?  
Ng et al. 2011



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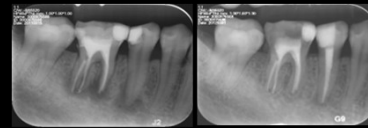
### Advantages

- Quick and cheap method
- Gives clinically relevant information

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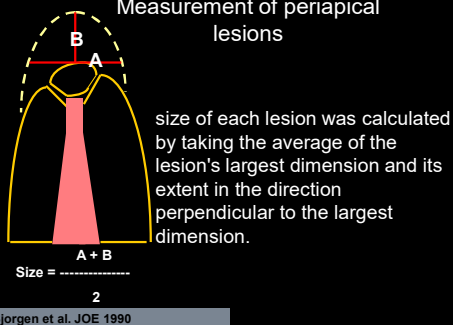
### Disdvantages

- Subjective
- No meaning for "shrinkage"
- On CBCT- lower healed rate on teeth with pre-treatment lesions (Liang et al. 2012: less than 50% after 2 years )



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### Measurement of periapical lesions



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### Measurement of periapical lesions



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### Advantages

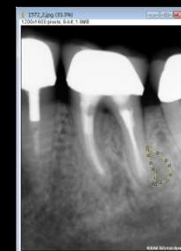
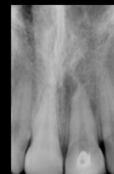
- Cheap method
- Quantitative



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### Disdvantages

- Time consuming
- Not accurate- difficult to standardize



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### Scoring systems

- Periapical scores for treatment outcome.
- Periapical destruction:
- 1= definitely NOT present
- 2= probably NOT present
- 3= unsure
- 4= probably present
- 5= definitely present

Who used this system ?  
Peters & Wesselink 2002

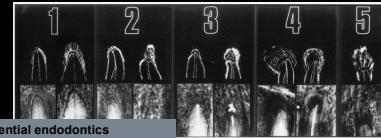
Reit & Gröndahl IEJ 1983

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### PAI Score



- PAI score (Ørstavik et al. 1986)
- "The PAI scoring system offers a visual reference scale for assigning a health status to the periapex."



Essential endodontics

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- In order to evaluate periapical section according to the PAI score, you have to compare periapical radiographs with a set of 5 radiographic images derived from Brynolf's histological-radiographic correlation study

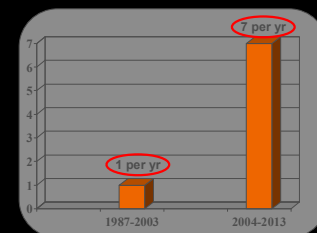


Brynolf, 1967

Who used this system ?  
The Toronto studies  
Marending et al. 2005  
And  
More than 70 studies !

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PAI has been used in more than 70 outcome studies since 1987



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### Advantages

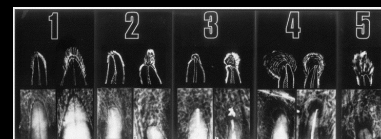
- Relatively easy to perform
- Many studies and experience with this method
- Uniformity



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### Disadvantages

- Based on findings from maxillary incisors
- Based on 2D information



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"Scores 2 to 5 represent increasing extent and severity of apical periodontitis."

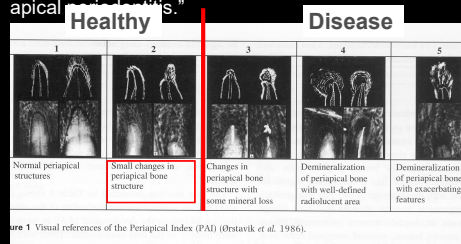


Figure 1 Visual references of the Periapical Index (PAI) (Ørstavik et al. 1986).

Ørstavik et al. Endod Dent Traumatol 1986

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Prognostic value of the full-scale Periapical Index. Kirkevang et al. Int Endod J. 2014

Repeated radiographic assessments of teeth using the full-scale PAI reveal that each of the five scores had distinct prognostic value for the course of periapical disease ...

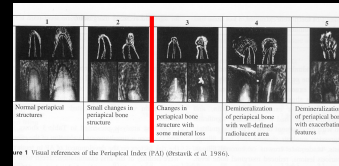
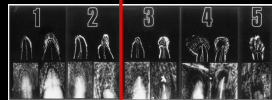


Figure 1 Visual references of the Periapical Index (PAI) (Ørstavik et al. 1986).

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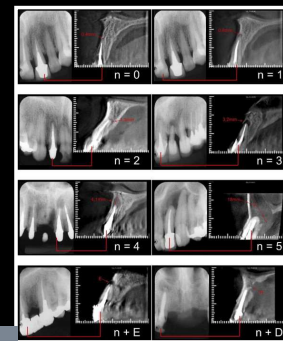
Success=	PAI 1+2	PAI 1
ALL	90	58
NO Pre-op PA	94	70
Pre-op PA	79	26



Ørstavik et al. Eur J Oral Sci 2004

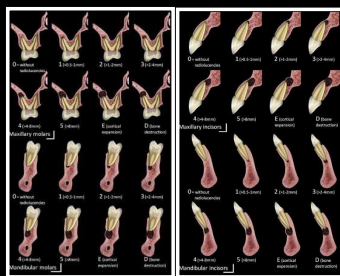
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The CBCT-PAI score



Estrella et al. JOE 2008

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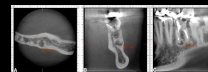


Estrella et al. JOE 2008

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The sizes of radiolucent periapical lesions were measured on CBCT scans in 3 dimensions: buccopalatal, mesiodistal, and diagonal. The CBCT-PAI was determined by the largest extension of the lesion. A 6-point (0-5) scoring system was used.

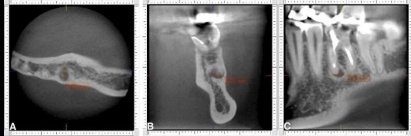


Who used this system ?  
Esposito et al. 2011

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### Advantages

- Based on findings from all teeth
- Based on 3D information
- Take 3 planes into consideration



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### Disadvantages

- Measurements are still based on personal interpretation and 2D concepts
- Radiation
- Artifacts like metal posts and radiodense materials
- Time consuming

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### 3D volume measurements

1. Threshold technique
2. The expansion technique

Who used this system ?  
Metska et al. 2013  
Van der Borden et al. 2013



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### Terminology

Patient-centered outcome:  
Survival, functionality



Disease-centered outcome:  
Healing of the periapical lesion



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### Outcome terminology

- Success & failure  
Too general ?
- Healing & healed  
Disease centered
- Effective & ineffective  
Patient centered
- Favourable and unfavourable outcome  
Too general ?
- Survival & Functionality  
Patient centered

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### What is the outcome of root canal treatment ?

- Strict/ loose criteria

	Initial	retreatment
Strict Volledige genezing	82,8	80,1
Loose kleiner geworden	89,1	85,6

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**Prevalence of apical periodontitis relative to endodontic treatment in an adult Dutch population: a repeated cross-sectional study**

Linda B. Peters, DDS, PhD,\* Jeroen A. Lindhorst, DDS, MD, PhD,\* Marika E. Ede, DDS,\* and Phil R. Wouda, DDS, PhD,\* Amsterdam, the Netherlands  
ACTA Academic Centre for Dentistry Amsterdam and Academic Medical Center

**Objective.** We aimed to compare an Amsterdam subpopulation's current prevalence of root canal fillings and associated periapical radiolucency with a similar patient sample from 1986.

**Study design.** An Amsterdam subpopulation was evaluated for missing teeth, restorations, quality of endodontic treatment, and periapical radiolucency.

**Results.** A total of 178 radiographs were evaluated and 4384 teeth were examined. Of these, 324 (7%) exhibited evidence of the apical periodontal ligament or periapical radiolucency and 234 (4.8%) had been endodontically treated. A total of 118 teeth (2.3%) had radiographic signs of apical periodontitis. Of these lesions, 14 (6.7%) were related to endodontically treated teeth, 24 (20%) to inadequately root canal fillings, and 80 (66.3%) to non-treated teeth. Apical radiolucency was significantly higher in these teeth than in adequately root-filled teeth.


**Conclusion.** Findings indicate that the percentage of active in an Amsterdam subpopulation has not improved over almost 2 decades. *Oral Surg Oral Med Oral Pathol Oral Radiol Endol* 2011;111:523-530.


**24% of the endodontically treated teeth were associated with a periapical lesion**


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35% of the root-filled teeth had AP 

34% of the root-filled teeth had AP 

34% of the root-filled teeth had AP 

41% of the root-filled teeth had AP 

52% of the root-filled teeth had AP 

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**REVIEW**  
**The global prevalence of apical periodontitis: a systematic review and meta-analysis**

Tiburcio-Machado, C. S. ET AL. INT ENDOD J. 2021 MAY;54(5):712-735.

**93 STUDIES INCLUDED**  
**about root filled teeth**  
**39% are associated with a lesion**


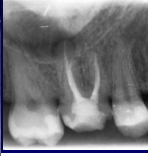


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**•How to explain the discrepancy ?**

- Cross sectional vs. Outcome study with follow-up
- Do outcome studies correctly reflect the situation?
- How long ago was the treatment done ?
- Healing of the lesion but not (yet) full recovery
- Apical scar tissue
- Quality of the treatment

LAUKKANEN ET AL. ACTA ODONTOL SCAND . 2021

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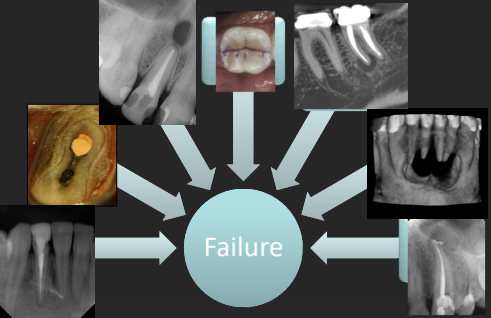
**Why do root canal treatments fail?**

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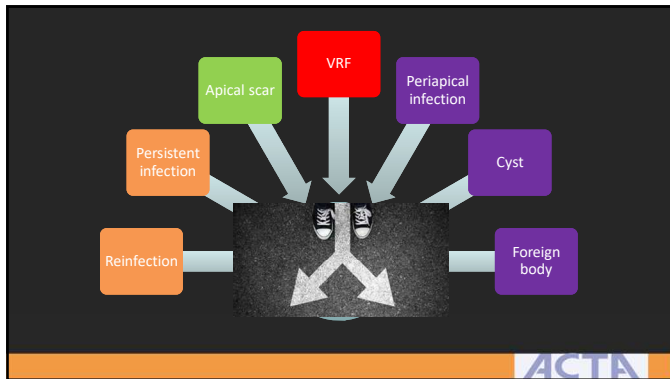
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**Failure**



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## How to manage failure of a root canal treatment?

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- Monitor
- Retreatment
- Surgical endodontics
- Combination
- Extraction

Reit C, Gröndahl HG. Swed Dent J. 1984;8(1):1-7.

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## ● Monitor

- When there are no complaints (of symptoms...?)
- When the treatment was recently (<4 years?)
- When we see no difference compared to older radiographs

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## ● Monitor

- When there is no clear diagnosis
- When there is no restorative plan
- When there are no systemic risks

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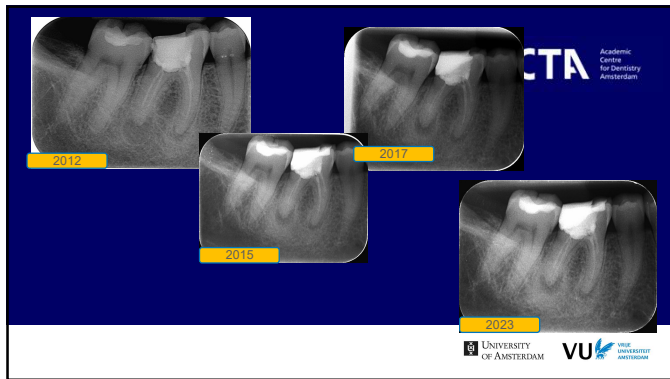
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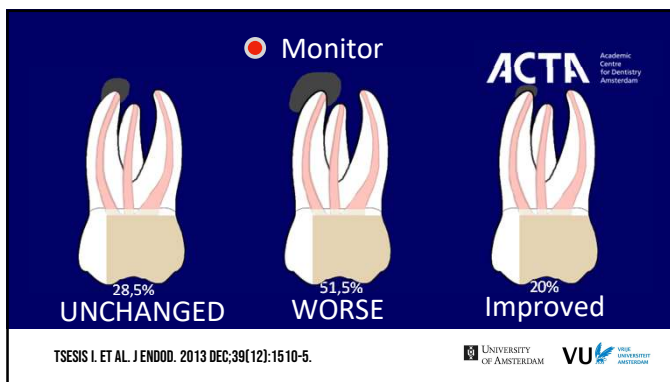




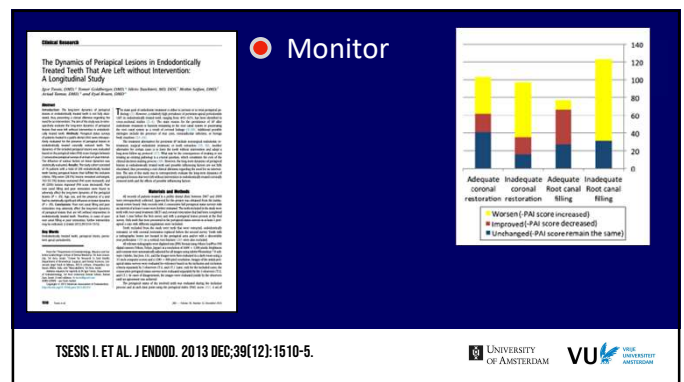
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### Monitor- recommendations

- Set baseline !
- Clinical checkups + radiographs
- Old radiographs ?
- Inform the patient, also risks of flareups
- Monitoring a BAD root canal treatment ↓↓↓
- Systemic implications ±

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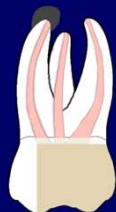
### How to manage failure of a root canal treatment?

- Monitor
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**RETREATMENT** ACTA Academic Centre for Dentistry Amsterdam



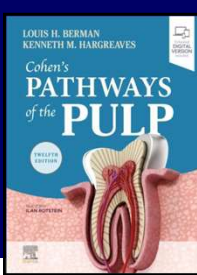
**SUCCESS RATE**  
78,04% - 86,38%

SABETI, M. ET AL. J ENDOD. 2024 APR;50(4):414-433.

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**RETREATMENT** ACTA Academic Centre for Dentistry Amsterdam



**NONSURGICAL ENDODONTIC RETREATMENT**

The primary difference between nonsurgical management of primary endodontic disease and that of posttreatment disease is the need to regain access to the apical area of the root canal space in the previously treated tooth. After that, all of the principles of endodontic therapy apply to the completion of the retreatment case. Coronal access needs to be completed, all previous root-filling materials need to be removed, canal obstructions must be managed, and impediments to achieving full working length must be overcome. Only then can cleaning

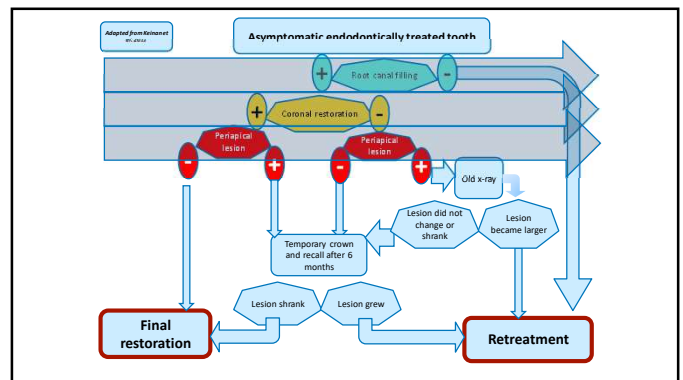
COHEN'S PATHWAYS OF THE PULP (12TH ED.). ST. LOUIS, MO

UNIVERSITY OF AMSTERDAM VU

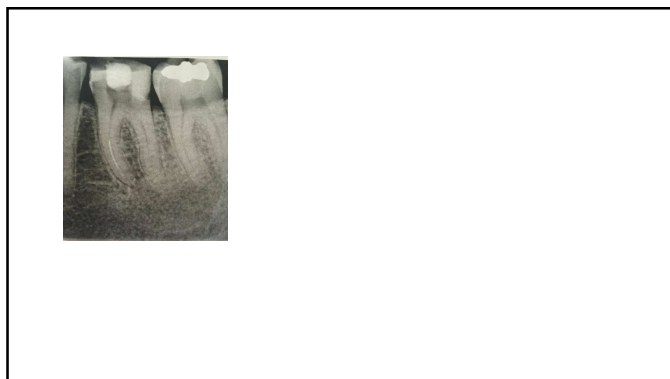
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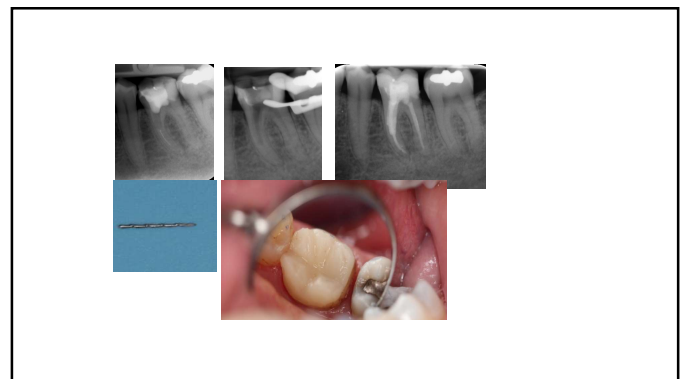
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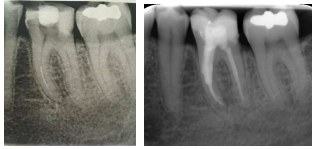
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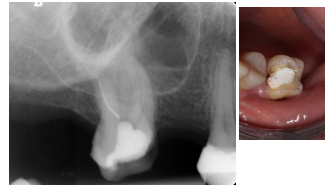
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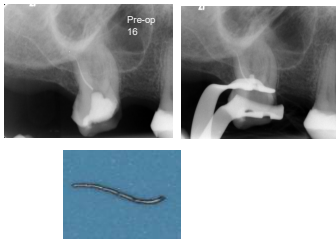
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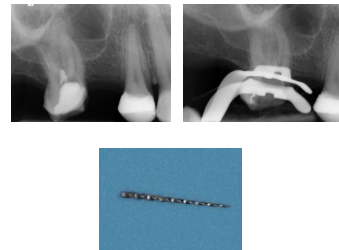
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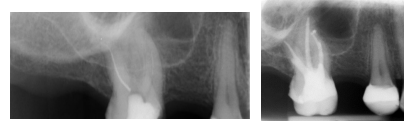
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## How to manage failure of a root canal treatment?

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Reit C, Gröndahl HG. Swed Dent J. 1984;8(1):1-7.

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## Verwijzing naar de endodontoloog

- Verwijsbrief, foto's incl. oude foto's indien beschikbaar
- Behandelplan
- Wat is er met de patient besproken? (verwachting, prognose, alternatieven...)
- Wat is reeds uitgevoerd?
- Relevante medische/ tandheelkunde voorgeschiedenis

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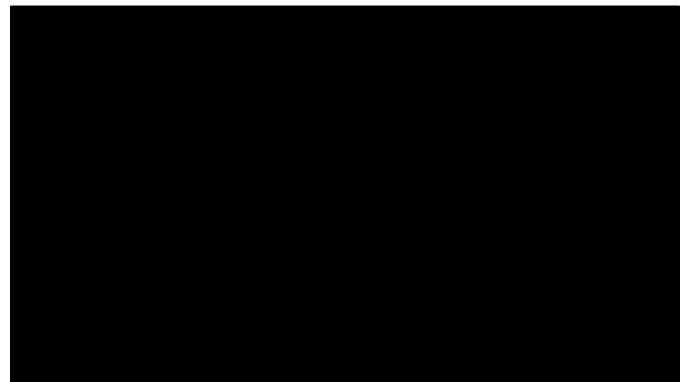
## Take HOME message

Quality? Leakage? Missed anatomy? **ACTA** Academic Centre for Dentistry Amsterdam  
CBCT?

- When you suspect a failed RCT always think first about the possible reason
- Can this reason be addressed by a retreatment?
- Can I improve the situation? Can I preform the treatment?
- Always pose 4 options to the patient : Do nothing, Extraction, Retreatment, surgery

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