

Case Mr Thompson

A radiolucency at the root tip,
Treat or not?

Mr Thompson

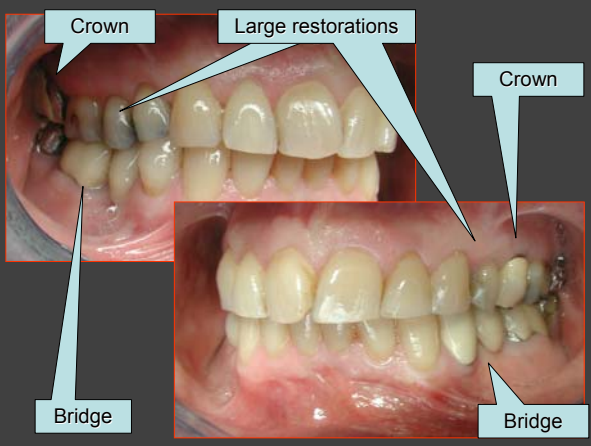
- 51 years; moved recently and presents himself as a new patient in your practice
- He has been regularly seen and treated for 25 years by his previous dentist
- This dentist has extensively restored his dentition 20 years ago; that time a lot of fixed prosthetics was made.
- 'It has cost me a fortune', but otherwise I would- he thinks - have lost all my teeth

Mr Thompson

- **REQUEST:** he has no specific complaints; he wants to keep his teeth still for a long period of time and expects that you will do everything to make that happen.
- Medical history gives nothing special
- He is a university teacher



Dorsal area shows gum bleeding on probing





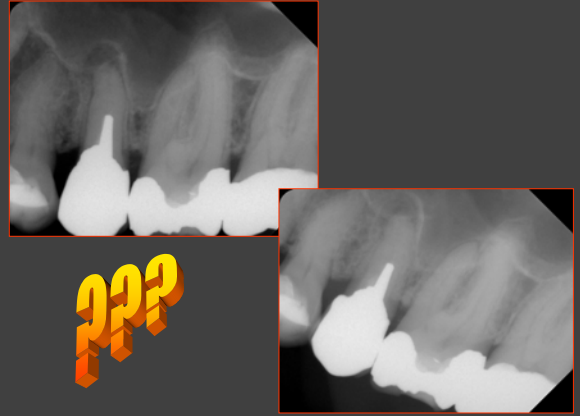
Clinical examination

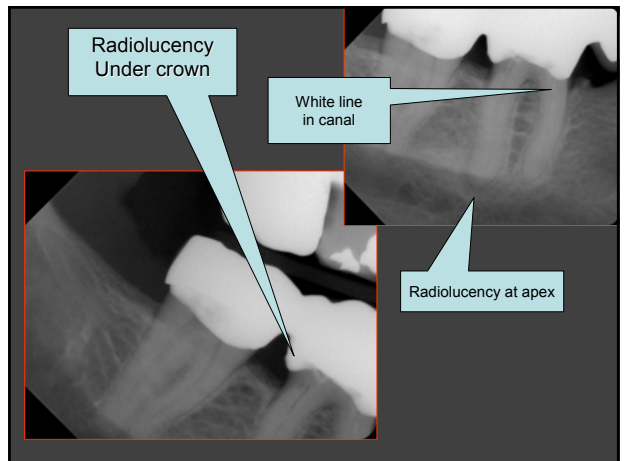
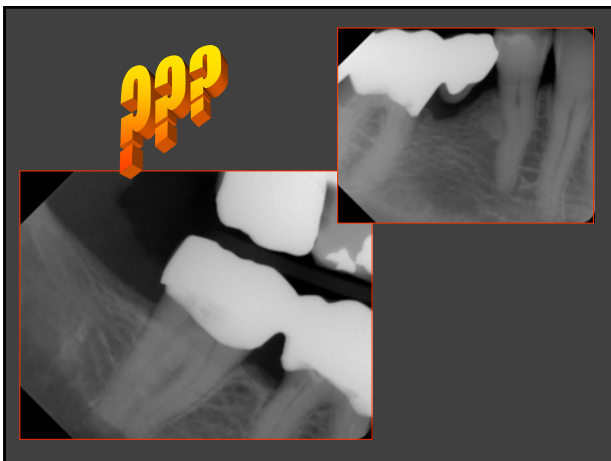
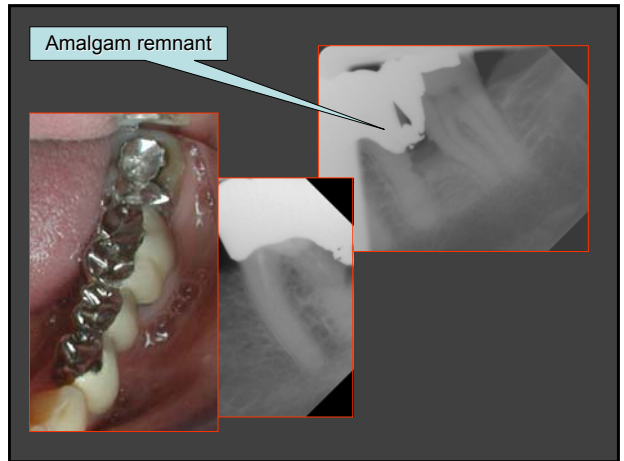
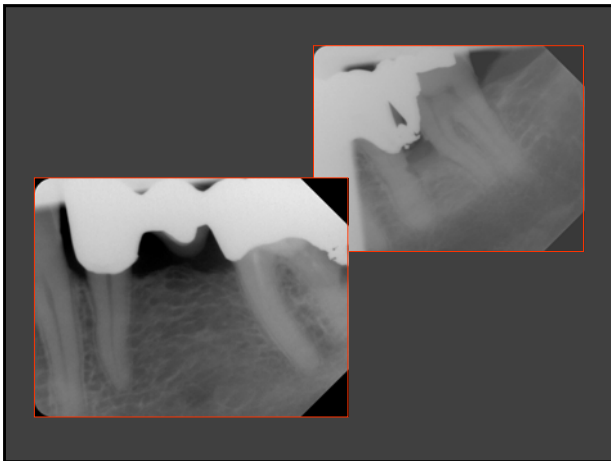
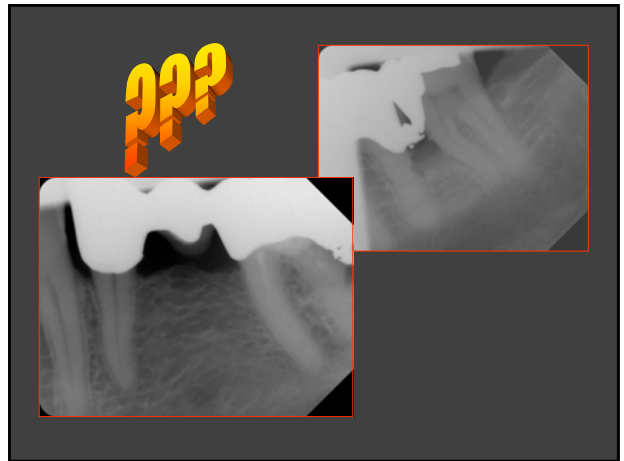
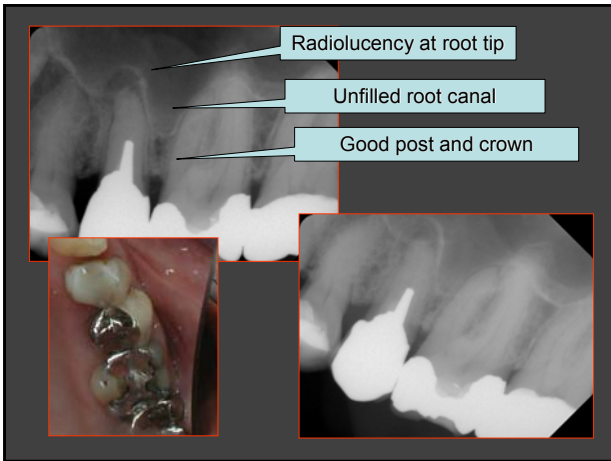
- Periodontal
 - Local plaque
 - Dorsal gum is bleeding on probing
 - DPSI-scores: front 2, sextant LL 4, others 3-
 - Between 36 and 37 'suspicious'
- Cariologic
 - Large fillings
 - No lesions
- Functional
 - Crown 17 and 25, bridges lower left and right, porcelain at surfaces had disappeared

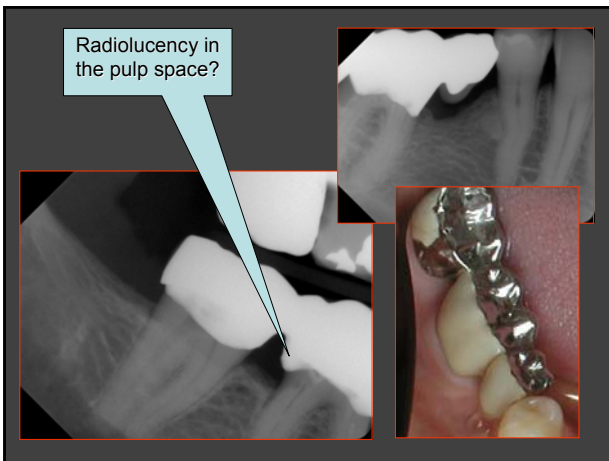
Radiologic examination



poor margin







Treatment options

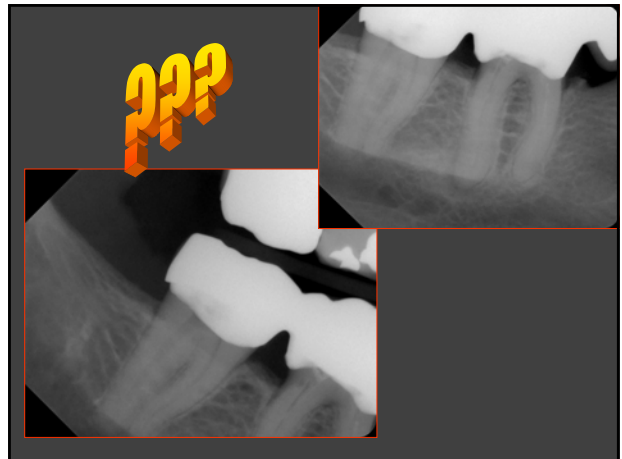
- Extraction
- Removal post and core and crown and root canal treatment
- Surgical root resection with retrograde filling
- Wishful waiting (monitoring)

Possible solutions

- **Reasons to do nothing**
 - It is there already 20 years!
 - Crown and post are good
- **Reasons to do something.**
 - You do not leave radiolucencies untreated, since
 - they may flare up and cause pain
 - they are damaging for the host system – eg. atherosclerosis and endocarditis (C-reactive proteins)

On which ground should a certain strategy be chosen:

- Prognosis of treatment
- Consequences of untreated disease
- Position of the tooth
- Risk of complications of therapy
- Access to the root canal
- Quality of original treatment
- Economic costs
- Personal values



“Since prevention and elimination of disease is the benchmark of health professions and since apical periodontitis is the disease unique to endodontics, it is logical to define clinical endodontics as the prevention and/or elimination of apical periodontitis.”

Trope M: Endodontic Topics 2003;5:1-11

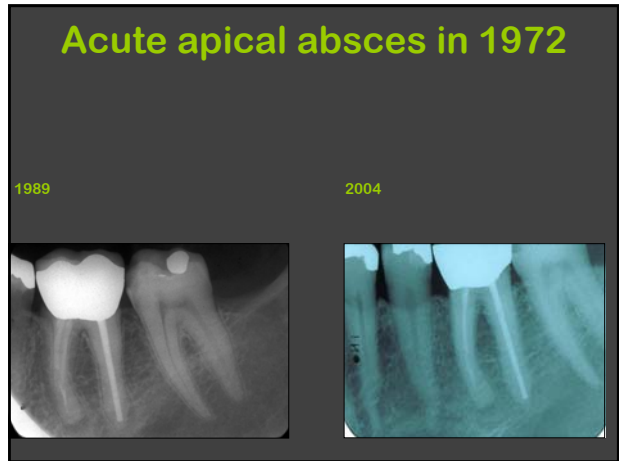
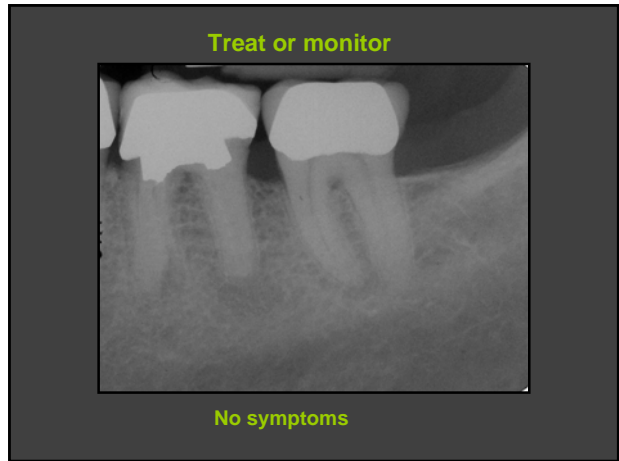
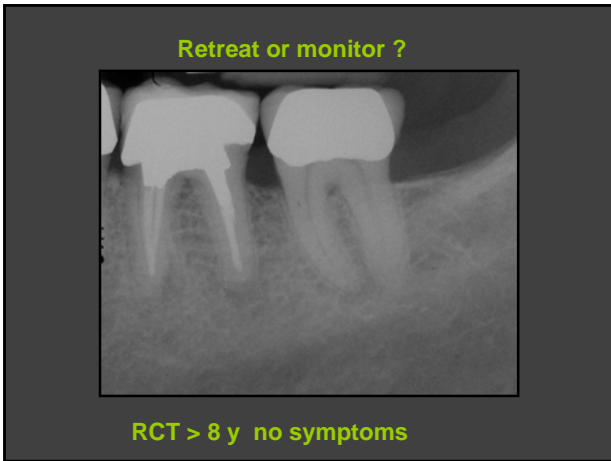
Ørstavik & Pitt Ford ed. *Essential Endodontology* 1998
Friedman S. *Endod Top* 2002
Trope M. *Endod Top* 2003

Clinical endodontics is defined as the prevention and/or elimination of apical periodontitis.

World health organisation

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity

Do we accept persistence of asymptomatic apical periodontitis as the consequence of successful endodontic treatment?



Desirable outcomes

1. Asymptomatic
2. Infection eliminated
3. Bone defects repaired
4. Safe for general health

Desirable outcomes

1. Asymptomatic
2. Infection eliminated
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4. Safe for general health

Symptoms and function

97% of 1.4 million teeth were functional in the oral cavity 8 years following non-surgical root canal treatment (Salehrabi & Rotstein *JOE* 30:846-50, 2004)

COMMUNIQUE
AUGUST/SEPTEMBER 2005

AAE and Foundation Approve Definition of Endodontic Outcomes

There has been little agreement within the scientific community about what constitutes endodontic success. Throughout the years, endodontists have used a number of terms and criteria to determine the outcome of root canal treatment. Clinical and/or radiographic indices, the periapical index or a combination of these are examples of the various benchmarks. Recently the AAE took a significant step toward creating greater uniformity. At its annual meeting in Dallas, the AAE Board of Directors approved new definitions of endodontic outcomes.

The definition is the product of several years of work and deliberation from a number of groups within the Association.

The definitions are constructed on the premise that the commonly used terms of "success" and "failure" are too vague. Success or failure can be attributed to a variety of factors. On the other hand, terms such as "healed," "nonhealed" and "healing" focus on the tooth, its surrounding structures and the host response. These are also words that patients can understand more easily. Function is one of the primary determinates for successful outcomes as it reflects clinical conditions with or without radiographic evidence of pathosis. Not all cases can be definitively categorized as healed, nonhealed or healing. When the outcome is uncertain, the clinician must use intuition and proper clinical judgment to ascertain the status of the tooth at that

Approved Definitions of Endodontic Outcomes

- **Healed**—Functional, asymptomatic teeth with no or minimal radiographic periradicular pathosis.
- **Nonhealed**—Nonfunctional, symptomatic teeth with or without radiographic periradicular pathosis.
- **Healing**—Teeth with periradicular pathosis, which are asymptomatic and functional, or teeth with or without radiographic periradicular pathosis, which are symptomatic but whose intended function is not altered.

AAE Board Approves Revised Definition of Endodontics

In order to reflect the current practice of its members, the AAE has proposed a revision to the definition of the specialty of endodontics for the first time in over 20 years.

The revision, prepared by an ad hoc committee, was approved by the AAE Board of Directors on February 21, 2005, and submitted to the Council on Dental Education and Licensure of the American Dental Association for review during its meeting in April.

"This is another step in advocating for the advancement of our specialty, and it was time to make this change," said President Sandra Madison, chair of the Ad Hoc Committee to Revise the Definition of Endodontics. "The revised definition encompasses all aspects of endodontics within the profession of dentistry."

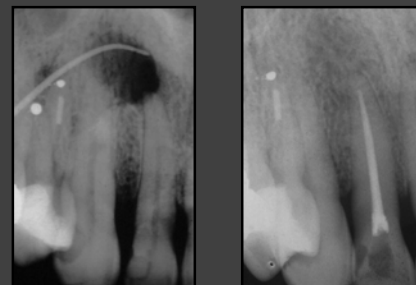
Along with President Madison, the members of the ad hoc committee were M. Lamar Hicks, Alan S. Law and Carl W. Newton. The group collaborated over the last few months to develop the revised definition that was presented to the AAE Board of Directors for final approval before submission to the CDEL.

Following the initial review of the recommended revisions and approval at the CDEL meeting, communities of interest, including the eight other

Current Definition:
Endodontics: that branch of dentistry, which is concerned with the morphology, physiology and pathology of the human dental pulp and periradicular tissues. Its study and practice encompasses the basic clinical sciences including biology of the normal pulp, the etiology, diagnosis, prevention and treatment of diseases and injuries of the pulp and associated periradicular conditions.

Revised Definition Submitted to the Council on Dental Education and Licensure:
Endodontics: Endodontics is the dental specialty pertaining to the biology, pathology and regeneration of the human dental complex and periradicular tissues. Its study and practice encompasses the biological and clinical sciences related to the normal and diseased dental pulp and associated periradicular tissues, as well as the etiology, diagnosis, prevention and treatment of pathoses and injuries of these tissues. Endodontics emphasizes the preservation of the healthy, natural dentition to promote the highest quality of life.

If asymptomatic inflammation remaining after endodontic treatment is considered as acceptable then what is the logic of treating asymptomatic lesions associated with teeth that have not received endodontic treatment?



So why bother with this?

Desirable outcomes

1. Asymptomatic
2. Infection eliminated
3. Bone defects repaired
4. Safe for general health

Elimination of canal infection

Ca(OH) ₂ 1 mon (Byström et al. 1985)	sampling (-) 100%
RF teeth with lesions (Molander et al. 1998)	sampling (+) 73%
RF teeth without lesions (Molander et al. 1998)	sampling (+) 45%
RF teeth with lesions (Nair et al. 2005)	histology (+) 88%

Current procedures are not effective to reduce root infection to that level.

Restrained root infection



Bergenholtz & Spångberg Critical Rev Oral Biol Med 15, 99-114 2004
Controversies in endodontics

Microbiological status of **120**
root filled teeth (Molander et al. Int Endod J
1998)

Bacteria were found in
77 (64%) main canals.

In many “successful” cases:

Absence of radiolucency
and

persistence of
inflammation.

Bacteria:

- 68% of filled canals associated with radiographic periodontitis.
- 45% of filled canals without radiographic periodontitis.

(Molander et al, Int Endod J, 1998)

Sampling in ramifications, isthmuses not possible.
Planktonic bacteria probably easier to detect than bacteria enclosed in biofilms.

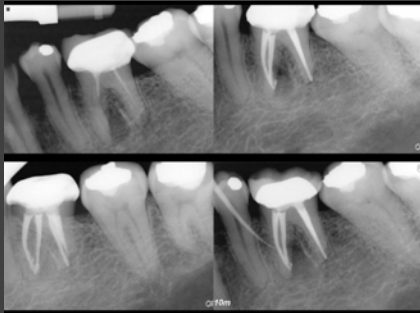
The follow-up period for 22 roots:

Average: 5 years 4 months

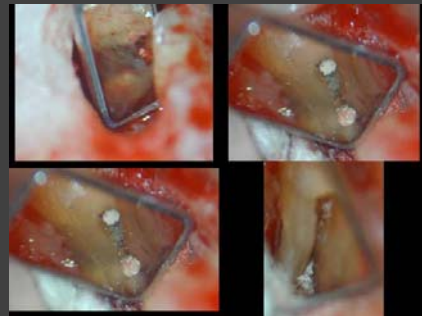
Minimum: 3 years

Maximum: 10 years 8 months

Ricucci & Langeland. Int Endod J 1998



Thanks to roots and Dr S Nallapati



RCT procedures

Using rubber dam.

Disinfect the field: 30% H₂O₂ and 5% iodine.

Irrigation: copious 1% NaOCl.

Obturation: LC with GP and Pulp Canal Sealer.

In 18 of the 22 roots, the canal was filled to 0-2 mm from the apex.

Treatment result of 22 roots:

Free of apical radiolucency: 18 (82%)

Free of apical periodontitis: 3 (14%)

Seltzer et al. Oral surg 1964

Holland. J Dent Res 1992

Katebzadeh et al. J Endod 1999

In the ferret and dog, the most apical portion of the root canal consists of a delta of many small canals that were neither cleaned nor filled by the technique used.

Poor healing (6-12 mon)

“One week after tooth extraction, no inflammatory cells were present.”

Holland GR. J Dent Res 1992

Desirable outcomes

1. Asymptomatic
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Apical healing

On radiographs: 90%

(Ørstavik et al. *Euro J Oral Sci* 2004)

On radiographs: 50%

(Caplan DJ. *Endod Top* 2004)

Histology/cadaver: 7-49%

(Brynolf I. 1967, Green et al. 1997, Barthel et al. 2004)

Histology/biopsy (≥ 3yr): 14%

(Ricucci & Langeland *Int Endod J* 1998)

Percentage of RF teeth with radiolucency

Country	Year	Percentage
Norway	1991	44%
U.K.	1997	52%
Germany	1997	61%
Belgium	2000	40%
Denmark	2001	52%
Canada	2003	44%
Spain	2004	65%

Percentage of RF teeth with radiolucency

Country	Year	Percentage
Netherl.	1993	39%
U.K.	1997	52%
Germany	1997	61%
Belgium	2000	40%
Denmark	2001	52%
Canada	2003	44%
Spain	2004	65%

ACTA	2004	1993
	%	%
Endo beh	5.3	2.3
Endo + AP	48.8	39.2
AP- Endo	6.6	5.2
Kroon+ AP	20.3	
Kroon+ PDL>	15.9	2.5
Plast.+ AP	7.2	3.6
Plast + PDL>	7.1	3.1

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Radiographs

The absence of apical radiolucency does not guarantee the absence of bone involvement.

(Bender & Seltzer 1961, van der Stelt 1985)

Cortex must be involved

Location of radiolucency

False-negative diagnosis: ± 40%

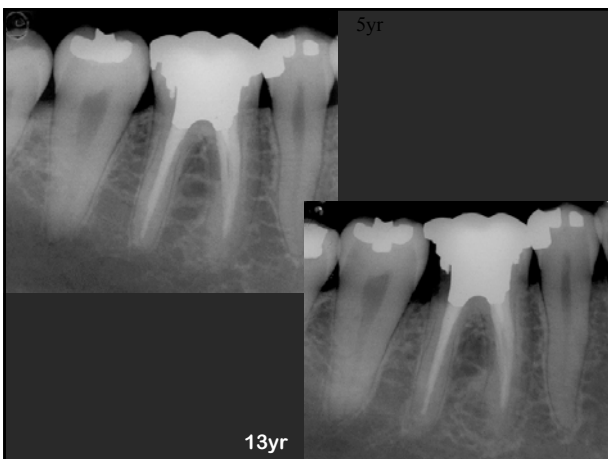
Positive predictive value of radiolucency 100%

Negative predictive value of radiolucency

Brynnolf 1967 53%

Rowe & Binnie 1974 55%

Barthel et al. 2004 67%



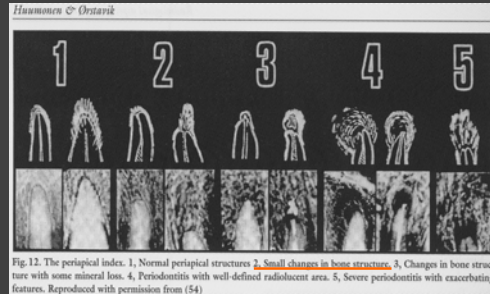
Ricucci

Ørstavik et al. (Eur J Oral Sci 2004)
Success rate: 90%

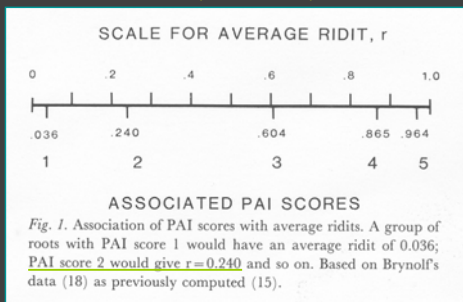
Negative predictive value of radiolucency:
60%

90% x 60% = 54%

Radiographic assessment (scores 1-5):
no radiolucency to bad radiolucency
(Brynolf 1967, Ørstavik et al. 1987)



Histological inflammatory status
from no inflammation to severe
inflammation (r: 0-1.0)



Ørstavik et al. Endod Dent Traumatol 1987;3:178-186

	Diminished recall rate	PAI=1
0 year	100%	42%
1 year	67%	45%
2 year	61%	56%
3 year	56%	62%
4 year	36%	65%

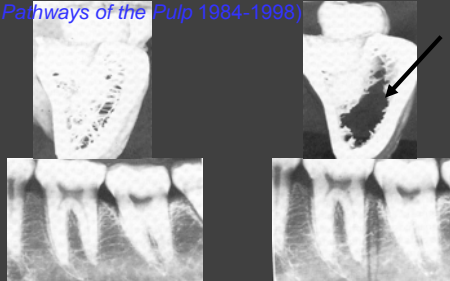
Ørstavik. Int Endod J 1996;29:150-155

	Diminished recall rate	PAI=1+2
0 year	100%	79%
1 year	68%	83%
2 year	63%	89%
3 year	59%	92%
4 year	☹37%☹	☺94%☺

Ørstavik et al. Endod Dent Traumatol 1987; 3:178-186.
Ørstavik et al. Int Endod J 1991; 24:1-7.
Ørstavik & Hörsted-Bindslev. Int Endod J 1993; 26:348-354.
Trope et al. J Endod 1999; 25:345-350.
Waltimo et al. OOOO 2001; 92:89-92.
Haumonen et al. Int Endod J 2003; 36:296-301
Friedman et al. J Endod 2003; 29:787-793
Ørstavik et al. Eur J Oral Sci 2004; 112:224-230.

Before and after creating a large defect in cancellous bone

(Pathways of the Pulp 1984-1998)



Recall rate: 36%

Success rate in a well-controlled 4-yr longitudinal study using PAI

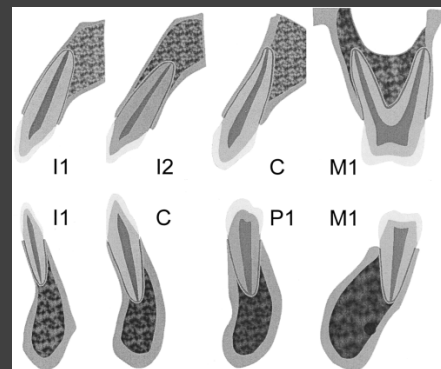
> 90%

Ørstavik et al. *Endod Dent Traumatol* 1987;3:178-186

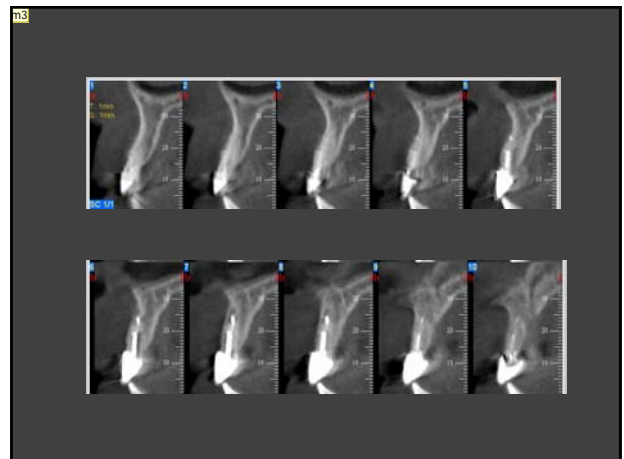
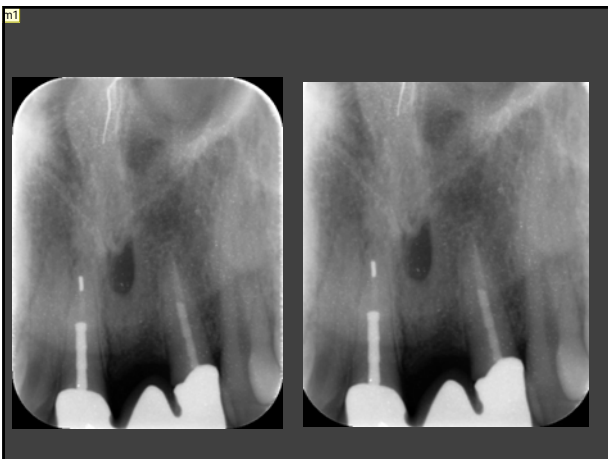
PAI index is based on the study of Ingrid Brynolf *Odont Rev* 18 suppl 11, 1967

A histological and roentgenographical study of the periapical region of

Human upper incisors



Huomonen and Ørstavik *Endod Topics* 2002;1; 3-25



Dia 77

m1

Foto links is niet bijgesneden, rechts wel
mvogels; 22-6-2006

Dia 78

m3

Dit zijn bijgesneden gedeeltes uit originele scan van vorige slide.
mvogels; 22-6-2006

Ørstavik et al. Clinical performance of three endodontic sealers.
Endod Dent Traumatol 1987;3:178-186

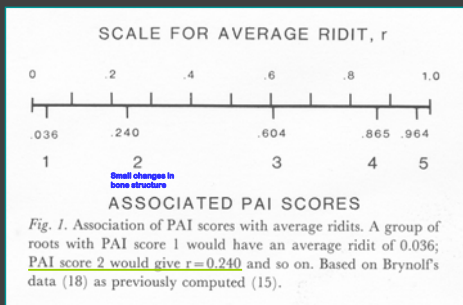
Success rate (AH26) at year 4

PAI=1 62%
 PAI=2 33%
 PAI=1+2 95%

“Following successful root canal treatment clinical symptoms originating from an endodontically induced apical periodontitis should neither persist nor develop and the contours of the periodontal ligament space around the root should radiographically be normal.”

European Society of Endodontology (ESE) 1994

Score 2 ≠ Success!



Ørstavik et al. Clinical performance of three endodontic sealers. *Endod Dent Traumatol* 1987;3:178-186

Success rate at year 4 (AH26)

PAI=1 62%
 PAI=2 33%
 PAI=1 + PAI=2 95%

Recall rate: 36%

Recall rate: 83%

Success rate in a university longitudinal study using PAI

90%

Ørstavik et al. A Multivariate analysis of the outcome of endodontic treatment.
Eur J Oral Sci 2004; 112:224-230

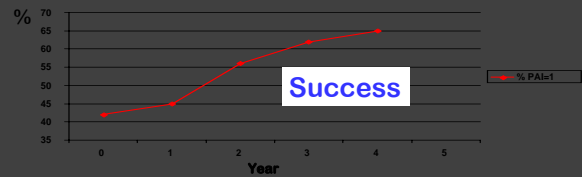
Ørstavik et al. *Eur J Oral Sci* 2004; 112:224-230
 79% or 26%?

Type of cases	Per cent values			Number of roots
	PAI=1 Success	PAI=2 Success or failure?	PAI≥3 Failure	
All	58%	32%	10%	675
Non-AP	70%	24%	6%	483 (72%)
AP	26%	53%	21%	192 (28%)

Comparison of success rate for AP cases in two longitudinal university studies

Study	N	Recall Rate	Treatment Quality	Criteria Success	Success Rate
Sjögren et al. <i>J Endod</i> 1990;16:498 Sweden	204	46%	0.5% NaOCl Ca(OH) ₂ LC, no sealer Root filling 0-2 mm to apex: 60%	Include teeth with periodontal contours widened around excess of material	86%
Ørstavik et al. <i>Eur J Oral Sci</i> 2004;112:224 Norway	192	83%	0.5% NaOCl Ca(OH) ₂ LC, with sealer	PAI=1:	26%
				PAI=1+2	79%

Ørstavik et al. *Endod Dent Traumatol* 1987;3:178-186



Cheung & Chan *Int Endod J* 2003;36:117-28

Desirable outcomes

1. Asymptomatic
2. Infection eliminated
3. Bone defects repaired
4. Safe for general health

Risk of untreated disease

The incidence of exacerbations per year is less than 5 %???

(Erikson H., *Essential Endodontology*, 1998)

Potential systemic effects of endodontic post-treatment disease

Coronal heart disease
Adverse pregnancy outcomes

CRP = C-reactive protein
Inflammation marker in blood

Ridker et al. *New Eng J Med* 1997;336:973-9

CRP < 0.5 mg/L
No heart attack

CRP 1-3 mg/L: a risk factor for coronal heart disease

Fredriksson et al. *J Periodontol* 1999;70:1355-60
Periodontitis patients: CRP=2mg/L
Without periodontitis: CRP=0mg/L

Loos et al. *J Periodontol* 2000;70:1528-34
Periodontitis results in higher CRP (p=0.030) and Interleukin-6 (p=0.015), potentially increase the risk of CHD.

Buttke TM, Shipper G, Delano EO, Trope M. *JOE* 2005

Chronic apical periodontitis is not associated with elevated CRP in dogs.

Total burden of dental infection (Total Dental Index)

Cariou lesions

Periodontitis

Apical periodontitis

(Oral infection includes diseases of mucous membrane.)

Mattila et al. *J Dent Res* 2000;79:756-60.

The risk of coronal heart disease increases in individuals with high Total Dental Index.

Mattila et al. *J Dent Res* 2000;79:756-60

The severity of dental infections correlates with the severity of coronal heart disease.

Total Dental Index was significantly associated with CHD.

Mattila et al. *BMJ* 1989;298:779-81
Mattila et al. *Atherosclerosis* 1993;103:205-11
Mattila KJ. *Eur Heart J* 1993;14:51-3
Mattila et al. *Clin Infect Dis* 1995;20:588-92
Mattila et al. *J Dent Res* 2000;79:756-60

Tooth loss was significantly associated with CHD.

DeStefano et al. *BMJ* 1993;306:688-91
Joshipura et al. *J Dent Res* 1996;75:1631-6
Frisk et al. *Acta Odontol Scand* 2003;61:257-62
Hung et al. *J Public Health Dent* 2004;64:209-15

Tooth Loss

Periodontitis

Apical periodontitis

Important findings during the last 15 years:

Total Dental Index was significantly associated with CHD.

Tooth loss was significantly associated with CHD.

Periodontitis results in higher CRP, potentially increases the risk of CHD.

Whether the risk of coronal heart disease increases in individuals with apical periodontitis?

Whether the risk of coronal heart disease decreases after successful root canal treatment?

Caplan et al. IADR Abstract 2004

Links between apical periodontitis and coronal heart disease

During a maximum follow-up of 32 y with 708 males, lesions of endodontic origin among those < 40y old were statistically significant, associated with CHD after controlling for baseline values of education, income, total cholesterol, triglycerides, diabetes, hypertension and smoking.

Frisk et al. *Acta Odontol Scand* 2003;61:257-62

Endodontic variables and coronary heart disease

Frisk et al. *Acta Odontol Scand* 2003;61:257-62

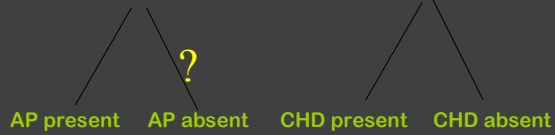
Age, tooth loss and individuals with 2 root-filled teeth were significantly associated with coronary heart disease.

The logistic regression analysis did not support an association between periapical radiolucency and coronary heart disease.

Failing to show the link between AP and CHD does not prove its absence.

Absence of radiolucency \neq Absence of AP

All individuals



The category “AP absent” contains many cases with radiographically non-detectable AP.

Root canal infection as a systemic health hazard has been debated over the years, however controlled clinical studies are rare and most authors judge the risk for the **medical uncompromised** individual as low.

(Debellian G.J. et al., 1994; Murray C.A. et al., 2000)

Whether persistence of apical periodontitis will harm the general health?

Still no final conclusion can be made.

Possible solutions



Compromised outcomes:

Coexistence of post-treatment root infection, post-treatment periapical inflammation, and life of highest quality.

Aristotle

Phronesis: practical wisdom

The ability to think about ‘practical matters’
To do the ‘right thing at the right moment’

Practical wisdom: combination of understanding and experience and the ability to read individual situations

On which ground should a certain strategy be chosen:

- Prognosis of treatment
- Consequences of untreated disease
- Position of the tooth
- Risk of complications of therapy
- Access to the root canal
- Quality of original treatment
- Economic costs
- Personal values

Knowledge is power, and it's time to equip our patients with the information they need to make rational, informed decisions about their dental care.

Patient

- As important professional knowledge and skill might be, it must be emphasized that the final decision is in the hand of the **INFORMED** patient. (Reit, Textbook of Endodontology, 2004)
- Remember that the patient is the expert on which symptoms are tolerable, which economic costs are acceptable and which risks are worth taking. (Reit, Textbook of Endodontology, 2004)

Informed choice



The End