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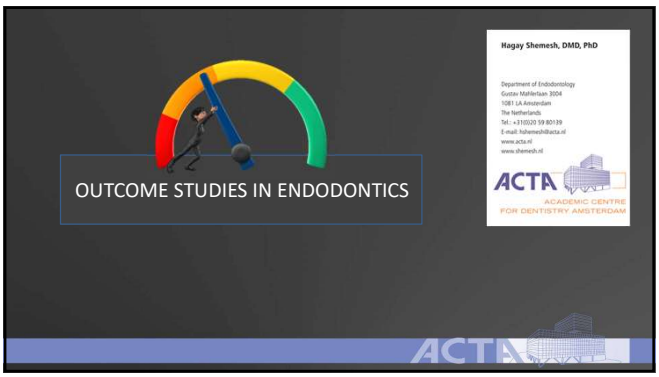
OUTCOME STUDIES IN ENDODONTICS
Hagay Shemesh, DMD, PhD
ACTA
ACADEMIC CENTRE FOR DENTISTRY AMSTERDAM

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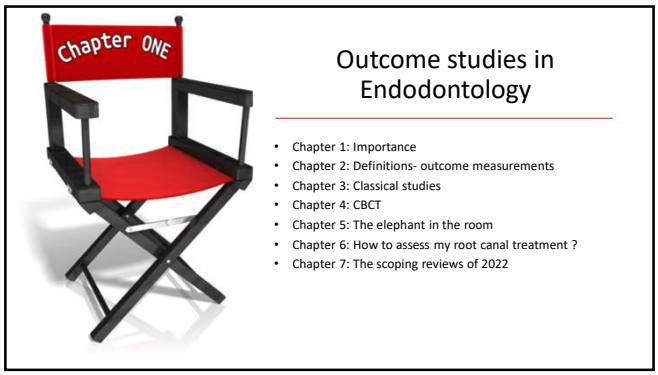
Chapter ONE
Outcome studies in Endodontology
Chapter 1: Importance
Chapter 2: Definitions- outcome measurements
Chapter 3: Classical studies
Chapter 4: CBCT
Chapter 5: The elephant in the room
Chapter 6: How to assess my root canal treatment ?
Chapter 7: The scoping reviews of 2022

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Chapter ONE
Importance

4


CONNECTING PERSPECTIVES
Research priorities for oral healthcare: agenda setting from the practioners' perspective.
P. v/d Wouden, May 2022
Acta Odontol Scand. 2021: Wouden, Shemesh, Heijden

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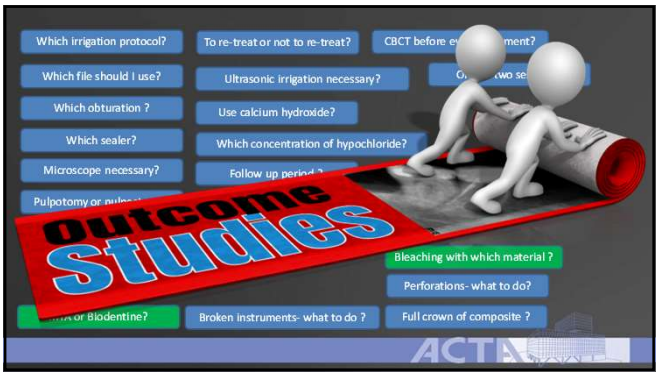
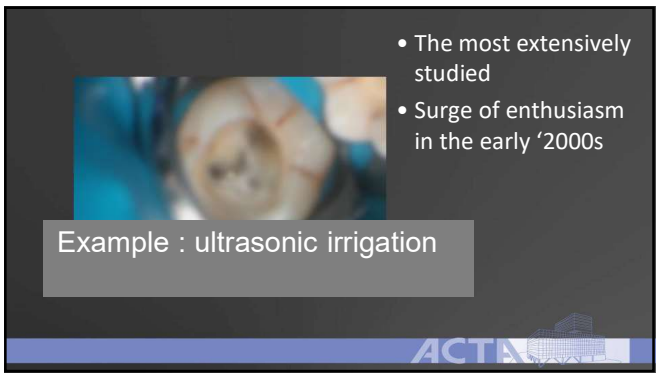

Which irrigation protocol?
To re-treat or not to re-treat?
Which file should I use?
Ultrasonic irrigation necessary?
Which obturation ?
Use calcium hydroxide?
Which sealer?
Which concentration of hypochloride?
Microscope necessary?
Outcome Studies
Bleaching with which material ?
Perforations- what to do?
Broken instruments- what to do ?
Full crown of composite ?

6



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Radiographic healing after a root canal treatment performed in single-rooted teeth with and without ultrasonic activation of the irrigant: a randomized controlled trial

Root canal treatments with and without additional ultrasonic activation of the irrigant contributed equally to periapical healing.

JOE 2013 : Liang et al.

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JOE 2019 : Căpută et al.

" …no strong clinical recommendations could be formulated"

BDJ 2019 : Silva et al.

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

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Importance:

- Outcome studies are the only reliable way to check the influence of different treatment modalities/ materials/ instruments on the aims of the treatment

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- General terms

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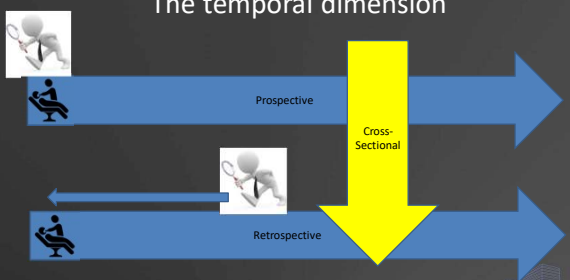
The temporal dimension



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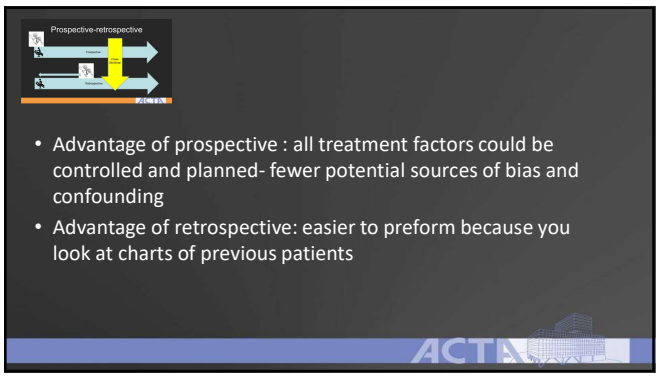

- Advantage of prospective : all treatment factors could be controlled and planned- fewer potential sources of bias and confounding
- Advantage of retrospective: easier to preform because you look at charts of previous patients

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End point and surrogate end point

End point

Healing of the periapical lesion

Tomorrow 10:00 Dr. Sascha Herbst: AI

14

Outcome was mostly determined by radiographs.

Tomorrow 09:00 Prof. Torsten E. Reichert: Radiology in Endodontology

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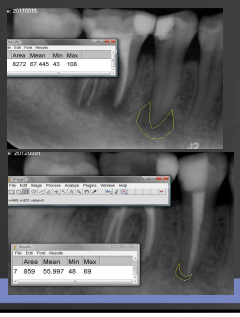
How do we measure/ determine healing?



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

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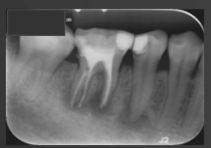
Qualitative assessment

- 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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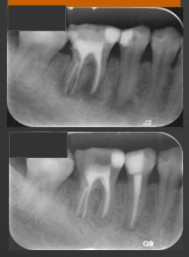
Qualitative assessment (strict criteria)



Advantage

Quick & cheap

Clinically relevant

Disadvantage

Subjective

No meaning to “ shrinkage”

CBCT

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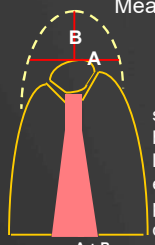
Measurement of periapical lesions



size of each lesion was calculated by taking the average of the lesion's largest dimension and its extent in the direction perpendicular to the largest dimension.

$$\text{Size} = \frac{A + B}{2}$$

JOE 1990 : Sjogren et al.

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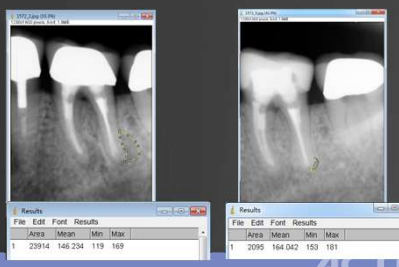
Measurement of periapical lesions



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Simple measurements

Advantage	Disadvantage
cheap	Inaccurate
Quantitative	Time consuming
	Standardization of the radiographs

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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

IEJ 1983 : Reit & Gröndahl

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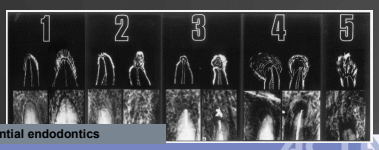
PAI Score

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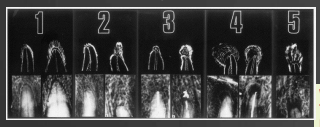
- In order to evaluate periapical section according to the PAI score, you have to compare periapical radiographs with a set of 5 radiographic images derived from Brynolf's histological-radiographic correlation study



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

PhD thesis 1967 : Brynolf

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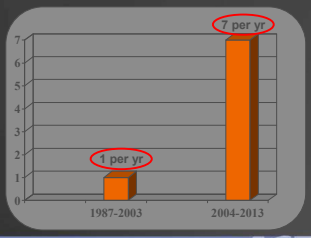
PAI has been used in more than 70 outcome studies since 1987



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PAI score

Advantage

Disadvantage

Uniform

Easy to do

Maxillary incisors

Radiographs, 2D

Dichotomization

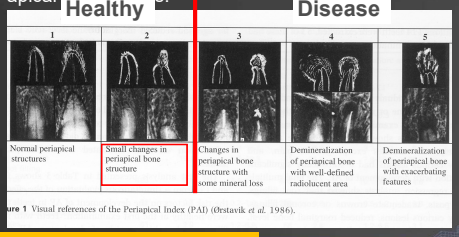
26

"Scores 2 to 5 represent increasing extent and severity of apical [illegible]"

Toronto studies 2003-2006
Healed: PAI < 3

Healthy

Disease



Endo Dent Traumat 1986 : Ørstavik et al.

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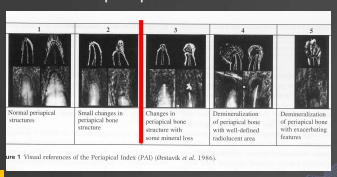
Success=	PAI 1+2	PAI 1
ALL	90	58
NO Pre-op PA	94	70
Pre-op PA	79	26

Eur J Oral Sci 2004 : Ørstavik et al.

28

Prognostic value of the full-scale Periapical Index.

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 …



IEJ 2014 : Kirkevang et al.

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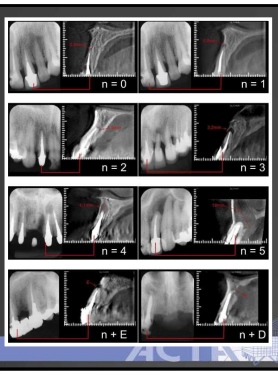
The CBCT-PAI score



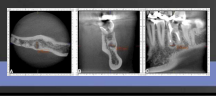
JOE 2008 : Estrella et al.

30

JOE 2008 : Estrella et al.

31

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

32

CBCT-PAI score

Advantage

Disadvantage

Time consuming

Based on ALL teeth

Artefacts like metal posts

All directions

Difficult to do

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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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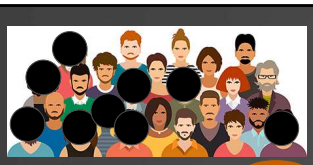

- Cohort 24
- Drop outs 9
- Recall rate- % of cohort patients that came back for recall 62.5%
- Recall rate < 70% decreases the accuracy of the conclusions
- recall rate ↑ accuracy ↑
- Follow-up period ↑ recall rate ↓

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General terms:
- Temporal dimension
- End points
- Assessing the outcome on radiographs
- Outcome measurements
- Basic terms

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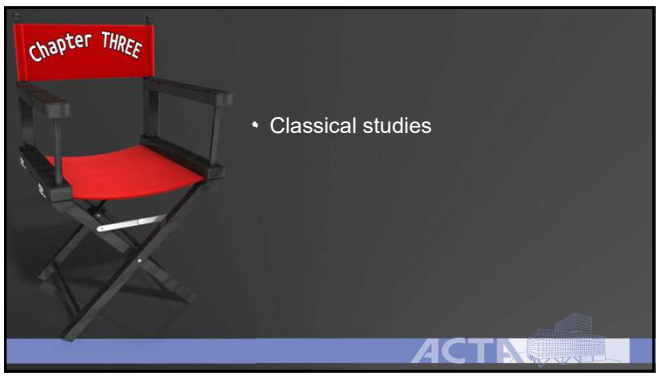

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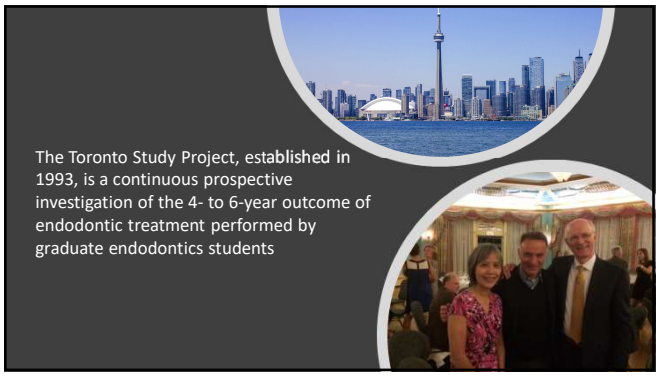

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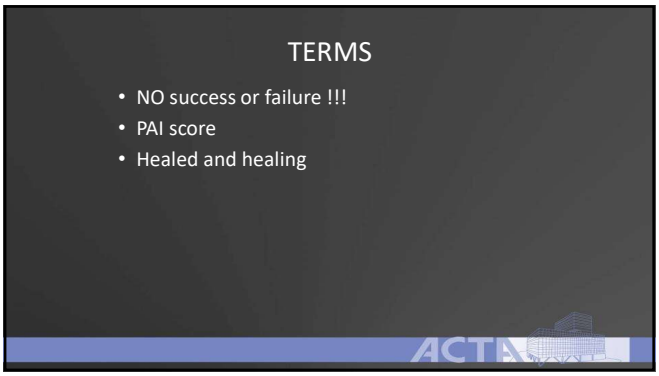

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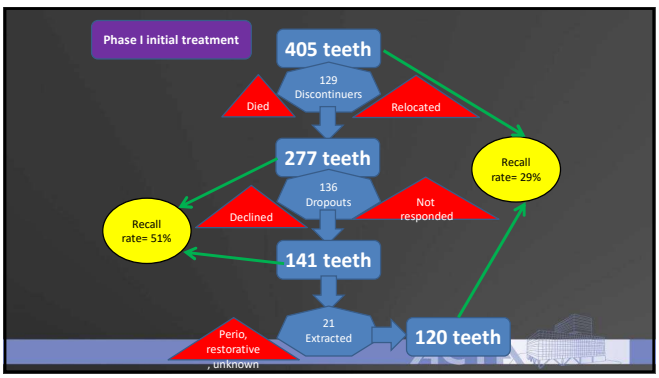

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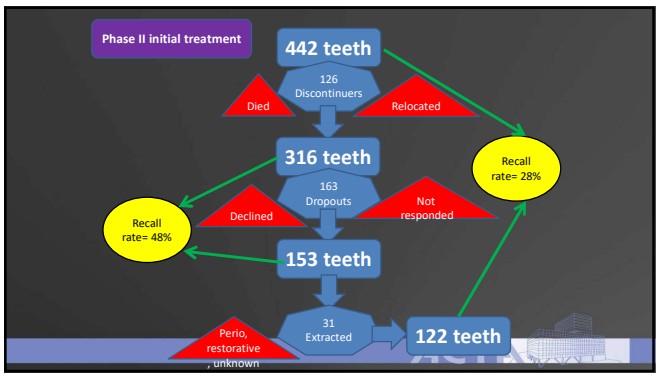

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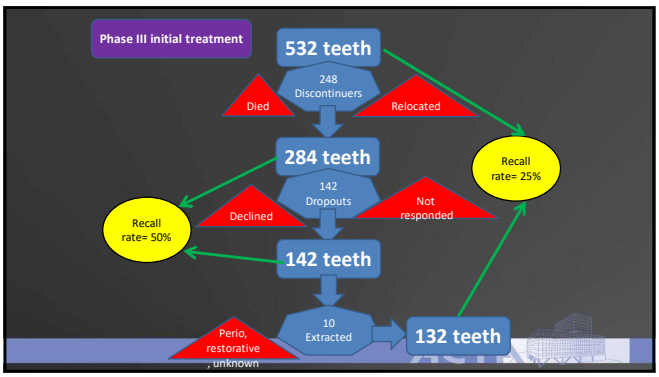

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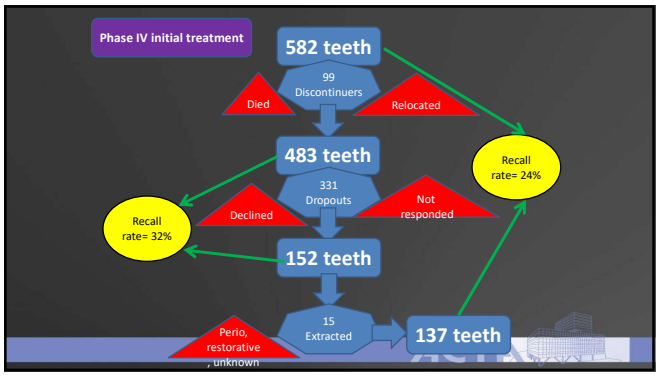

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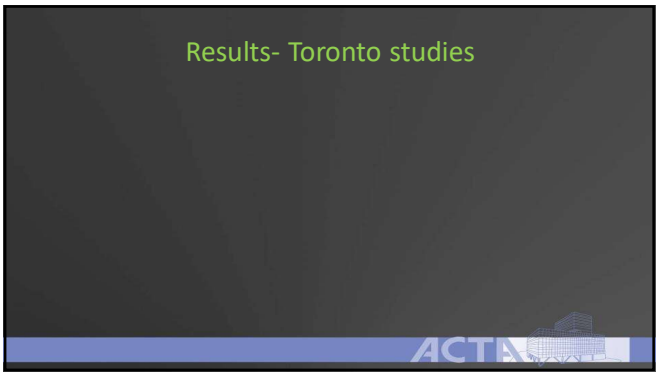

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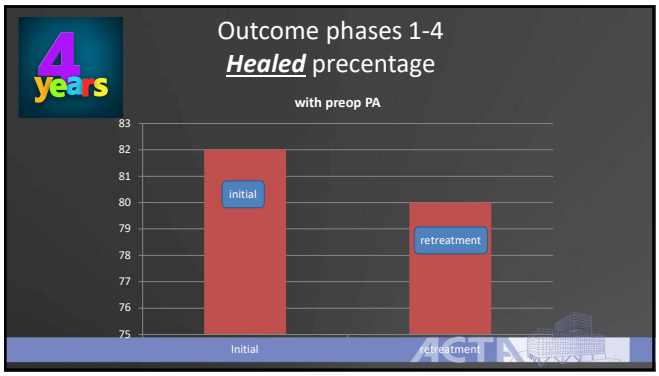

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Ng studies- IEJ

1. "Outcome of primary…part 1 " Ng, Mann, Rahbarab, Lewsey & Gulabivala 2007
2. "Outcome of primary…part 2 " Ng, Mann, Rahbarab, Lewsey & Gulabivala 2007
3. "Outcome of s… Ng, Mann & Gulabivala 2008
4. "Tooth survival…" Ng, Mann & Gulabivala 2010
5. "A prospective study…part 1 "- Ng, Mann & Gulabivala 2011
6. "A prospective study…part 2 "- Ng, Mann & Gulabivala 2011

Reviews

Outcome studies

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A prospective study of the factors affecting outcomes of nonsurgical root canal treatment: part 1: periapical health.

- The goal was to identify the prognostic factors for root canal (re) treatment.
- Observational design : factors cannot be controlled but only accounted for.
- All patients undergoing RCT of retreatment from 1st October 1997 until June 2005. By residents in Eastman. (Toronto : 1993-2001)
- Excluded from the study: perio or if the apex was not discernible on the x-ray
- Excluded from the analysis: follow-up less than 2 years, extracted, not enough data

IEJ 2011 : Ng et al.

50

Classification

- Preoperative: 1. intact PDL 2. Widened PDL, 3. Lesion
- Diameter of the lesion measured with a ruler
- Diameter of widened PDL 0.5 mm

IEJ 2011 : Ng et al.

51

Outcome measurements

- Ng does not agree with Friedman and contantly uses the term "success rate".
- Primary: Clinical and radiographic : absence or healing of lesion for each root
- Secondary: survival

Succeess:

- 1.strict criteria : no pain, sympthoms and complete healing
- 2.Loose criteria : healing lesion.

IEJ 2011 : Ng et al.

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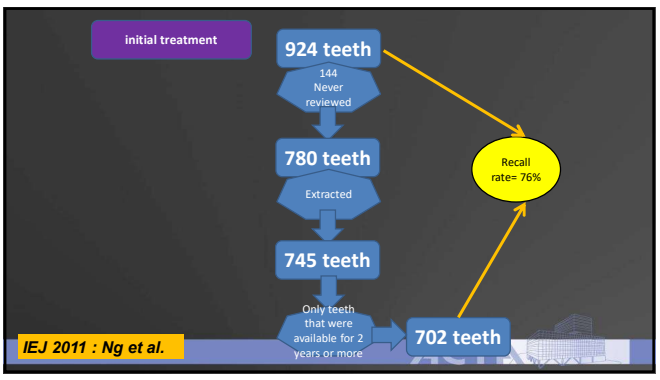

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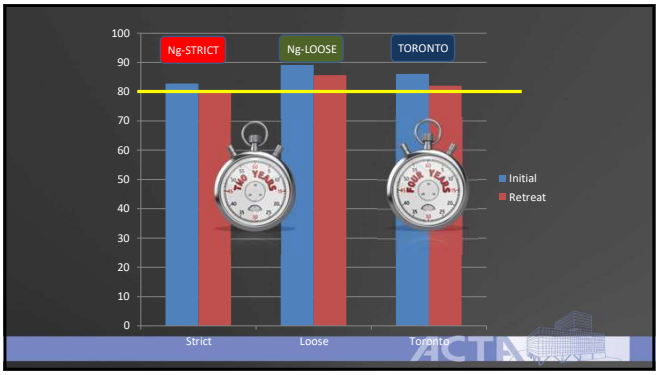
Results Ng

	Initial	retreatment
Strict	82,8	80,1
Loose	89,1	85,6

IEJ 2011 : Ng et al.

55



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Classical studies:

- Toronto studies (Friedman S. et al.)
- Ng studies
  - Both could serve as a reference standard for endodontic outcome references.
  - However, they have their limitations
  - New technical innovations will challenge these studies

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- CBCT

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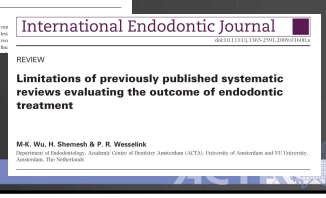
Outcome studies with CBCT


International Endodontic Journal

EDITORIAL


International Endodontic Journal

REVIEW

Limitations of previously published systematic reviews evaluating the outcome of endodontic treatment

M-K. Wu, H. Shemesh & P. R. Wesselink

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First outcome studies using CBCT

- Liang, Li, Wesselink, Wu. J Endod. 2011
- Patel, Wilson, Dawood, Foschi, Mannocci.Int Endod J 2012
- Metska, Parsa, Aartman, Wesselink, Ozok (J Endod.) 2013
- Borden, Wang, Wu,Shemesh (J Endod.) 2013
- Liang, Li, Shemesh, Wesselink, Wu. Clin Oral Investig. 2012
- Fernández, Cadavid, Zapata, Alvarez, Restrepo. J Endod. 2013
- Liang, Jiang, Jiang, Chen, Liu, Tian, Bao, Gau, Versluis, Wu, v/d Sluis (J Endod.) 2013
- Davis, Patel, Foschi, Andiappan, Mitchell, Mannocci.Int Endod J 2015

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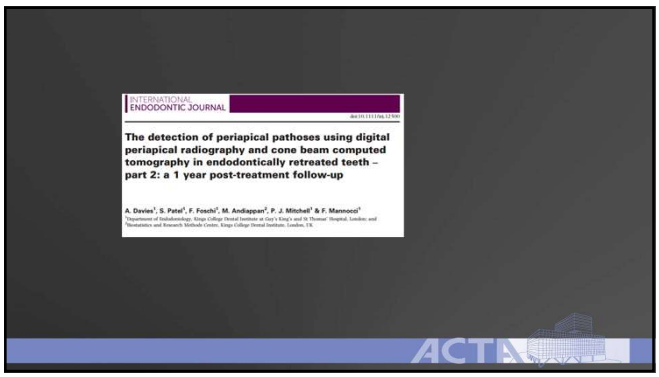

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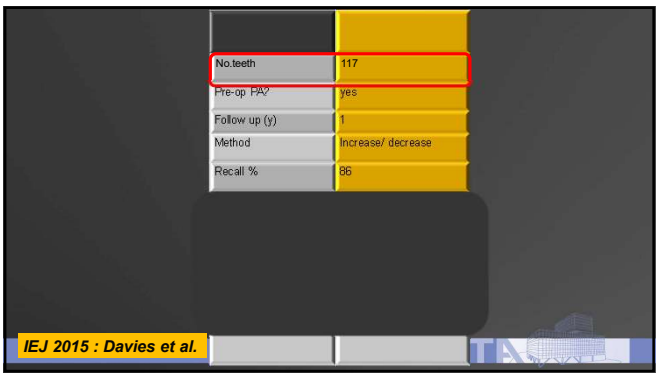

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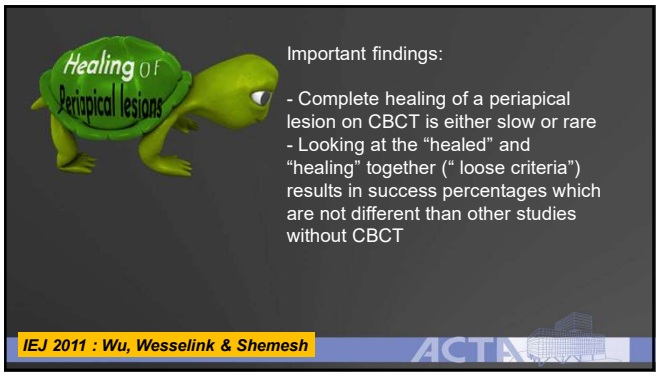

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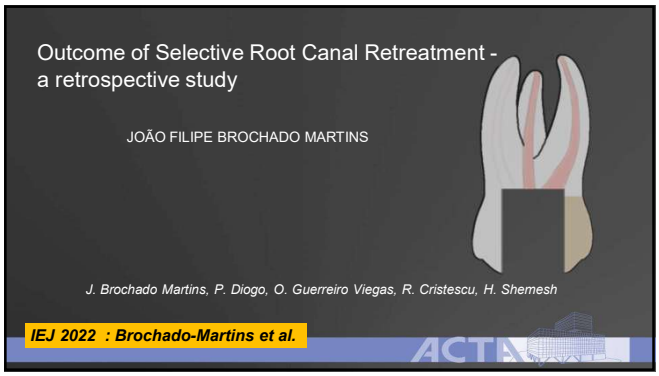

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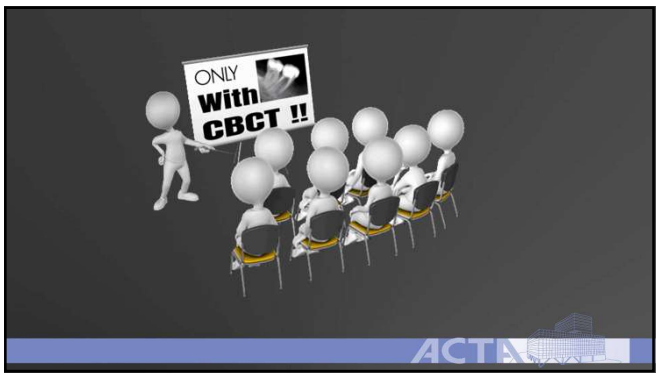

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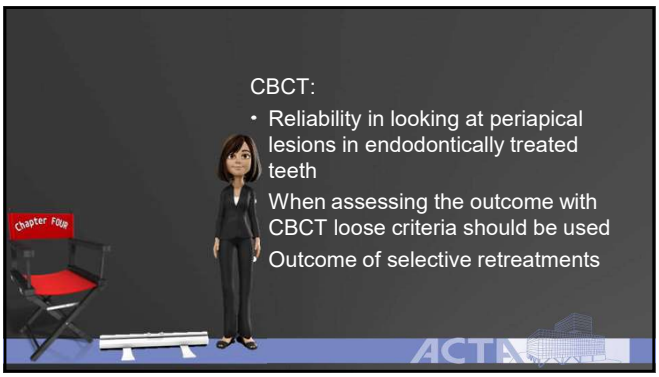

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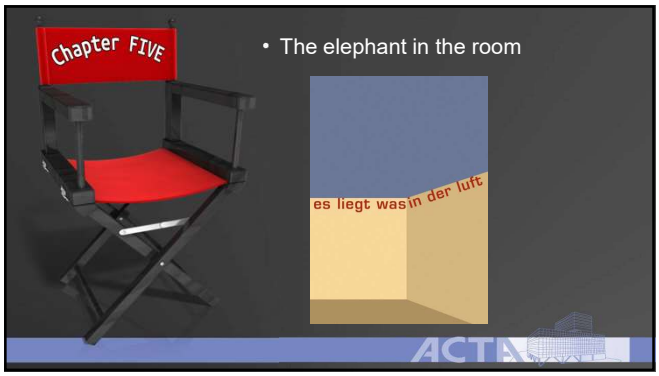

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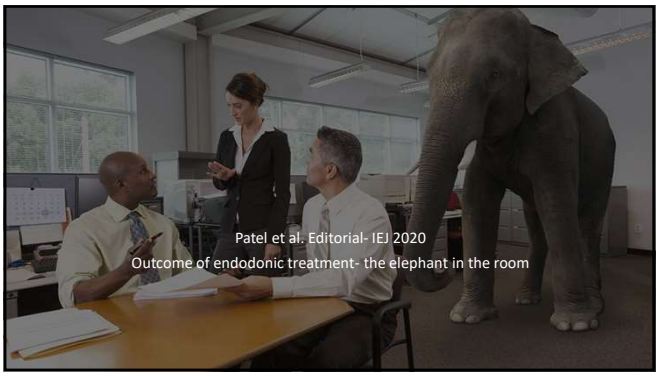

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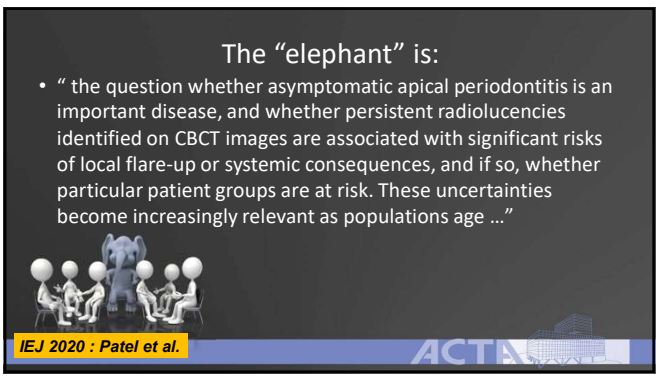

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Apical Periodontitis Is Associated with Elevated Concentrations of Inflammatory Mediators in Peripheral Blood: A Systematic Review and Meta-analysis.

Conclusions: The existing literature indicates that AP adds on to systemic inflammation by elevating C-reactive protein, interleukin 6, asymmetric dimethylarginine, and C3 levels.

JOE 2019 : Georgiou et al.

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The influence of apical periodontitis on circulatory inflammatory mediators in peripheral blood: A prospective case-control study.

Conclusions: The immunologic profile of chronic AP in one tooth and its healing profile reveals a systemic low-grade inflammation through compensatory immunosuppression. A larger lesion or multiple lesions could disrupt the balance that the system is trying to maintain, resulting in loss of homeostasis.

Tomorrow 11:15 Prof. E. Cotti

IEJ 2022 : Georgiou et al.

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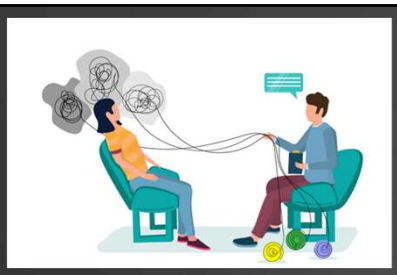

Individually designed treatments

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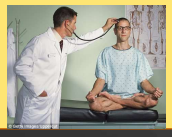
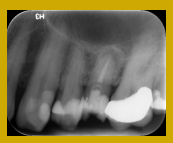
Patient-centered outcome: Quality of Life Costs/ pain Functionality



Disease-centered outcome: Healing of the periapical lesion



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The elephant in the room:

- How important is an asymptomatic periapical lesion and should we treat it ?

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- Monitoring the outcome

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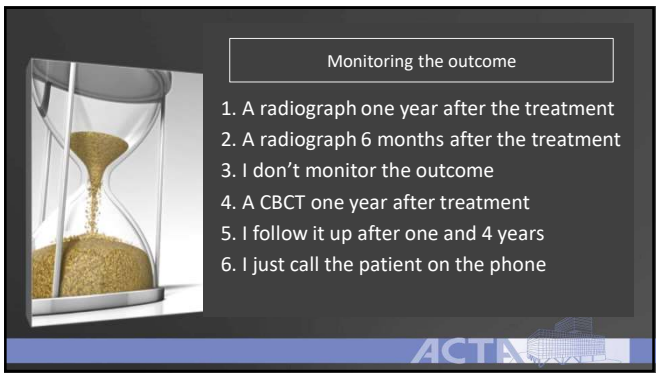

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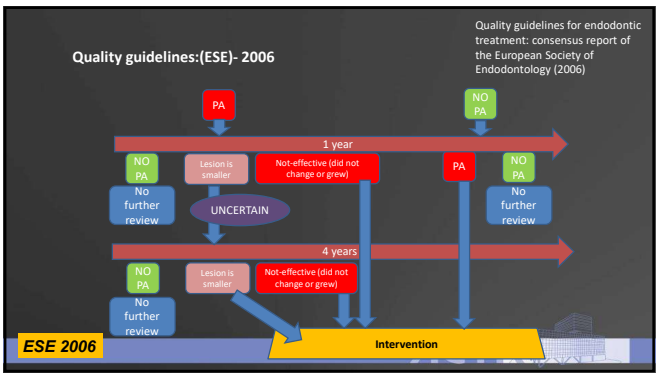

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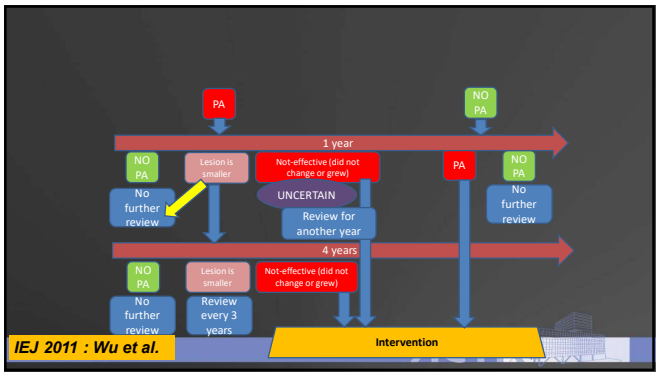

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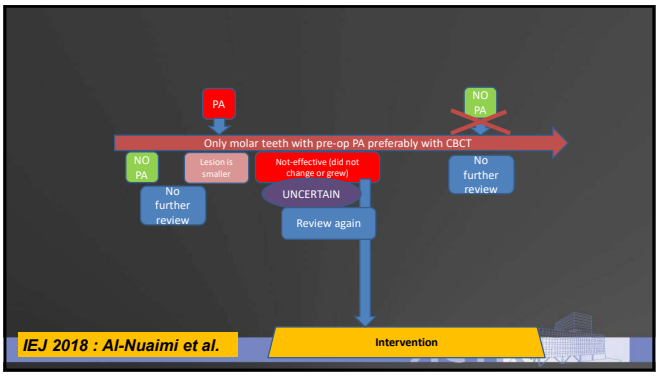

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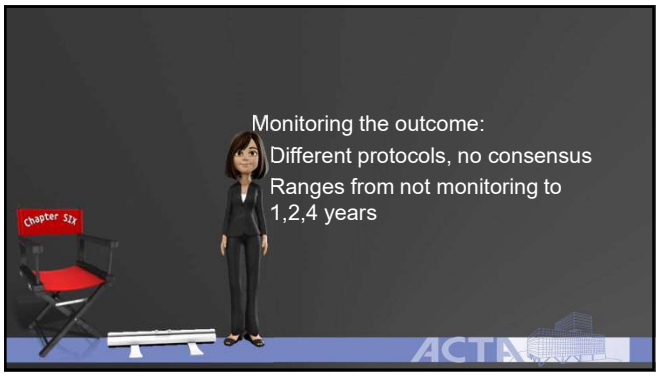

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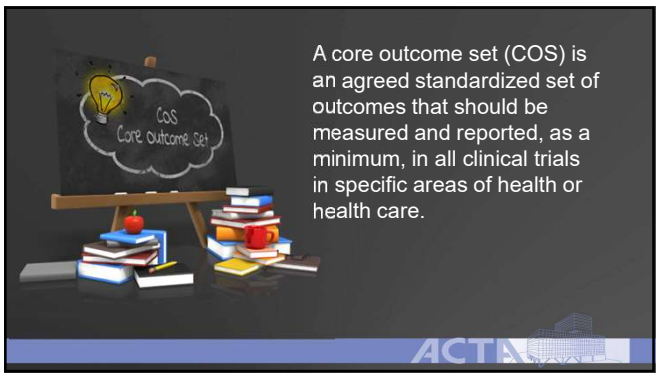

A core outcome set (COS) is an agreed standardized set of outcomes that should be measured and reported, as a minimum, in all clinical trials in specific areas of health or health care.

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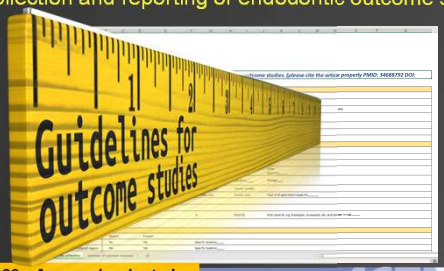
Part 3: A proposed framework for standardized data collection and reporting of endodontic outcome studies



JOE 2022 : Azarpazhooh et al.

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Recent (2022) scoping reviews urge the scientific community to take steps and form a unified method to report outcomes in the future

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- Outcome studies are the essence of clinical studies in endodontology because they can give answers to most clinic questions
- Healing of the periapical lesion on radiograph is mostly used to assess the outcome
- Patient centered outcomes are also being used *(and should be used more often?)*
- CBCT as a new tool to assess outcome (limited!)
- The importance of persistent asymptomatic periapical lesions is still unknown
- Hopefully more uniform outcome studies will be conducted (COS)
- ESE will formulate new guidelines (for assessing the outcome)

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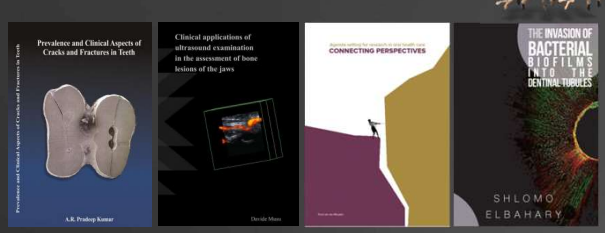
…Thanks to my latest PhD students…



A.R. P. Kumar, April 2021 | D. Musu, June, 2021 | P. v/d Wouden, May 2022 | S. Elbahary, October 2022

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