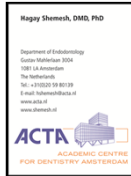


To cBCT or not to cBCT
That is the question...



1

When do YOU use a CBCT ?

2

ACTA ACADEMISCH CENTRUM
TANDHEELKUNDE AMSTERDAM

HET GEBRUIK VAN CBCT DOOR ENDODONTologen IN NEDERLAND 2022



BACHELOR THESIS - 2022

Christian van Mierlo en Rob Vergouwen
(begeleiders: F. Dommering & H. Shemesh)

3

Digital questionnaire was sent to
all endodontists in the Netherlands

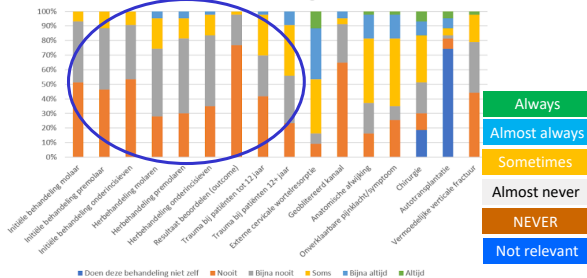
Questions :
- Personal details
- How often do you make a CBCT
- In which indication (list of 16 indications)
- Always, Almost always, sometimes, almost never, never

Response

Analysis

4

Indicaties voor CBCT door endodontologen in Nederland



5

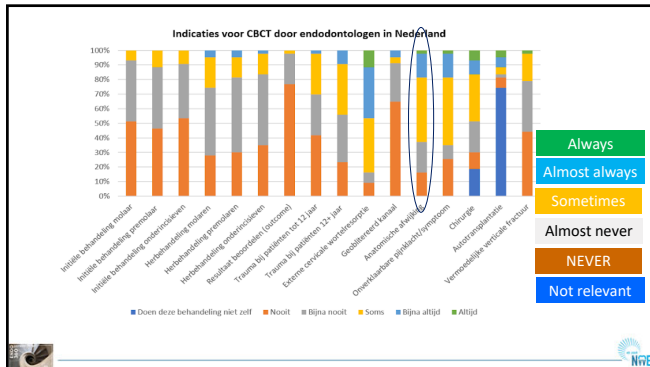
- Assessment of CBCT Referral Reasons and the Impact of CBCT Evaluation on Decision Treatment Planning Procedure in Endodontics

JOE 2020: Kakavetos et al.

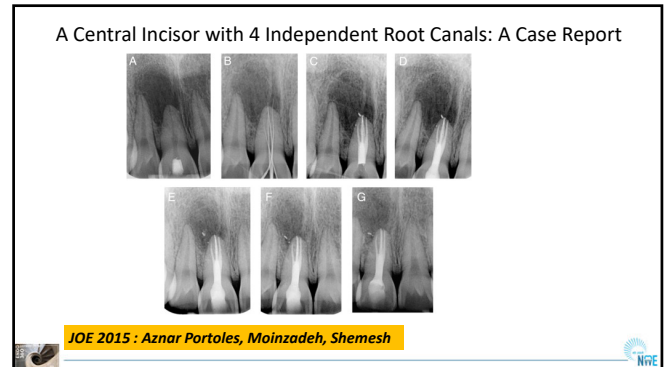
- CBCT-Predictors and characteristics of usage in Australia and New Zealand, a multifactorial analysis

Aust Endod J 2022: Isaac-Mathew et al.

6



7

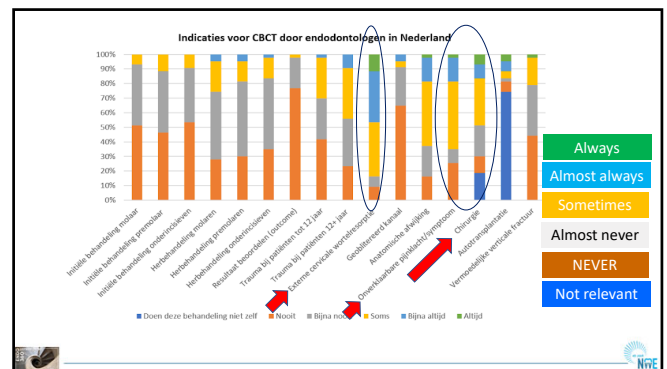


8

The present report is the first to describe a maxillary central incisor with 4 canals in a tooth with no developmental abnormalities. It stresses the importance of using a dental operating microscope during endodontic treatment **as well as questioning the routine use of CBCT imaging for similar cases.**

JOE 2015 : Aznar Portoles, Moinezhadeh, Shemesh

9



10

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

IEJ 2009 : Wu, Shemesh & Wesselink

- Editorial Int Endod J
- Radiographs and CBCT--time for a reassessment?

IEJ 2011 : Patel, Mannocci, Shemesh, Wu, Wesselink, Lambrechts

11



12

A comparative investigation of CBCT and periapical radiography in the diagnosis of a healthy periapex

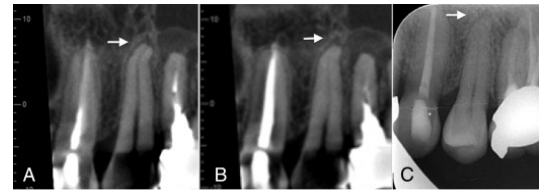
CBCT scans & radiographs of 200 teeth

Clinical tests

JOE 2014 : Pope et al.



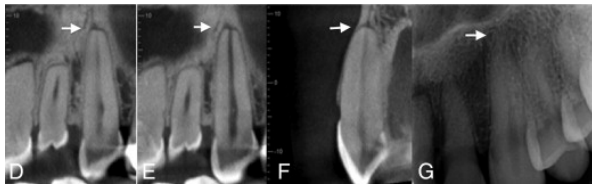
13



JOE 2014 : Pope et al.



14



JOE 2014 : Pope et al.



15

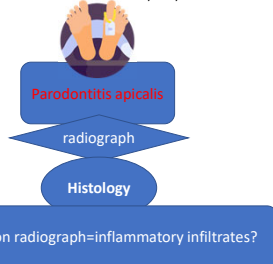
Conclusions: the PDL space of a healthy tooth demonstrated significant variation when examined by CBCT. The radiographic interpretation of health and disease on CBCT must be further investigated ...

JOE 2014 : Pope et al.



16

Cadaver validation Study Brynolf

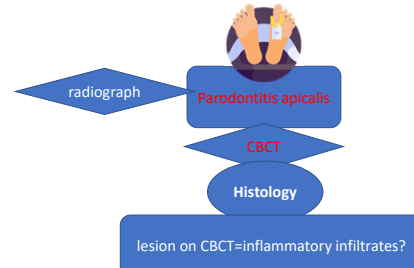


Brynolf 1967 : thesis



17

Cadaver validation Studies Patel vs. Kruse



IEJ 2017 : Kanagasingham et al.

IEJ 2019 : Kruse et al.



18

Validation study No. 1

Diagnostic accuracy of periapical radiography and CBCT in detecting apical periodontitis using histopathological findings as a reference standard.

IEJ 2017 : Kanagasingham et al.



19

- 9 unclaimed bodies before cremation (Malaysia)
- Max. 14 days old
- Jaw sections 67 teeth
- AP detection by radiographs and CBCT
- Histopathological examination

IEJ 2017 : Kanagasingham et al.



20

- Sensitivity : (the ability to correctly detect periapical periodontitis)
- PR : 0.27
- CBCT : 0.89
- Positive Predictive Value (if there is a lesion on the CBCT there is indeed an inflammation process histologically) = 1

IEJ 2017 : Kanagasingham et al.



21

Validation study No. 2

Diagnostic accuracy of CBCT used for assessment of apical periodontitis: an ex vivo histopathological study on human cadavers.

IEJ 2019 : Kruse et al.



22

- bodies donated for science (Denmark)
- Fixated bodies (Formaline)
- Jaw sections 223 teeth
- AP detection by radiographs and CBCT
- Histopathological examination

IEJ 2019 : Kruse et al.



23

- Sensitivity : (the ability to correctly detect periapical periodontitis)
CBCT : 0.95 (root-filled teeth: 0.63-0.91)
- Positive Predictive Value (if there is a lesion on the CBCT there is indeed an inflammation process histologically) = 0.77 (root-filled teeth: 0.48-0.64)

IEJ 2019 : Kruse et al.



24

Diagnostic validity of periapical radiography and CBCT for assessing periapical lesions that persist after endodontic surgery

149 patients after Apex resection (about 7 years ago)

108 recalled

Those where a periapical lesion still existed were offered a re-surgery (20 patients accepted)

Biopsy

Dentomaxillofac Radiology : Kruse et al.



25

42% without periapical inflammation
Correct diagnosis with CBCT : 58% and 63% with PR

- Conclusions: Of the re-operated teeth, 42% had no apical inflammation and hence no benefit from resurgery.

Dentomaxillofac Radiology : Kruse et al.



26

- Endodontically treated teeth could demonstrate a periapical lesion on CBCT while there is no inflammatory process going on



27

- Beam Hardening and streaking artefacts
- Connective tissue healing



28

NEW STUDY

- Selective retreatment



29

ACTA ACADEMISCH CENTRUM
TANDHEELKUNDE AMSTERDAM

OUTCOME OF SELECTIVE ROOT CANAL RETREATMENT - A RETROSPECTIVE STUDY

JOÃO FILIPE BROCHADO MARTINS
SUPERVISOR: HAGAY SHEMESH



MASTER THESIS - ORAL HEALTH SCIENCES 2019-2022



30

Outcome of selective retreatments-
J. Brochado Martins, P. Diogo, O. Guerreiro Viegas, R. Cristescu, H. Shemesh



IEJ 2023 : Brochado-Martins et al.



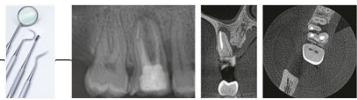
31

Some clinicians preform a selective retreatment
ONLY after they verify with a CBCT which roots
are associated with a lesion

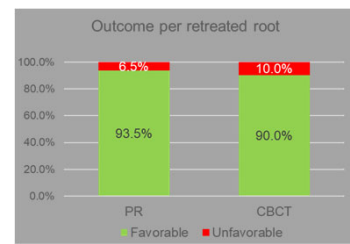


32

- Patient-related parameters
- Tooth related parameters
- Treatment-related parameters
- Clinical and radiographic assessment (CBCT
? Radiographs!)



33



RESULTS

34

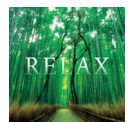
SELECTIVE ROOT CANAL RETREATMENT COULD BE A
RELIABLE TREATMENT OPTION EVEN WITHOUT THE USE
OF PRE-OPERATIVE CBCT

CONCLUSION

35

What to do ?

- Do not jump to conclusions
- Base your clinical decision not only on CBCT
- Think twice before making a CBCT for evaluation of endodontically treated teeth



36

Ultrasound examination for the detection of simulated periapical bone lesions in bovine mandibles: an ex vivo study.

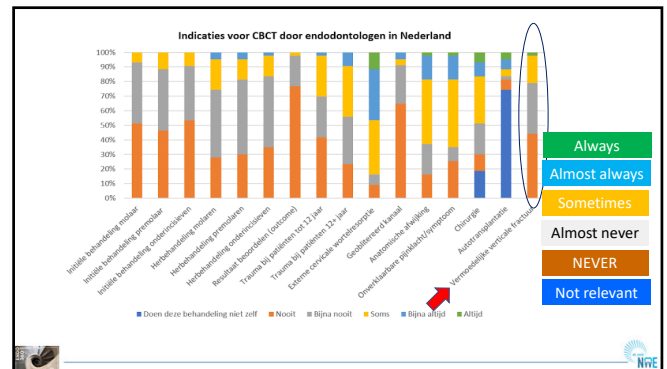
Promotie - 2022



IEJ 2020 : Musu, Dessalvi, Shemesh, Frenda Mercuri, Cotti

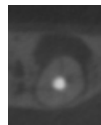
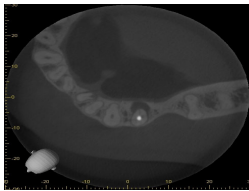


37



38

VRF on CBCT



Detection of VRF in endodontically treated teeth by a CBCT

JOE 2009 : Hassan et al.



39



40

The detection of VRF in root filled teeth with periapical radiographs and CBCT scans.

“...periapical radiographs and CBCT were not accurate in detecting the presence and absence of simulated VRF”

IEJ 2013 : Patel et al.



41

CBCT for the diagnosis of VRF: A systemic review of the literature and meta-analysis

„No superiority of CBCT compared with conventional radiography...”

Oral and Maxillofacial 2014: Corbella et al.



42

Accuracy of high-resolution small-volume CBCT in the diagnosis of VRF: An in vivo analysis .

Not only endodontically treated
(but 90 % were)

“The accuracy of CBCT imaging for the diagnosis of VRF’s was poor, although it was higher than with conventional radiography”

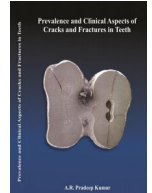
JOE 2020 : Dias et al.



43

Diagnosis of VRF by CBCT in Root-filled Teeth with Confirmation by Direct Visualization: A Systematic Review and Meta-Analysis.

“CBCT imaging is still not a good tool for diagnosing VRFs in root-filled teeth compared with direct visualization”.



JOE 2021: PradeepKumar et al.

Promotie : 2022



44

Assessment of true vertical root fracture line in endodontically treated teeth using a new subtraction software - A Micro-CT and CBCT study.

“To summarise, for in vivo endodontically treated teeth with subtle VRFs, many true fractures lines could not be demonstrated on CBCT images”

Aus Endod J 2021: Gulibire et al.



45

CBCT can HELP in diagnosing VRF TOGETHER with the clinical signs and symptoms :

- The combination of a deep pocket, a sinus tract and a lateral lesion on an endodontically treated tooth (especially upper premolars and the mesial root of lower molars)
- On the CBCT the bone loss pattern could be demonstrated

But don't expect to see the fracture itself



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Remember

- Technology evolves !



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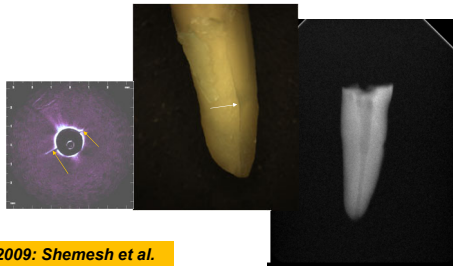
Effect of object position in the field of view and application of a metal artifact reduction algorithm on the detection of VRF on CBCT scans: An in vitro study

Imaging Sci Dent 2018: Nikbin et al.



48

Detection of vertical root fracture with Optical Coherence Tomography



JOE 2009: Shemesh et al.

49



50

Artificial intelligence (AI) in health care

Virtual

Physical (robotics)

51

- Detection of periapical lesions (CBCT?)
- Detection of root fractures (CBCT?)
- Working length determination (CBCT)
- Root and root canal system morphology (CBCT)
- Predictions (retreatments, viability of stem cells)

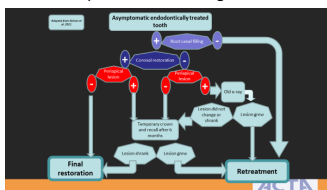
Artificial intelligence (AI) in health care

Virtual

Physical (robotics)

52

Artificial intelligence (AI) has the potential to replicate human intelligence to perform prediction and complex decision making in health care



Artificial Intelligence in Endodontics: Current Applications and Future Directions.

JOE 2021 : Aminoshariae et al.


53

Association between patient-, tooth- and treatment-level factors and root canal treatment failure: A retrospective longitudinal and machine learning study.

Predicting failure was only limitedly possible, also with more complex Machine Learning.

J Dent 2022 : Herbst et al.

54



Artificial intelligence (AI) in health care

Virtual

Physical (robotics)

First experiences with patient-centered training in virtual reality.



J Dent Educ 2020: Serrano, Wesselink, Vervoorn



55

Conclusions- CBCT limitations & future

- Periapical lesions on endodontically treated teeth can be confusing on a CBCT. Base your diagnosis and treatment plan not on the image alone.
- CBCT is (still) not efficient for diagnosis of VRF
- Developments in CBCT technology
- AI

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