Relationships between orthodontics and endodontology

Hagay Shemesh
ACTA

1

- What am I going to speak about ?
- Introduction
  - Limited evidence
- The 5 questions
  - Influence on the pulp
  - resorption
  - Ortho movements
  - Special considerations
  - Combinations
- Conclusions and recommendations

ACTA

2

- Little information
- Literature focuses on specific clinical questions and case reports

3

Questions

1. How does an orthodontic treatment influences the pulp?
2. Is there a difference in resorption between teeth with/ without root canal treatment ?
3. Does an endodontically treated tooth react the same to orthodontic treatment?
4. Are there special considerations when we perform a root canal treatment by an orthodontic patient?
5. Combinations orthodontic treatment and root canal treatment in specific situations

4

1. How does an orthodontic treatment influences the pulp?

5

Pulpal change in orthodontics

1. Blood vessels- vascularisation
2. Nerve tissue- sensibility
3. Calcifications and obliterations

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Pulpal change in orthodontics

Initial changes in pulpal microvasculature during orthodonic tooth movement: a stereological study
M.Santamaria et al 2006
4 groups of rats (5 per group)
M1 pulled mesially with force 0.4 N (Newton). For 6,24,72 hours (spring)
Histological sections changes in volume density blood vessels (Vv)
(hyperemy and vasodilatation)
Results : All treated teeth- increase in Vv after 6 h. After 24 h – adaptation of the pulp, and after 72 h Vv almost normal.

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Pulpal changes in orthodontics

Spring in a rat model

Santamaria et al. 2006

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Pulpal changes in orthodontics

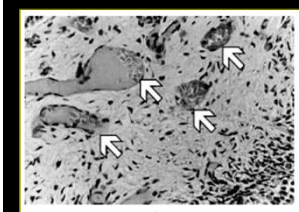

Figure 4. Photomicrograph of a histological section showing areas of congested vessels and edema in the pulp center of the 6-h group (X400; HE). Arrows indicate areas of congested vessels.

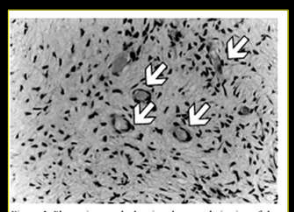

Figure 5. Photomicrograph showing the vascularization of the central layer of the pulp (control group; X400; HE). Arrows indicate vessels.

Coronal pulp control group. X400

Santamaria et al. 2006

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Pulpal changes in orthodontics

Pulp vitality after rapid palatal expansion (RPE)
Cho et al 2010

Aim: Can RPE change the response of the pulp to EPT?
25 patients treated with RPE. EPT test of premolars and molars. If negative, cold test.
Results : During and directly after treatment some teeth react negative. All teeth return to normal reaction 9 months after treatment.
Conclusion: Teeth after RPE do not loose their vitality.

Cho et al. 2010

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There is no pulp necrosis or calcific metamorphosis of pulp induced by orthodontic treatment: biological basis.

Consolaro -Dental Press J Orthod. 2018

1) The orthodontic movement does not induce pulp necrosis or calcific metamorphosis of the pulp;
2) When pulp necrosis or calcific metamorphosis of the pulp is diagnosed during orthodontic treatment or soon after removal of orthodontic appliances, its etiology should be assigned to concussion dental trauma, rather than to orthodontic treatment;

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J Oral Sci. 2018
Effect of age on pulpal blood flow in human teeth during orthodontic movement.

Ersahan & Sabuncuoglu

Decreased blood supply to pulp cells commonly occurs with age and can change the response of pulp to orthodontic tooth movement.

Aim: to assess the relationship between age, pulpal blood flow (PBF), and orthodontic treatment outcomes.

28 human subjects divided into 2 groups according to age.
A laser Doppler flowmeter was used to record blood flow to the teeth prior to and during the course of orthodontic treatment (days 1, 3, and 7; week 3; and month 1). Mean PBF values were significantly higher in the young group compared to the old group at all time points ($P < 0.001$).

The decreased PBF in response to tooth movement was more severe in the old group and was also of longer duration.

12

J Contemp Dent Pract. 2018 Sep 1;19(9):1095-1099.

A Retrospective Analysis of Pulp Stones in Patients following Orthodontic Treatment.

Jena D et al.

Dentists performing endodontic treatment among patients who have undergone orthodontic treatment should be aware about the increased chances of presence of pulp stones

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Pulpal changes in orthodontics

Narrowing of the canal

Before treatment | At the end of the treatment | 5 year after retention

Popp et al. 1992

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Pulpal changes in orthodontics

Pulpal response to orthodontic tooth movement in adolescents: a radiographic study.
Popp et al 1992
2 groups of patients
Radiographs before the treatment, after retention and 5 year after treatment.
Results : All treated teeth show narrowing of the canal. But also the control group showed the same.
Conclusion: Narrowing of the canal after ortho is actually a normal maturing process which is probably accelerated by the orthodontic pressure.

Popp et al. 1992

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Pulpal changes in orthodontics

Volumetric Pulp Changes after Orthodontic Treatment Determined by CBCT.
Venkatesh et al JOE 2014
2 groups of patients (n=48)
CBCT before the treatment, after retention.
Results : All treated teeth show narrowing of the canal. Less so in the control group.
Conclusion: Narrowing of the canal after ortho is NOT a normal maturing process and is a consequence of the orthodontic forces.

Vankatesh et al. 2014

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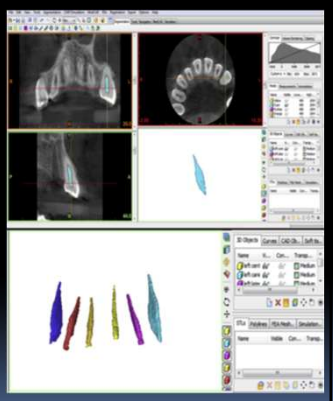
- A 3D image of the pulp cavity by the CBCT is created and the volume of the pulp cavity is calculated.



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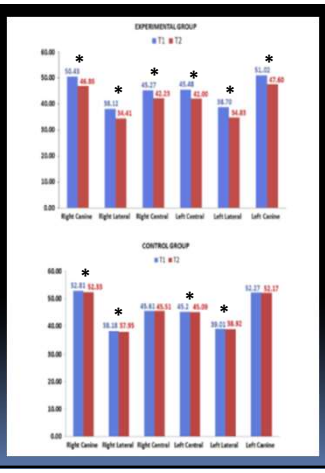

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Force → Pulp hyperemia: vasodilatation, increased permeability, and edema → increase in pulp pressure and compression of the venous return → Deposition of tertiary dentin.

19

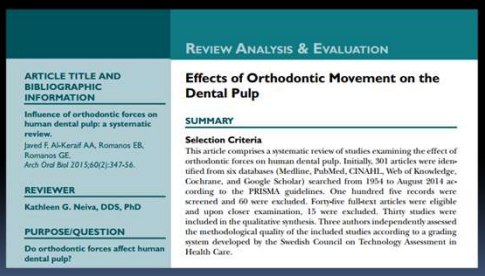
Agematsu et al. 2010

Age-related secondary dentin deposition by using micro CT imaging pulp volumes decreased only in men in their 50s and 60s and women in their 40s and 50s.

Agematsu H et al. Three-dimensional observation of decrease in pulp cavity volume using micro-CT: age-related change. Bull Tokyo Dent Coll. 2010;51(1):1-6.

20

Effects of Orthodontic Movement on the Dental Pulp.
Neiva KG.
J Evid Based Dent Pract. 2015



REVIEW ANALYSIS & EVALUATION

ARTICLE TITLE AND BIBLIOGRAPHIC INFORMATION

Influence of orthodontic forces on human dental pulp: a systematic review.
Javed F, Al-Kersif AA, Romanos EB, Romanos GE.
Arch Oral Biol 2015;60(2):347-56.

REVIEWER

Kathleen G. Neiva, DDS, PhD

PURPOSE/QUESTION

Do orthodontic forces affect human dental pulp?

Effects of Orthodontic Movement on the Dental Pulp

SUMMARY

Selection Criteria

This article comprises a systematic review of studies examining the effect of orthodontic forces on human dental pulp. Initially, 301 articles were identified from six databases (Medline, PubMed, CINAHL, Web of Knowledge, Cochrane, and Google Scholar) searched from 1954 to August 2014 according to the PRISMA guidelines. One hundred five records were screened and 60 were excluded. Forty-five full-text articles were eligible and upon closer examination, 15 were excluded. Thirty studies were included in the qualitative synthesis. Three authors independently assessed the methodological quality of the included studies according to a grading system developed by the Swedish Council on Technology Assessment in Health Care.

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- "There is insufficient scientific validation regarding the association between orthodontic forces and human dental pulp."
- "A history of dental trauma may be considered a risk factor for the loss of pulp vitality during orthodontic treatment`

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Conclusions

Orthodontic treatment produced a significant decrease in size of the pulp, which was statistically significant.

Decreases in pulp volumes were also noted in the control group but they were clinically insignificant as determined by pulp testing methods.

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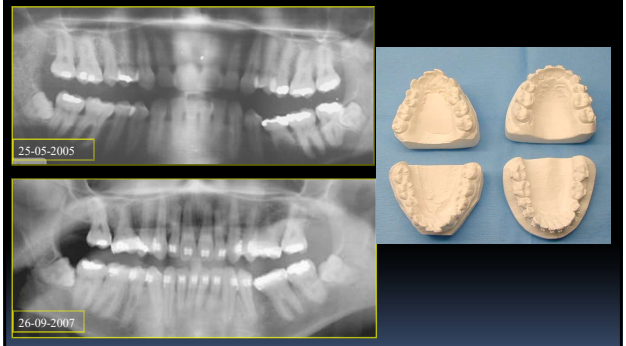
Pulpal changes in orthodontics



G. Aesaert

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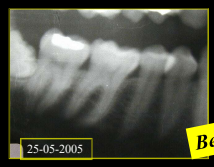
Pulpal changes in orthodontics



Because of the ortho or something else?

G. Aesaert

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Pulpal changes in orthodontics

E. Haring

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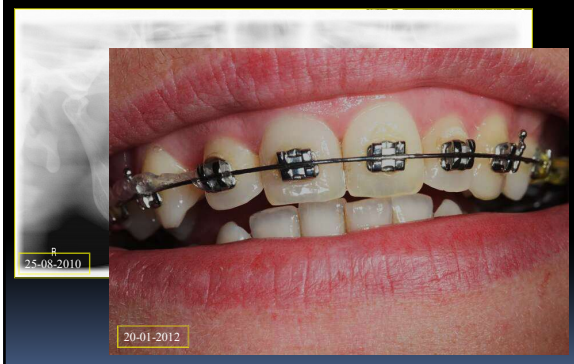
Pulpal changes in orthodontics



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Carlos Aznar Portoles

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1. How does an orthodontic treatment influences the pulp?

- There is little evidence that orthodontic movements can irrevesibly influence the pulp
- These changes are mainly neurovascular
- Neurotransmittors (neuropeptides) can influence the blood and cell metabolism
- These changes could be pronounced by other external factors such as trauma and caries
- Teeth with open apex – the chance for changes is smaller (more space apicaly and higher healing and regeneration capacity)

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2. Is there a difference in resorption between teeth with/ without root canal treatment ?

M. S. Marques

30

Resorption

Apical resorption

- Ottolengui 1914: Direct relationship between ortho treatment and apical resorption.
- 35-45% of maxillary front teeth show resorption after ortho treatment (compared to 3% without)
- Sterile inflammatory resorption
- open apex chance for resorption is smaller (Brezniak et al. 2002)

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Resorption

Not always benign

H. Shemesh

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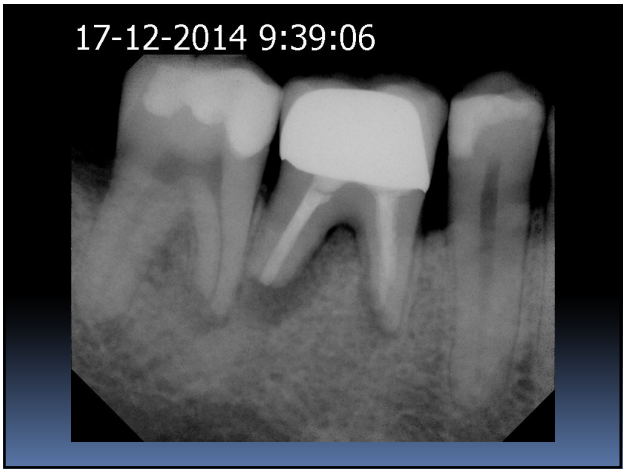

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Resorption

Apical resorption – predisposing factors

- Trauma
- Large orthodontic pressures like intrusion, tipping
- Teeth with anatomical abberations like dens-in-dente (Kjr 1995)
- Teeth with a this root (but lower incisors demonstrate LESS resorption)
- Vital teeth compared to endodontically treated teeth

???

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Resorption

T. Zwart, H. Shemesh

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Resorption

- Neuropeptides (from the pulp) stimulate CGRP-IR fibres (calcitonin gene-related peptide- Immuno Reactive)
- Pulp fibroblasts are stimulated by substance P and can cause resorption (Yamagucci et al. 2008)
- Endodontically treated teeth have no pulp and thus no stimulation for CGRP-IR fibers (Bender et al. 1997)

M. S. Marques

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- External apical root resorption in maxillary root-filled incisors after orthodontic treatment: A split-mouth design study. Llamas-Carreras et al. 2012

Conclusion- no difference in resorption of vital or endodontically treated teeth

- Also Estevans 2007, Spurrier et al. 1990

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Effects of Pulpectomy on the Amount of Root Resorption during Orthodontic Tooth Movement
Kaku et al. Journal of endodontics 2014

- Freshly extracted teeth
- Cell culture of the pulp tissue
- Gene expression , protein concentration of macrophages fators, receptors activation with and without pressure
- A few rat teeth- extirpation and then again, check all parameters
- Conclusion: tensile forces enhance the expression of cytokines which may lead to root resorption during tooth movement

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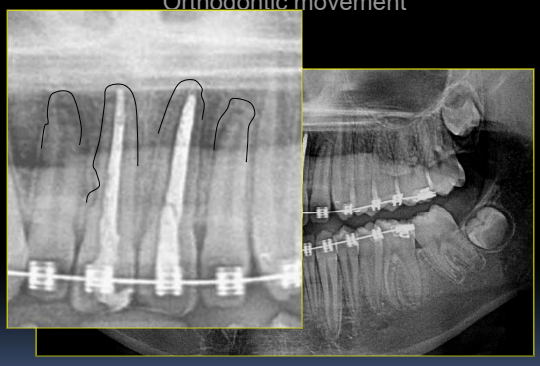
Orthodontic movement



A. Haimovsky

39

Resorptie

- Apical resorption
- Internal resorption
- Inflammatory resorption

} In combination with other factors

H. Shemesh

G. Aesaert

M. S. Marques

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Resorption

Treatment of resorption

- Depends on the kind of resorption
- Internal & inflammatory : root canal treatment as soon a spossible.

Pause or stop orthodontic forces (Brezniak & Wasserstein 2002)

- Apical resorption: almost always
- Extreme resorption (>1/3) stop ortho and consider root canal treatment

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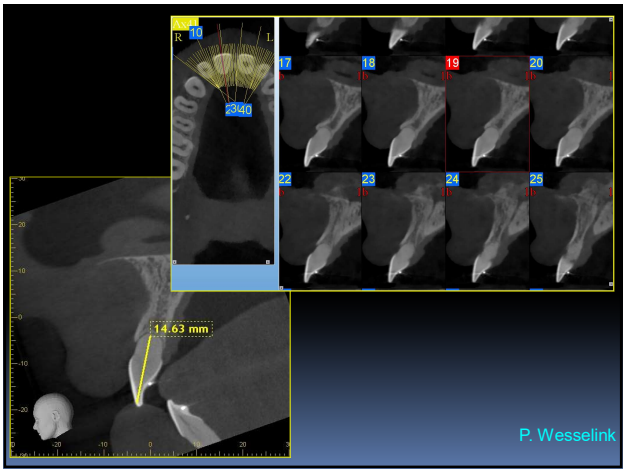

P. Wesselink

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Trauma case

Endo: Karim Idzahi
Ortho: ACTA afdeling orthodontie

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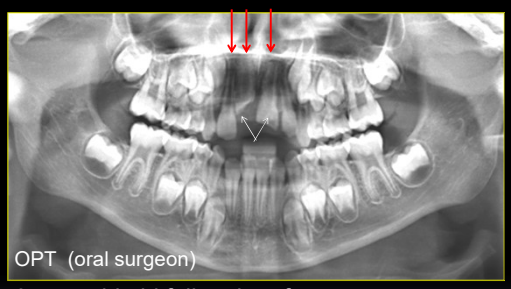

9 year old girl fell on iron fence
Intrusion 11,12 en 21
Complicated crown fracture 11,21 en Un-complicated crown fracture 22

K. Idzahi

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- Surgeon: General anaesthesia reposition 11,12,21 Rigid splint and calcium hydroxide on pulp-exposure 11,21
- Dep. Of endo ACTA 2 days later

K. Idzahi

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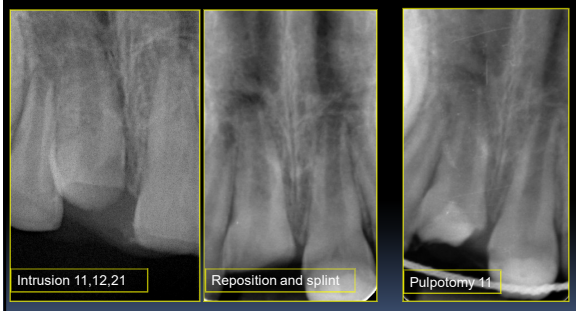

K. Idzahi

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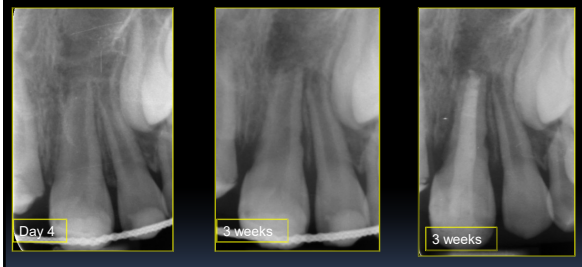

K. Idzahi

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Spontanous eruption 11

- If the root is not yet fully developed
- Beter prognosis
- Usually up to 6 months for full eruption
- No movement after 1 month→ Orthodontic or surgical repositioning
- Follow up for pulp necrosis or inflammatory resorption

K. Idzahi

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After 1 month

K. Idzahi

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Extrusion 11

K. Idzahi

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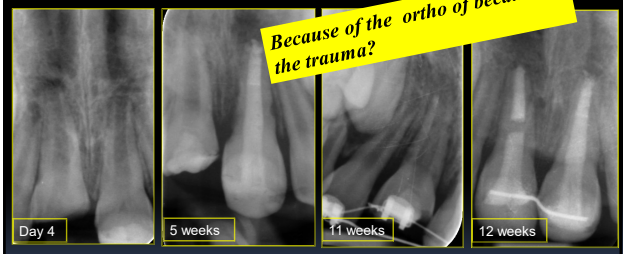
Inflammatory resorption



K. Idzahi

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K. Idzahi

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2. Is there a difference in resorption between teeth with/ without root canal treatment ?

M. S Marques

Some observations that endodontically treated teeth could show resistance to resorption probably this is multifactorial and there are other reasons as well for the resorption

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3. Does an endodontically treated tooth react the same to orthodontic treatment?

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Orthodontisc movement

- Endodontically treated teeth could be moved just like vital teeth (Hunter et al. 1990, Mah et al 1996, Llamas-Carreras et al 2012)

As long as

- There is no other factor that could interfere with the movement (like replacement resorption)

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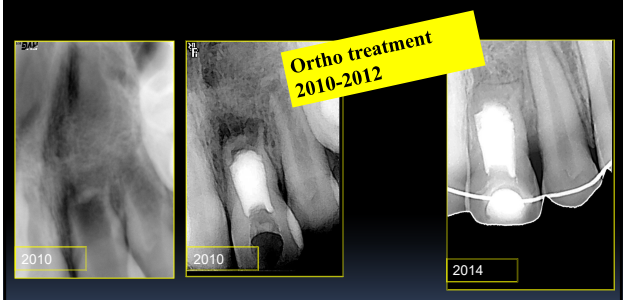
Orthodontic movement



G. Aesaert

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Orthodontic movement

Can a tooth with apical periodontitis treated orthodontically?

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Orthodontic movement

Influence of orthodontic dental movement on the healing process of teeth with periapical lesions
RS de Sauza et al 2006
Aim: Check influence of ortho treatment on healing of periapical lesions in dogs

30 roots in 2 dogs with periapical lesions. 20 were endodontically treated. Half of them got orthodontic treatment
After 5 months: Histology sections
Results : all treated teeth demonsatrated a healing process..
Conclusion: Orthodontic treatment can delay healing but not stop it.

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Orthodontisc movement

Can a tooth after apical surgery treated orthodontically ?

59

G. Aesaert

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Orthodontic movement

Problems…

- More apical resorption (More exposed dentine)
- Irritation and persistent inflammation
- Fenestration
- Scar tissue

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Orthodontic movement

Baranowskyj 1969

- Orthodontic intrusion in dogs
- Conclusion: early onset of orthodontic treatment after apical surgery can interfere with the healing through increased mobility and irritation to the bone

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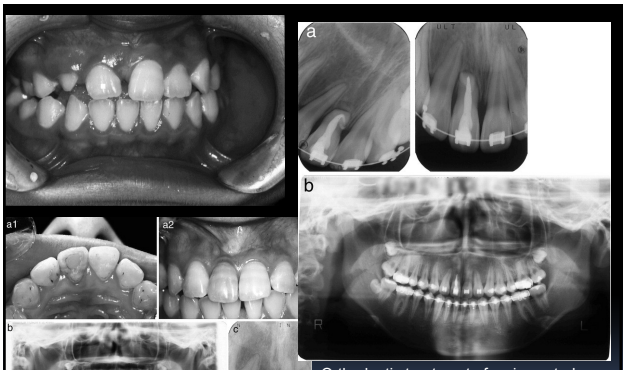

Orthodontic treatment of an impacted dilacerated maxillary central incisor combined with surgical exposure and apicoectomy.
Uematsu et al. 2004

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Orthodontic-Surgical-Endodontic Management of Unerupted Maxillary Central Incisor With Distoangular Root Dilaceration
José Valladares Neto et al. JOE 2010

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3. Does an endodontically treated tooth react the same to orthodontic treatment?

- Endodontically treated teeth move at the same way as vital teeth
- Teeth after apical surgery: no long term clinical studies
- Recommendation: Begin orthodontic movement after healing of surgical wound

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Orthodontic Movement after Regenerative Endodontic Procedure: Case Report and Long-term Observations

Antonis Chaniotis, DDS, MD

Journal of Endodontics
Volume 44, Issue 3, Pages 432-437 (March 2018)
DOI: 10.1016/j.joen.2017.11.008

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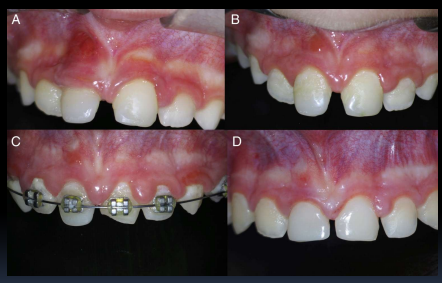

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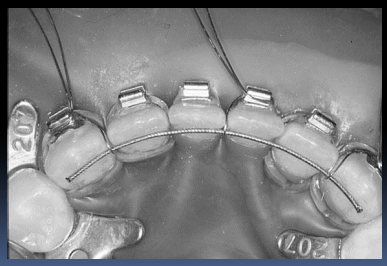
4. Are there special considerations when we perform a root canal treatment by an orthodontic patient?



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Endo during orthodontic treatment

1. Diagnosis

During an orthodontic treatment the endodontic treatment is complicated by:

- Changes in the bone are not always pathologic
- Metal rings and wires complicate radiographic interpretations
- Sensibility tests are usully impossible

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Endo during orthodontic treatment

2. Treatment

- Difficulties with rubber dam placement
- Lingual/ palatinal brackets make the access opening difficult
- Lingual/ palatinal retention wire
- Remember that removing retention wires and placing them again is relative easy and quick (Krell et al. 1993)

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Endo during orthodontic treatment

Treatment

- Apical resorption- no constriction. Important for length measurements and filling
- Electronic apex locator ?

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Ortho/ Endo case

Hesam Mirmohammadi
ACTA

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Healthy girl 13 year

Rapid maxillary expansion, after: brackets

H. Mirmohammadi

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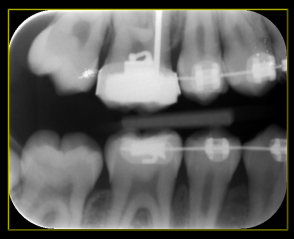
1 year into the treatment: pain 16, dentist could not diagnose the reason for the complaints because of the orthodontic metal ring
Month later: Ring removed. No caries found. Pain subsides



H. Mirmohammadi

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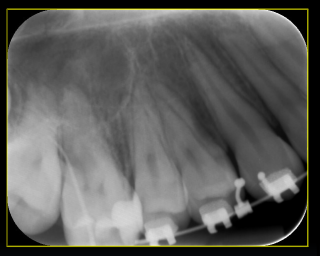
Clinical testing 16:

Cold: 16+/ 26+
Percussion: 16-
Palpation: 16-
Pocket : Buc.: 8 mm
X-ray: Tracing through the pocket



Diagnosis: Localized aggressive juvenile periodontitis ?!

-Referral to the priodontist

H. Mirmohammadi

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appointment periodontist

Pocket –Now not deeper than 3mm
Plaque, Furcation
Recession of 3 mm
Sensitivity: ++ (cold test!)

dental hygiene instructions

H. Mirmohammadi

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Recall

- Deep pocket and complaints are back

H. Mirmohammadi

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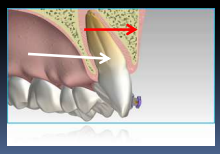
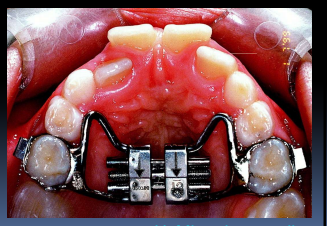
Rapid expansion

- CBCT?!
- Send back to the periodontist?
- Reffer to the orthodontist?
- Extraction ?





H. Mirmohammadi

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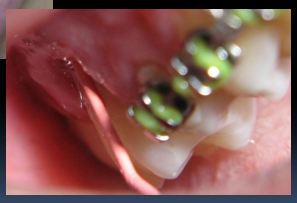

H. Mirmohammadi

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4. Are there special considerations when we perform a root canal treatment during an orthodontic treatment?

- During the diagnose always consider special situation/ external factors
- During the treatment- special attention to rubber dam, retention wire and resorptions

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5. Combinations orthodontic treatment and root canal treatments in specific situations

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Combination endo-ortho

- Ortho is sometimes indicated after trauma like in luxations en avulsions
- Ortho specific before endo: extrusion (forced eruption)
- Fractured teeth, deep caries, resorption, perforations
- Ortho for restorative reasons

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Combinations endo-ortho

Cervical root resorption

A. Braun, T. Zwart

84

Avulsion

H. Shemesh, T. Zwart

85

H. Shemesh, T. Zwart

86

H. Shemesh, T. Zwart

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5. Combinations orthodontic treatment and root canal treatments in specific situations

- Extrusion (Usually for restorative reasons)
- Trauma

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Questions

1. How does an orthodontic tr… pulp?
   1. Vascularisation
   2. Reaction to EPT/ cold
   3. narrowing
2. Is there a difference in resc… between teeth with/ without root canal trea…
   1. YES
   2. NO
3. Does an endodontically treated tooth react the same to orthodontic treatm…
   NO
4. Are there special considerations when we perform a root canal treatment by a … odontic patient?
   YES
5. Combinations orthodontic treamtnet and root canal treatments in specific…
   1. Trauma
   2. Restorative
   3. Extrusion

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Summary

- Complications during and after ortho are usually multifactorial and seldom only because of the orthodontic treatment
- Teeth after trauma have more chance for complications

In situations of advanced resorption ask the orthodontist to stop pause or shorten the treatment and consider root canal treatment.

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