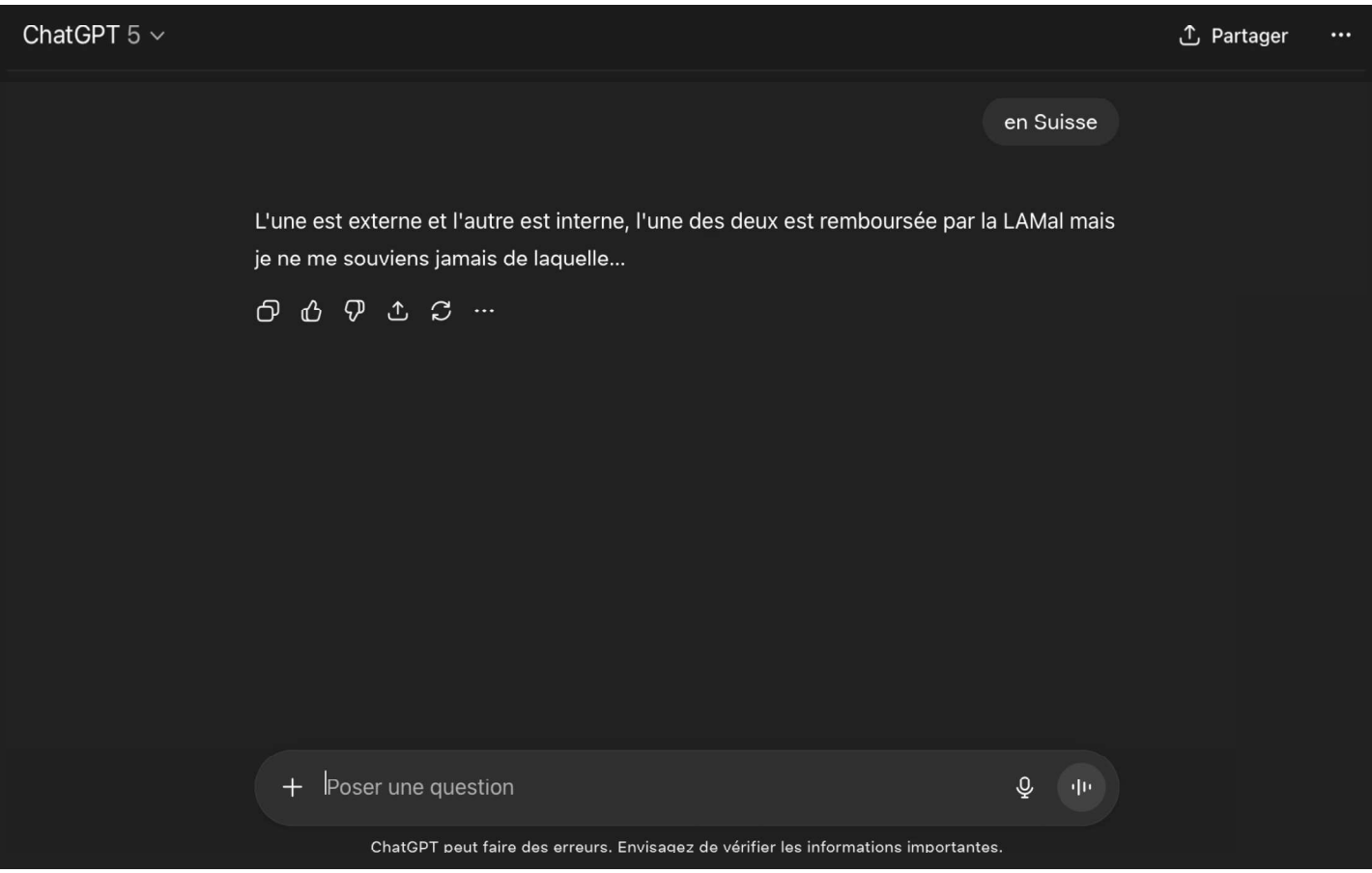
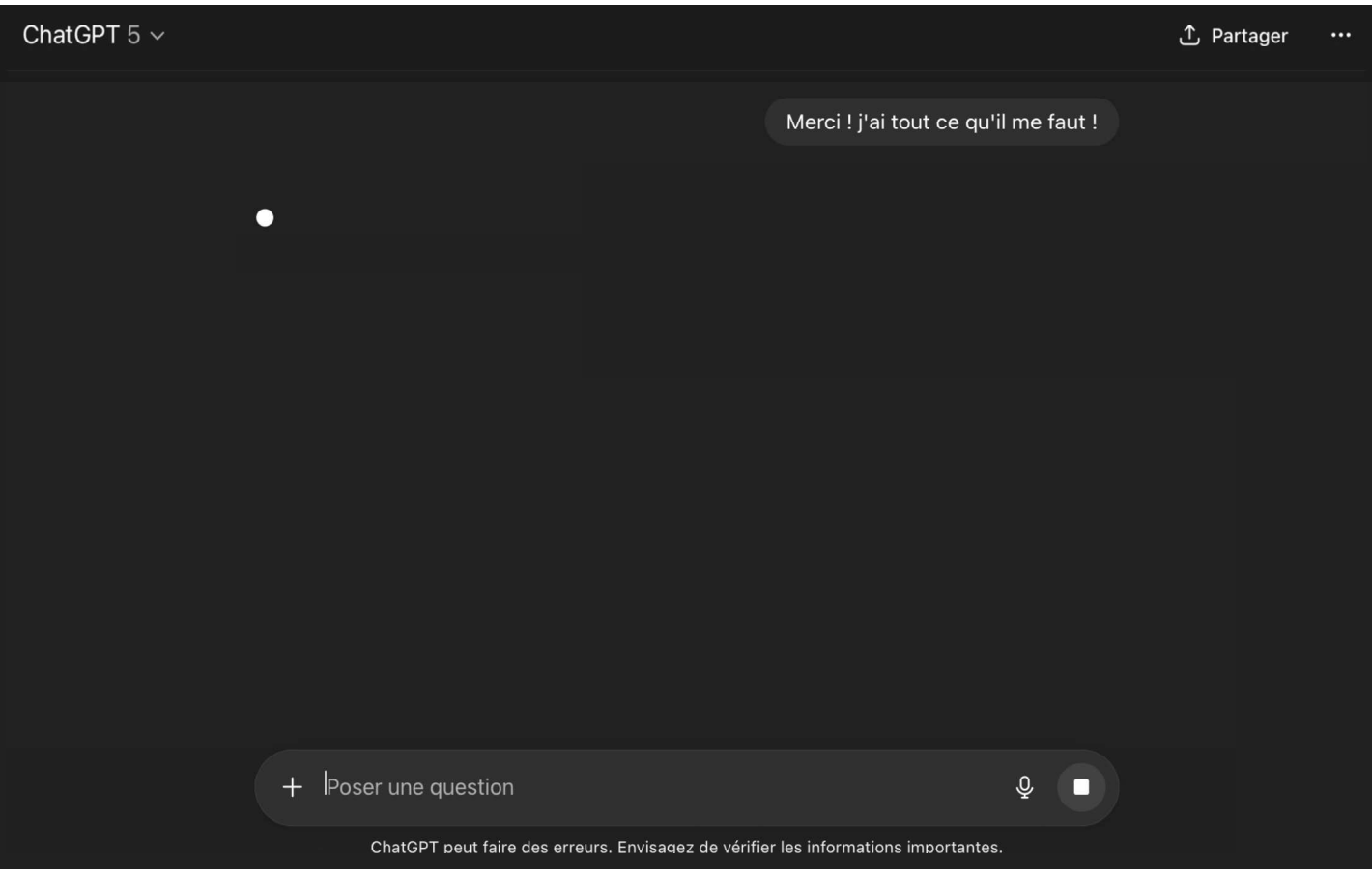
Résorptions radiculaires

Julian LEPRINCE Montreux 2025

UNIVERSITÉ DE GENÈVE
FACULTY OF MEDICINE
University Clinics of
Dental Medicine - CUMD


ChatGPT 5
Partager
que faut-il savoir en bref sur les résorptions dentaires ?
Poser une question
ChatGPT peut faire des erreurs. Envisagez de vérifier les informations importantes.


ChatGPT 5
Partager
en Suisse
L'une est externe et l'autre est interne, l'une des deux est remboursée par la LAMal mais je ne me souviens jamais de laquelle...
Poser une question
ChatGPT peut faire des erreurs. Envisagez de vérifier les informations importantes.


ChatGPT 5
Partager
Merci ! j'ai tout ce qu'il me faut !
Poser une question
ChatGPT peut faire des erreurs. Envisagez de vérifier les informations importantes.

Résorptions radiculaires

Mécanismes

✓Mieux comprendre

& Manifestations cliniques

✓Mieux diagnostiquer

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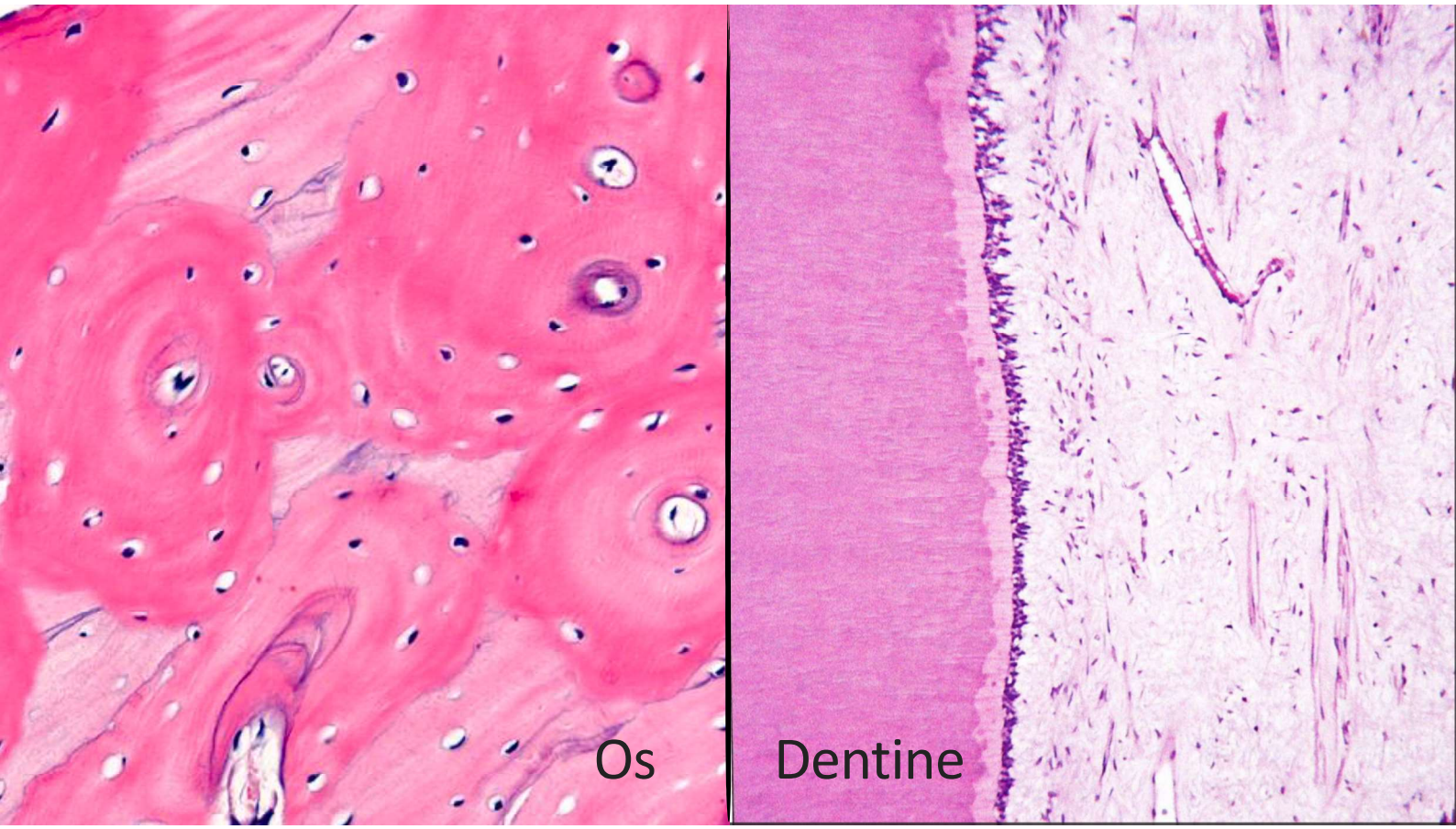
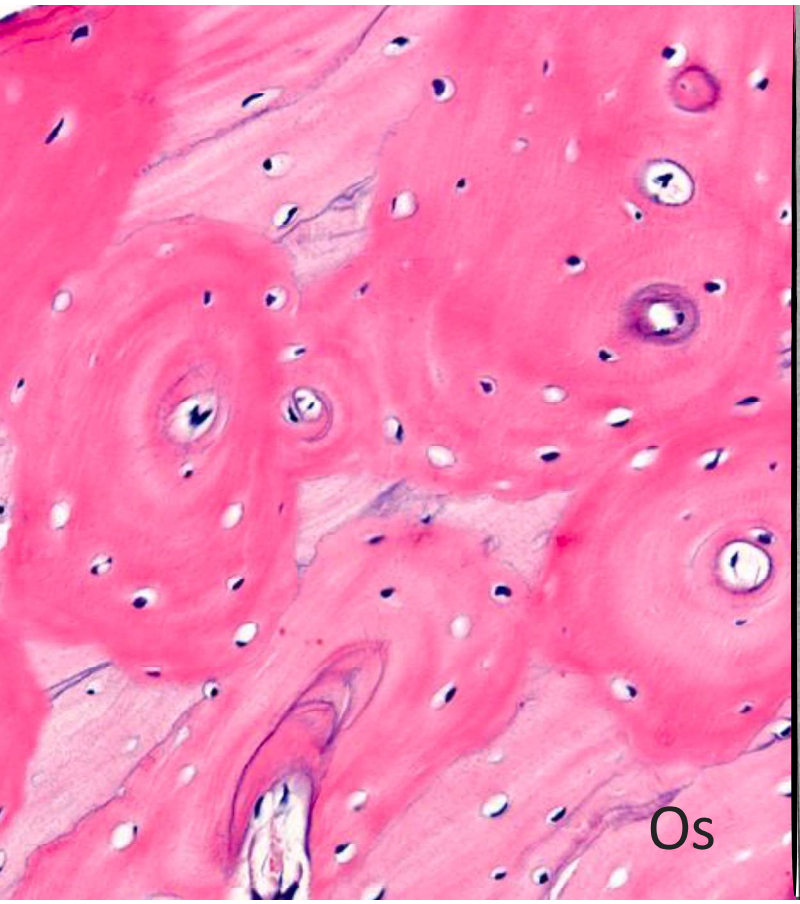

Os
Dentine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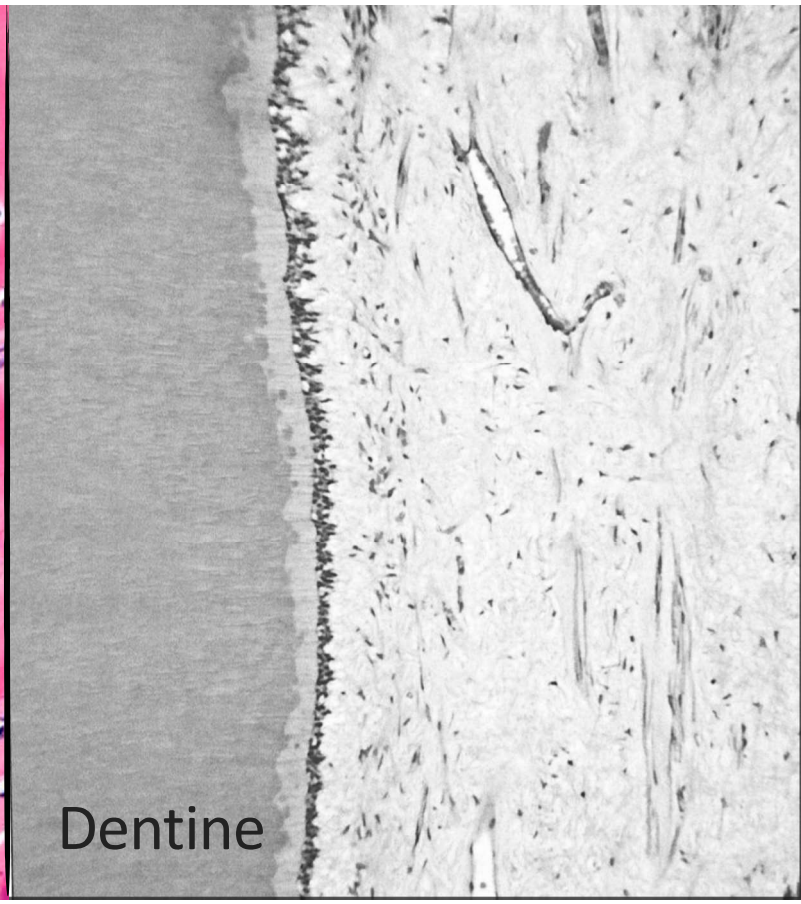
Dentine

BONE RESORPTION

Process by which osteoclasts break down the tissue in bones and release the minerals, resulting in a transfer of calcium from bone tissue to the blood

Tilg et al., Gut 2008

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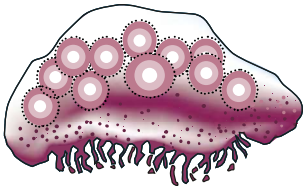
OSTEOCLAST ACTIVATION

Bone marrow precusor

CFU-S

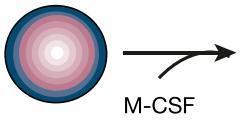
Activated osteoclast



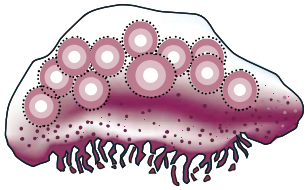
Boyle et al., Nature 2003

OSTEOCLAST ACTIVATION

Bone marrow precusor



Activated osteoclast



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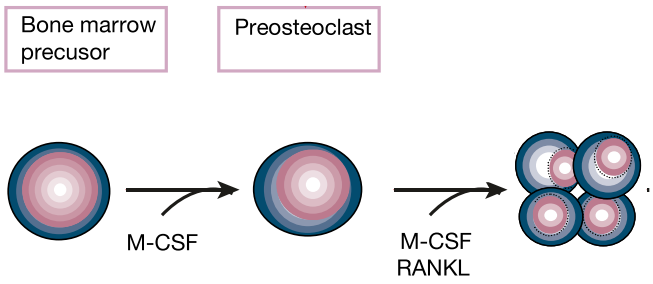
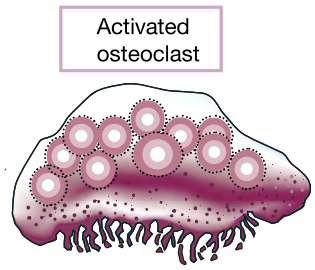
OSTEOCLAST ACTIVATION





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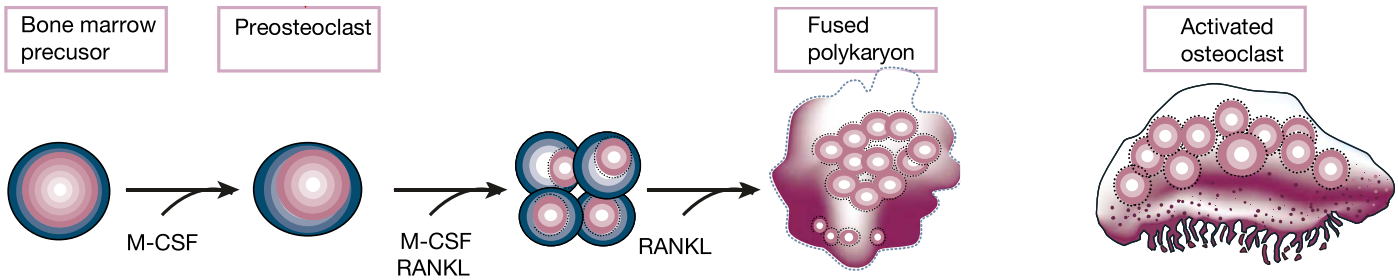
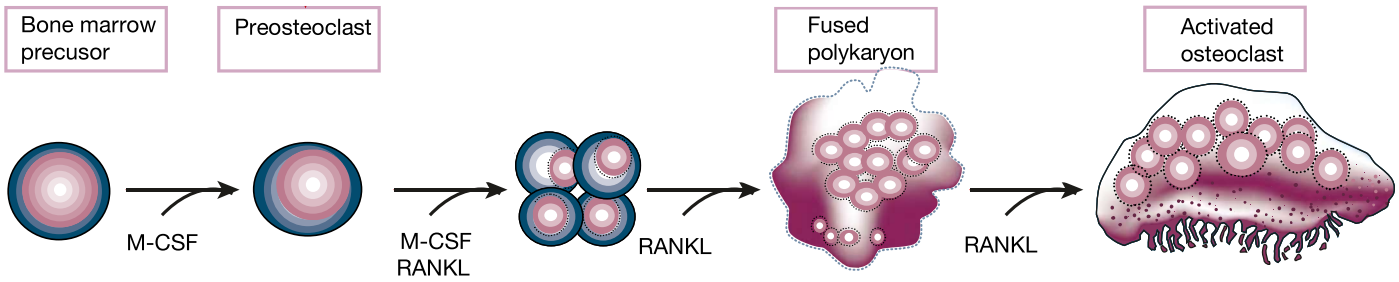


Boyle et al., Nature 2003

OSTEOCLAST ACTIVATION

M-CSF
RANKL



Boyle et al., Nature 2003

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Process by which osteoclasts
break down the tissue in bones
and release the minerals,
resulting in a transfer of calcium
from bone tissue to the blood

Can be physiological or pathological

Tilg et al., Gut 2008

BONE RESORPTION

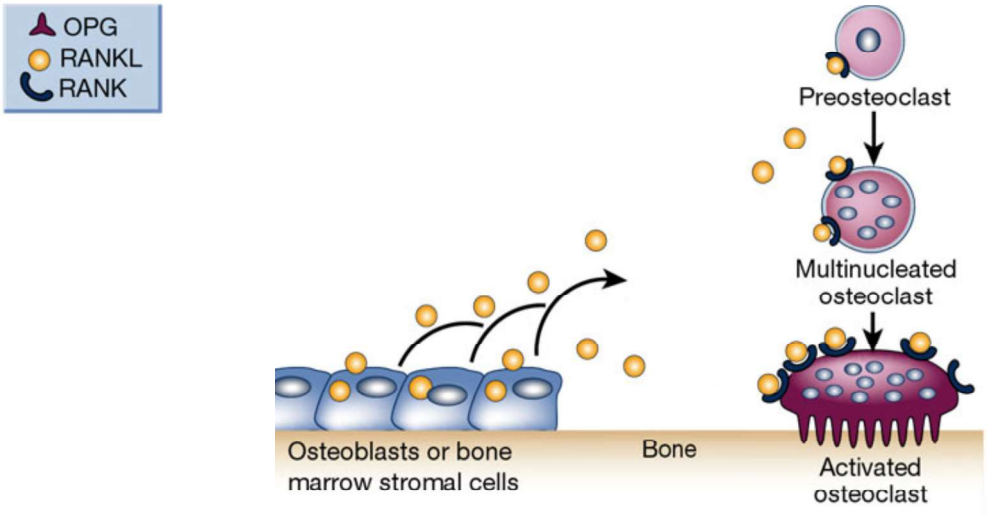
✓ Physiological bone resorption

is an integral part of bone functioning, while the bone is constantly growing thanks to two processes — breakdown and formation of bone tissue

Tilg et al., Gut 2008

PHYSIOLOGY

Resorption

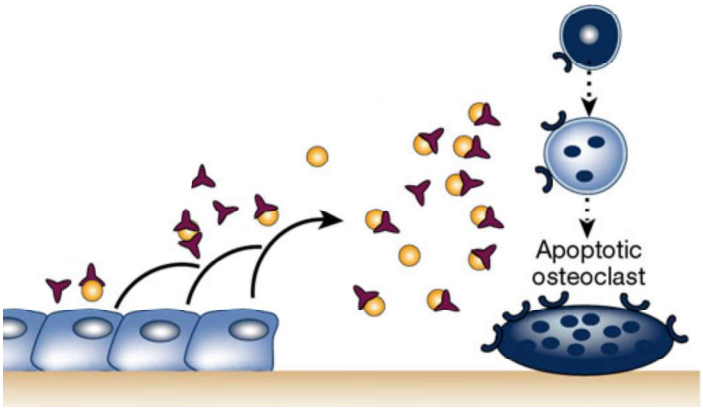


Boyle et al., Nature 2003

PHYSIOLOGY

Protection

OPG
RANKL
RANK



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PHYSIOLOGY

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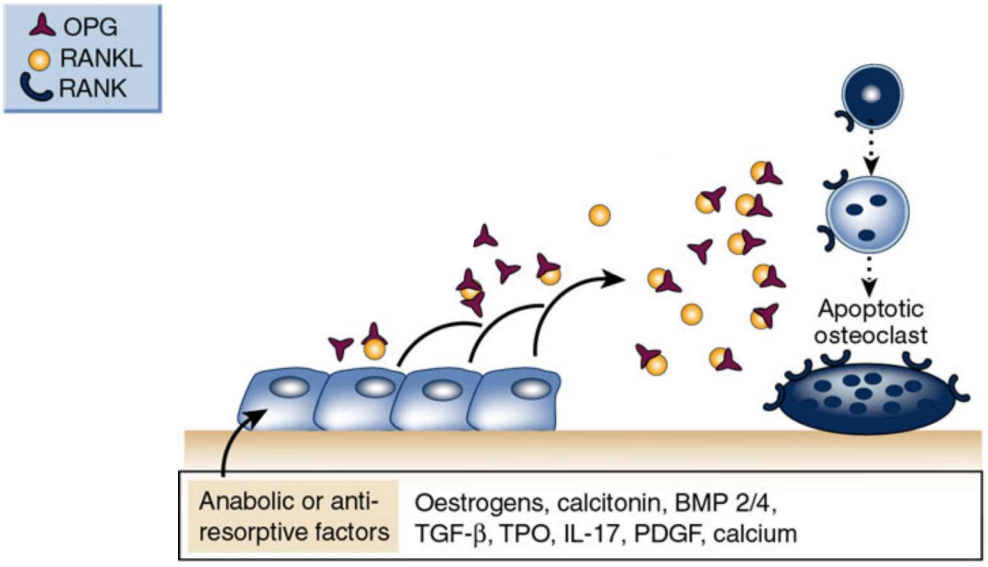

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BONE RESORPTION

✓Physiological bone resorption

is an integral part of bone functioning, while the bone is constantly growing thanks to two processes — breakdown and formation of bone tissue

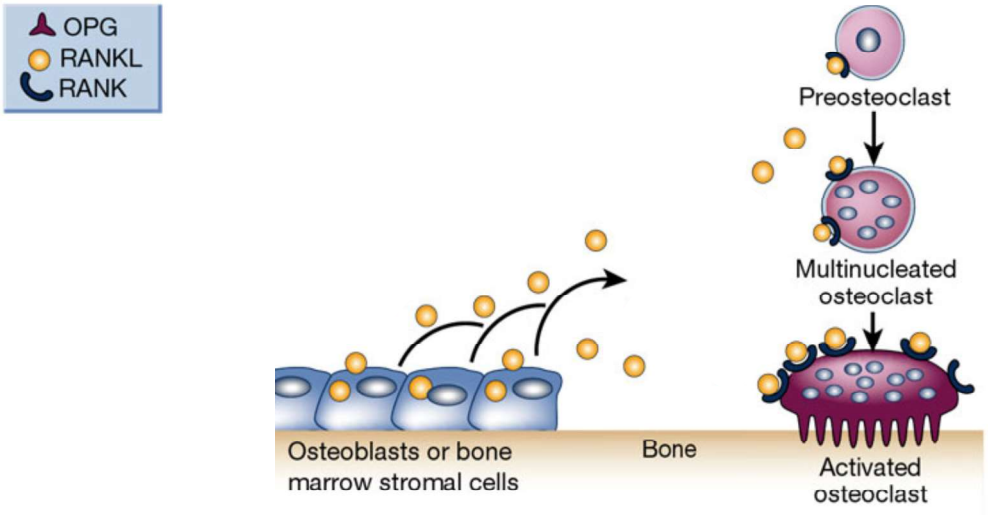
✓Pathological bone resorption

could be induced by local inflammation, (ex: trauma or infection or in several metabolic skeleton diseases, such as osteopenia and osteoporosis)

Tilg et al., Gut 2008

PHYSIOLOGY

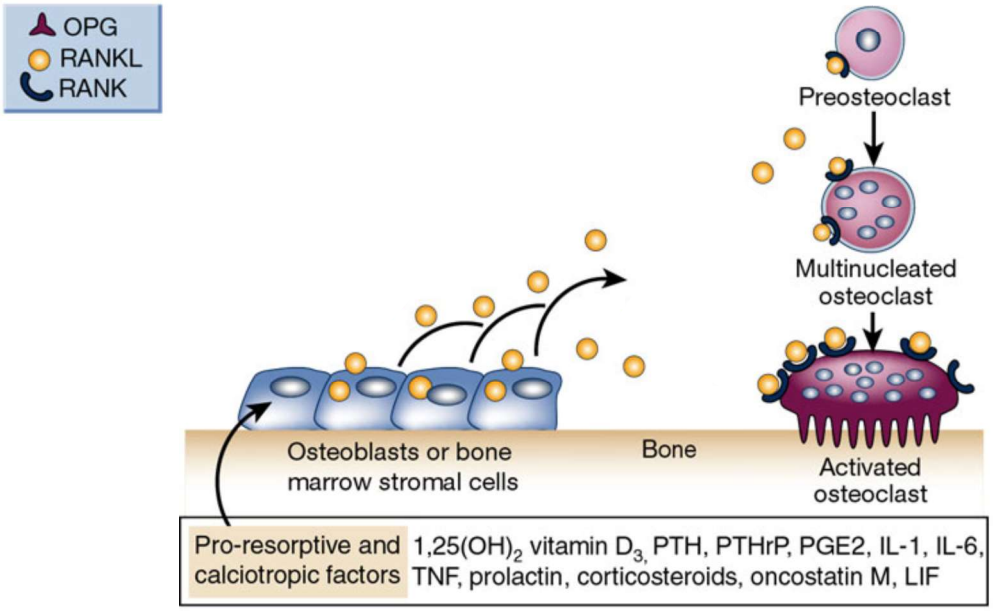
Resorption



Boyle et al., Nature 2003

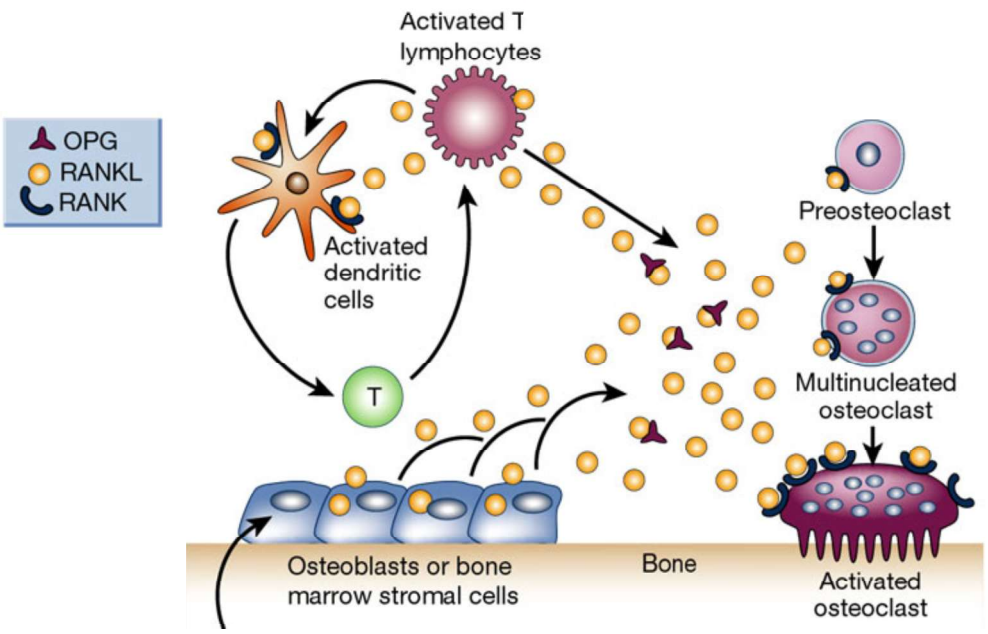
PATHOLOGY

Resorption



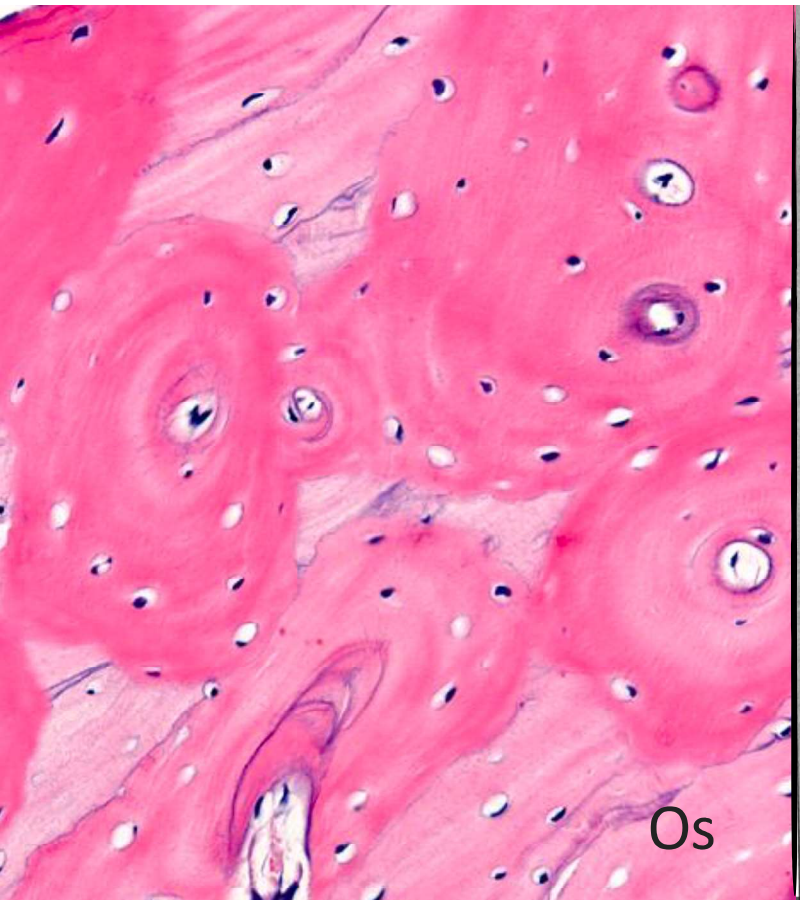
Boyle et al., Nature 2003

PATHOLOGY



Resorption

Boyle et al., Nature 2003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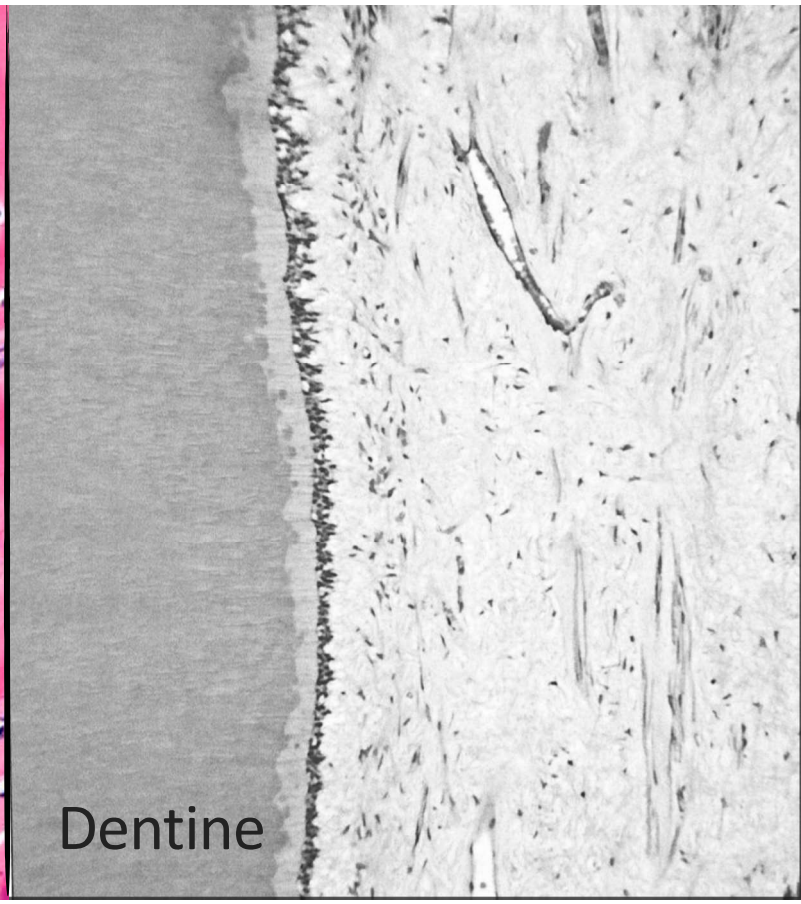
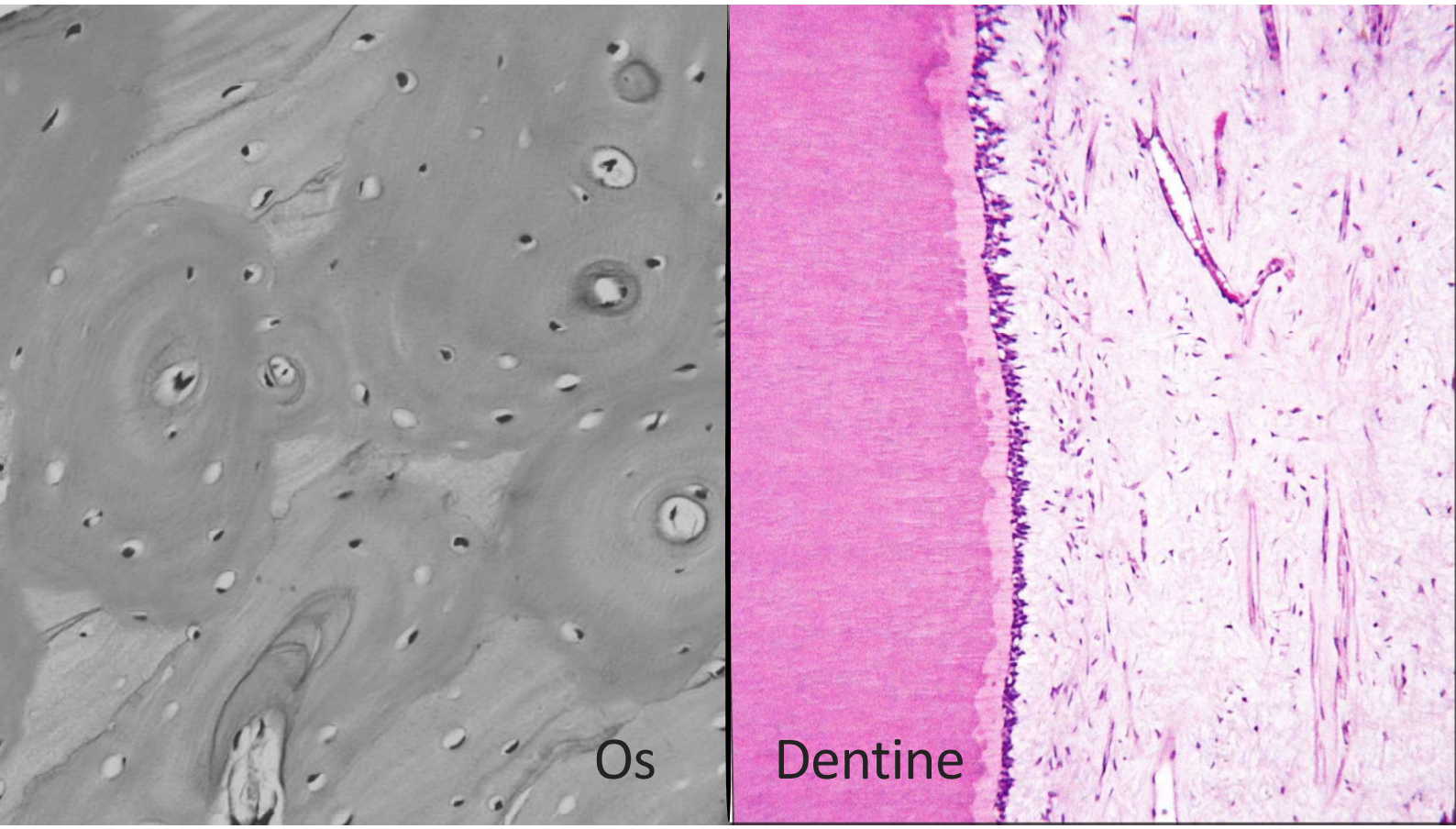

Dentine


Os
Dentine

DENTAL RESORPTION

Loss of dental hard tissues
as a result of clastic activities

Tilg et al., Gut 2008

DENTAL RESORPTION

Loss of dental hard tissues
as a result of clastic activities

Can be physiological or pathological

Tilg et al., Gut 2008

DENTAL RESORPTION

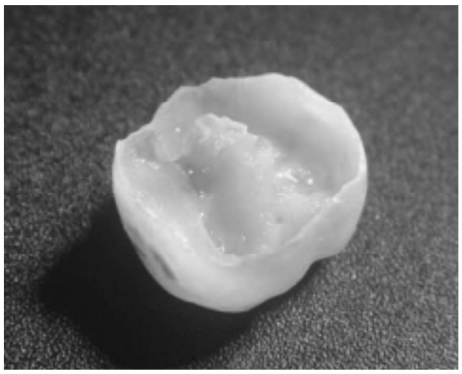
✓Physiological in primary dentition

unless it occurs prematurely

Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

DENTAL RESORPTION

Various levels of resorption



Harokopakis-Hajishengallis, J Or Sci 2007

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DENTAL RESORPTION

✓Physiological in primary dentition

unless it occurs prematurely

✓Pathological in permanent dentition

and if left untreated,
it may result in premature loss of the affected teeth

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CHARACTERISTICS OF THE PHENOMENON

- ✓ Often detected during routine clinical examination, or as an incidental radiographic finding
- ✓ The patient may be asymptomatic
- ✓ The process may be self-limiting

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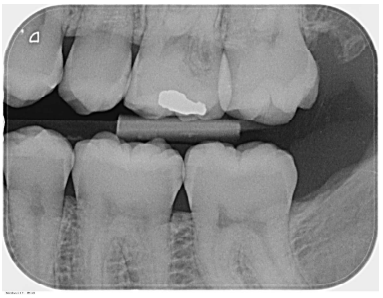
CHARACTERISTICS OF THE PHENOMENON



11/2013

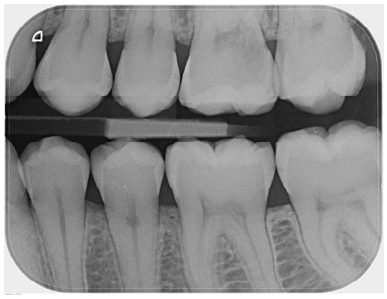
07/2015

06/2016

12/2017

11/2018

12/2019



11/2020

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CHARACTERISTICS OF THE PHENOMENON

- ✓ If the initial surface resorptive process is sustained …

  for example, by infection and/or pressure

- ✓ …then dental hard tissue destruction will continue and substantial tooth tissue loss may occur
- ✓ This may result in the tooth becoming **untreatable.**

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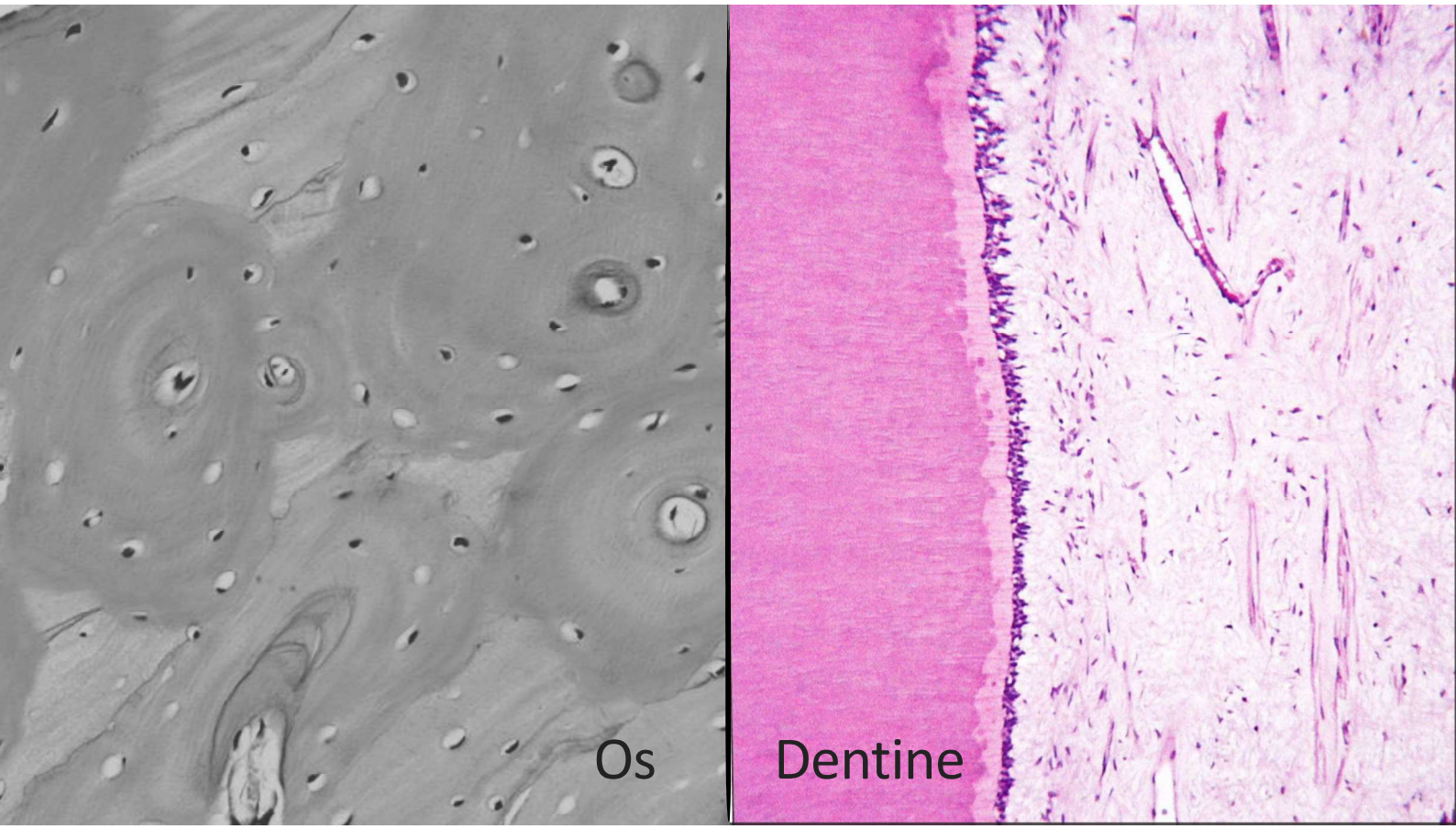
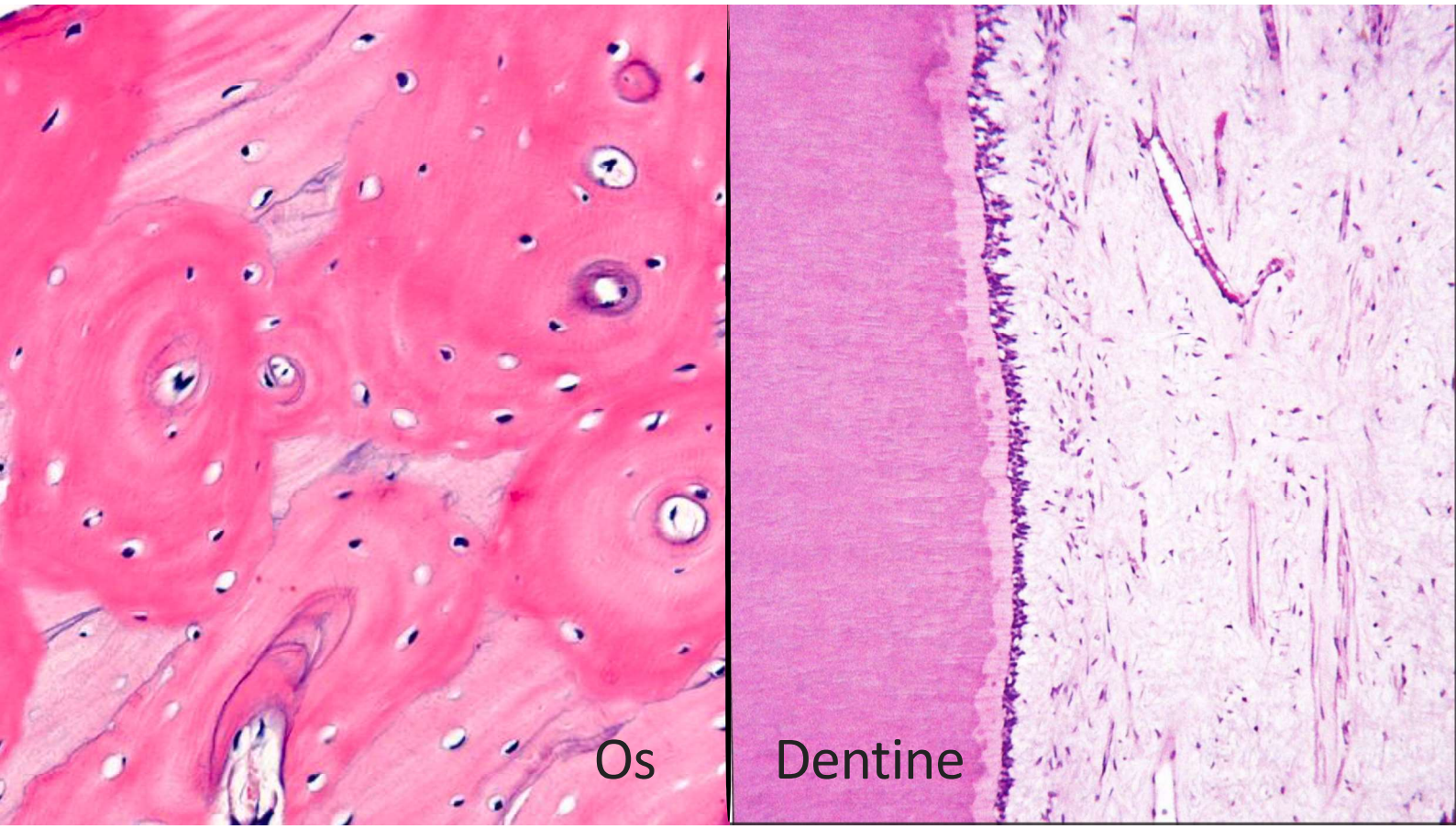

Os
Dentine


Os
Dentine

OSTEOCLASTS vs ODONTOCLASTS

= Resorb tissues through the same mechanisms

= Have the same enzymatic properties

= Have the same cytological characteristics

= Attach to the tissue in the same way

≠ Affected tissues

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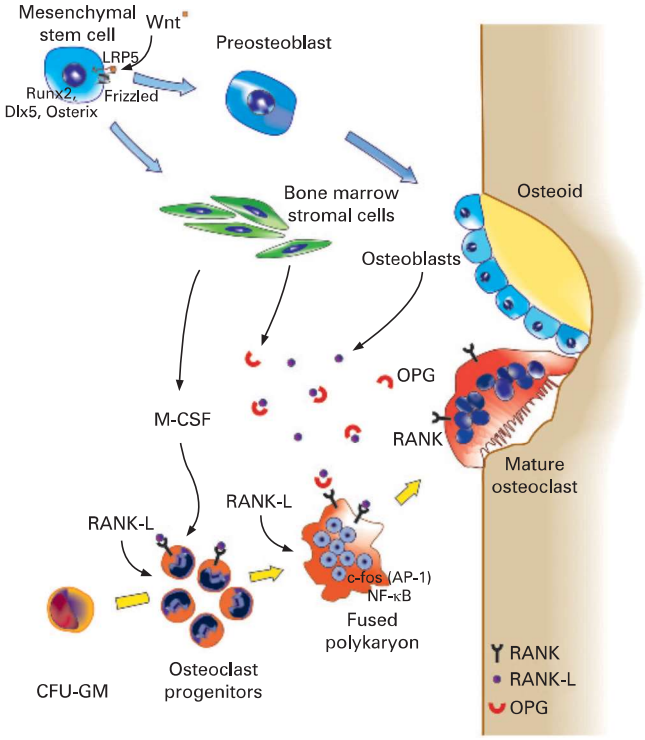
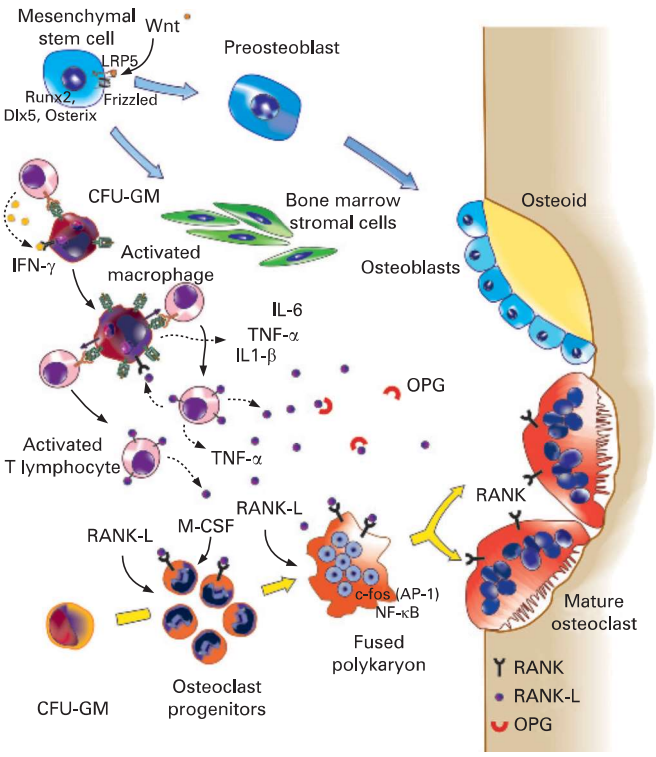
Physiological conditions



Pathological conditions (chronic inflammation)



Tilg et al., Gut 2008

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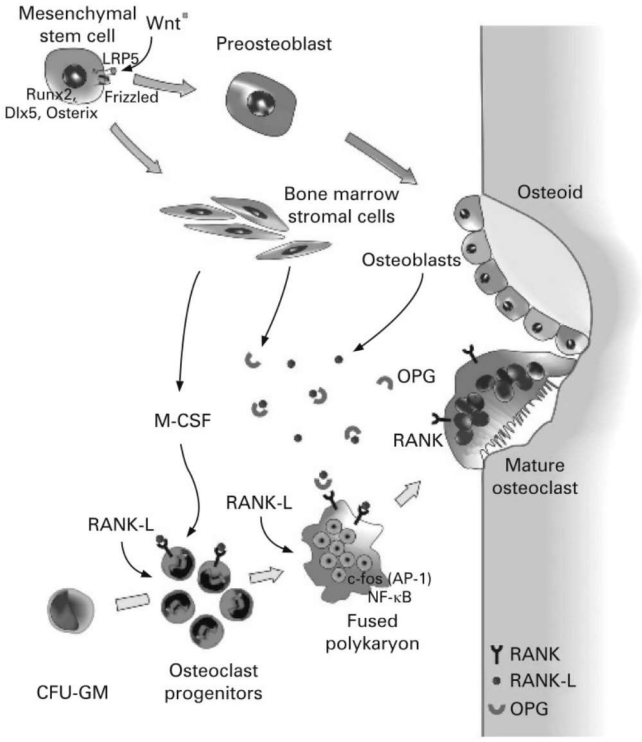

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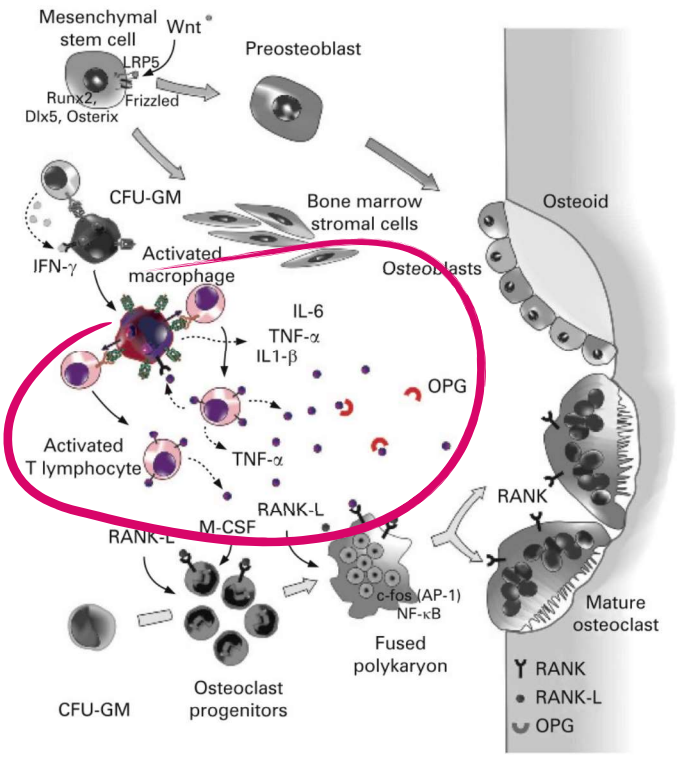

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PREREQUISITES FOR DENTAL TISSUE RESORPTION

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PREREQUISITES FOR DENTAL TISSUE RESORPTION

1. Inflammation

   Recrutement and activation of clastic cells to the site of injury by various inflammatory cytokines

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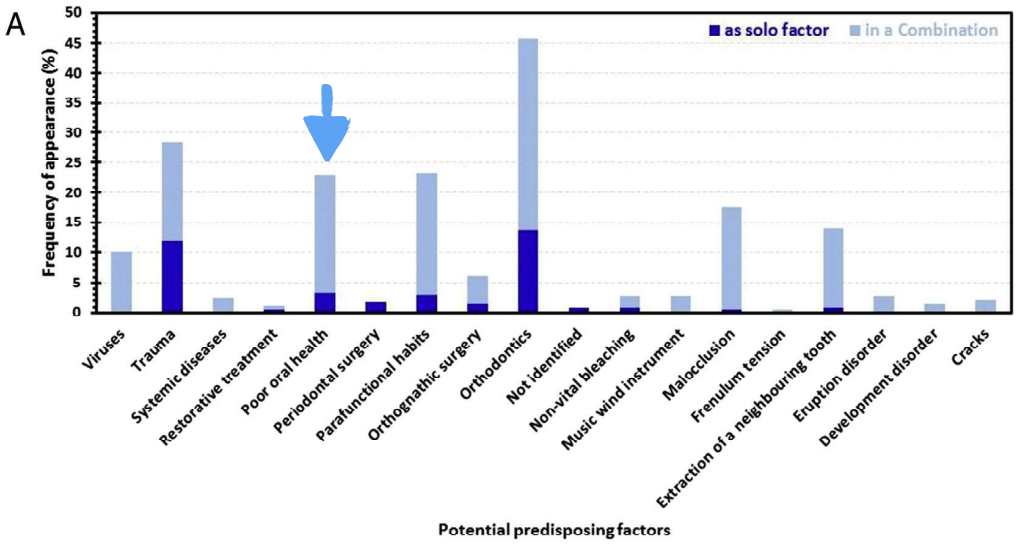
PREDISPOSING FACTORS

Factors Associated
with **External Cervical Resorption**



Mavridou et al., J Endod 2018

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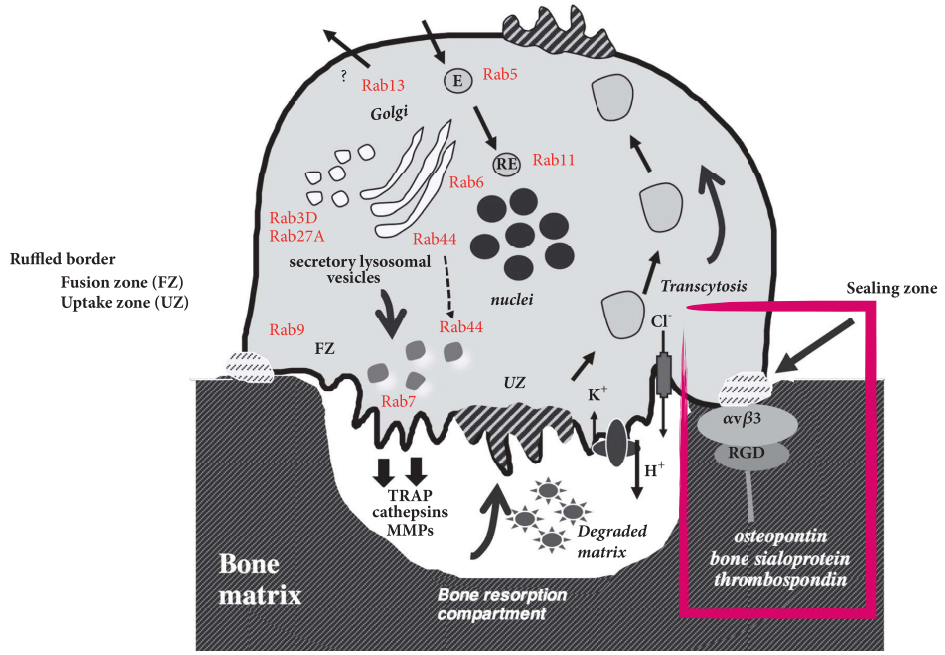
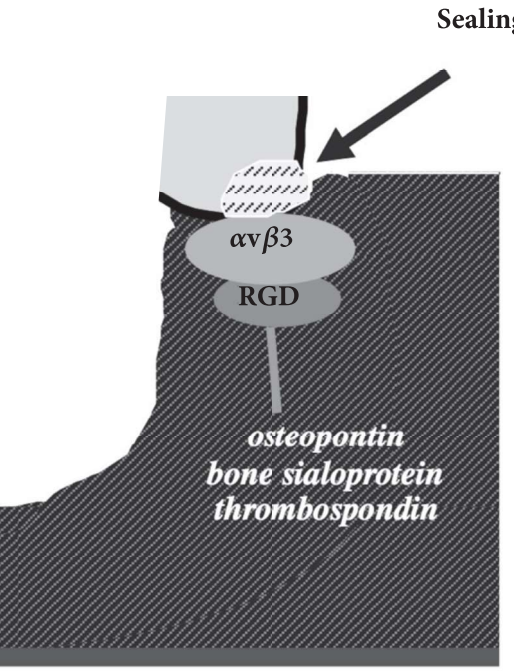
BINDING TO MINERALIZED TISSUES



Roy and Roux, BioMed Research International 2018

BINDING TO MINERALIZED TISSUES



✓The recruited activated clastic cells bind to the extracellular protein containing arginine-glycine-aspartic acid (RGD) sequence of aminoacids present on the surface of mineralized tissues by means of integrins (αvβ3)

Roy and Roux, BioMed Research International 2018

PROTECTION AGAINST BINDING

PROTECTION AGAINST BINDING

✓Clastic cells are not capable of adhering to unmineralized collagen matrices ~~(RGD)~~

That includes pre-dentin and pre-cement

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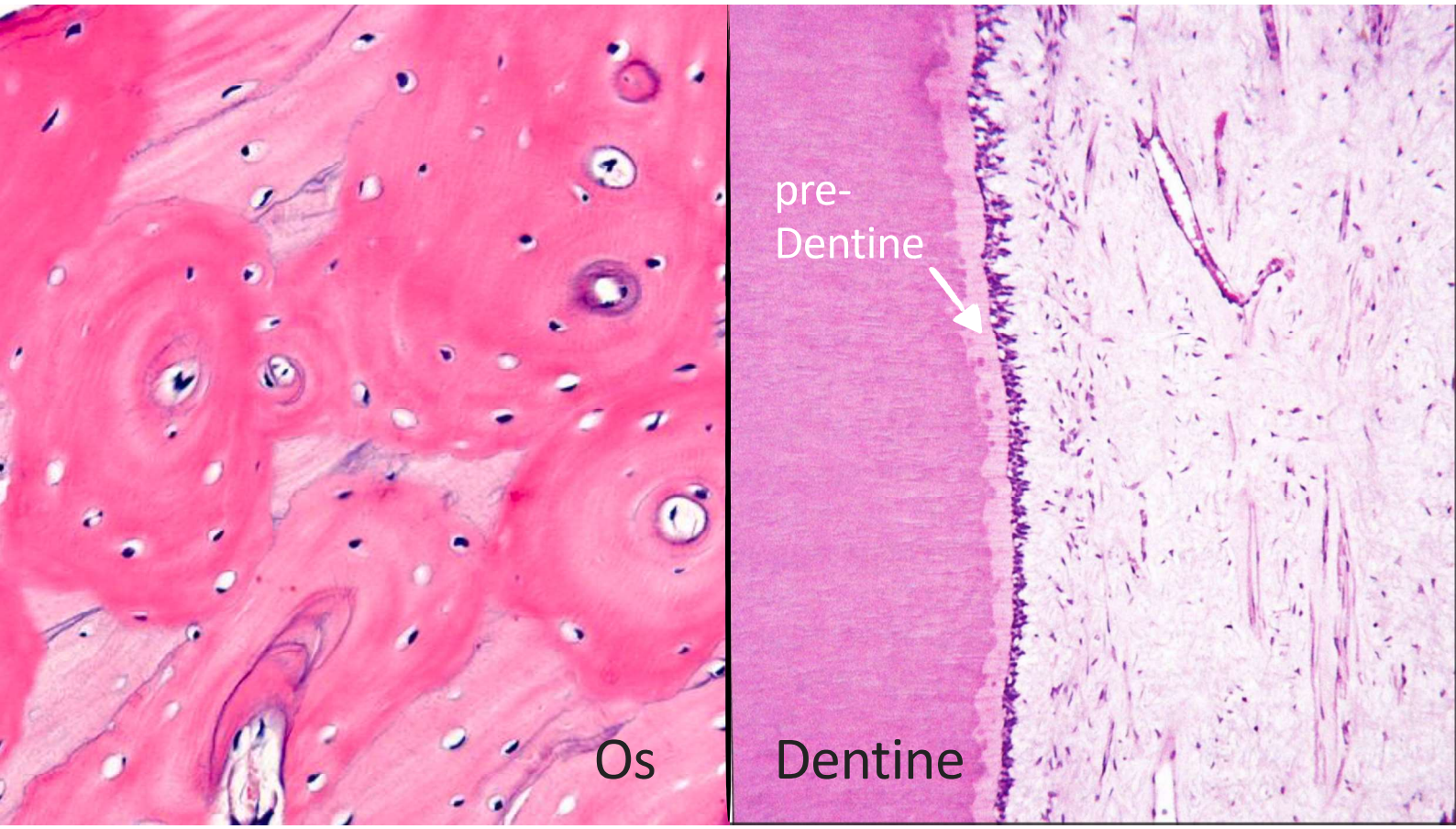
pre-
Dentine
Os
Dentine

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PROTECTION AGAINST BINDING

- ✓ Clastic cells are not capable of adhering to unmineralized collagen matrices ~~(RGD)~~
  - That includes pre-dentin and pre-cement
- ✓ Fibroblasts from periodontal ligament and odontoblasts produce OPG
  - Which neutralizes RANKL and prevents clastic differentiation in close proximity

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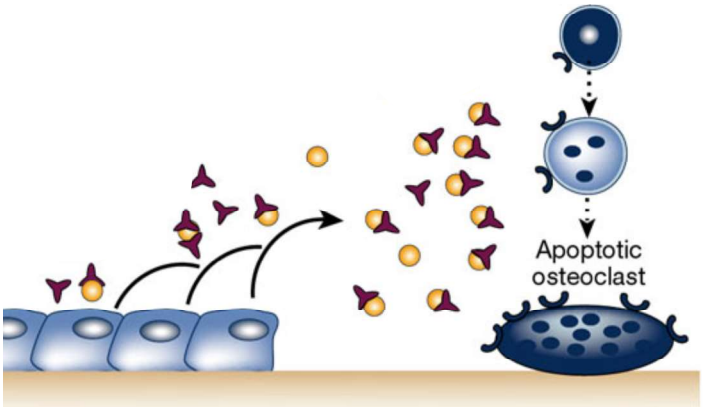
PHYSIOLOGY

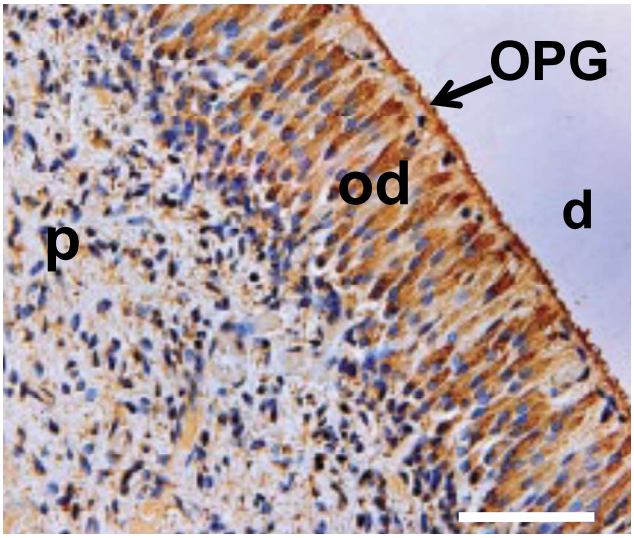
Protection

OPG
RANKL
RANK



Boyle et al., Nature 2003

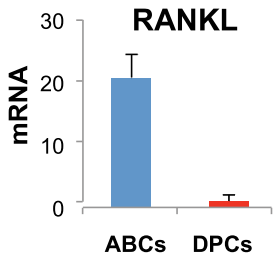
PROTECTION AGAINST BINDING

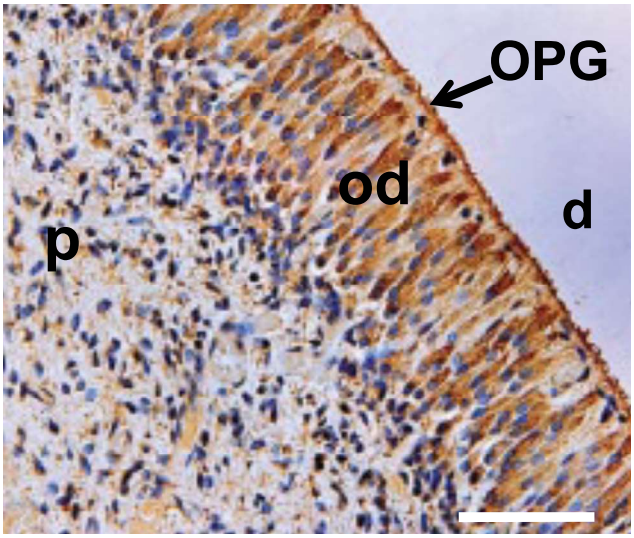


ABC = Alveolar Bone Cells
DPC = Dental Pulp Cells

Zheng et al., JDR 2015

PROTECTION AGAINST BINDING





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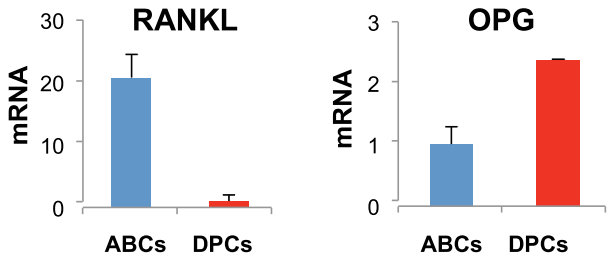
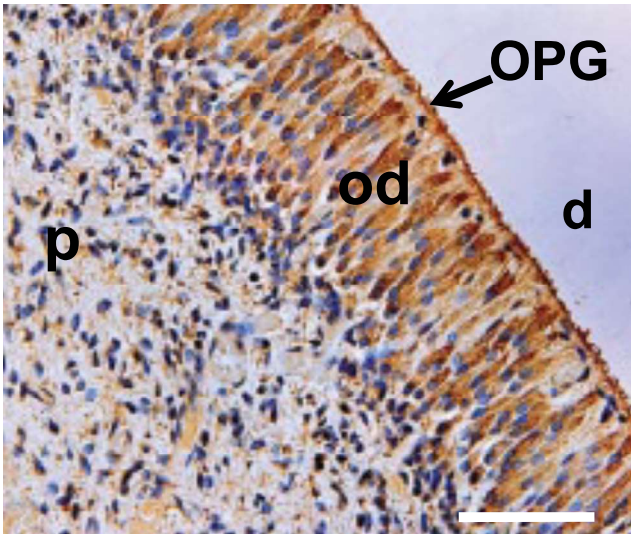


	RANKL:OPG
ABCs	41
DPCs	1



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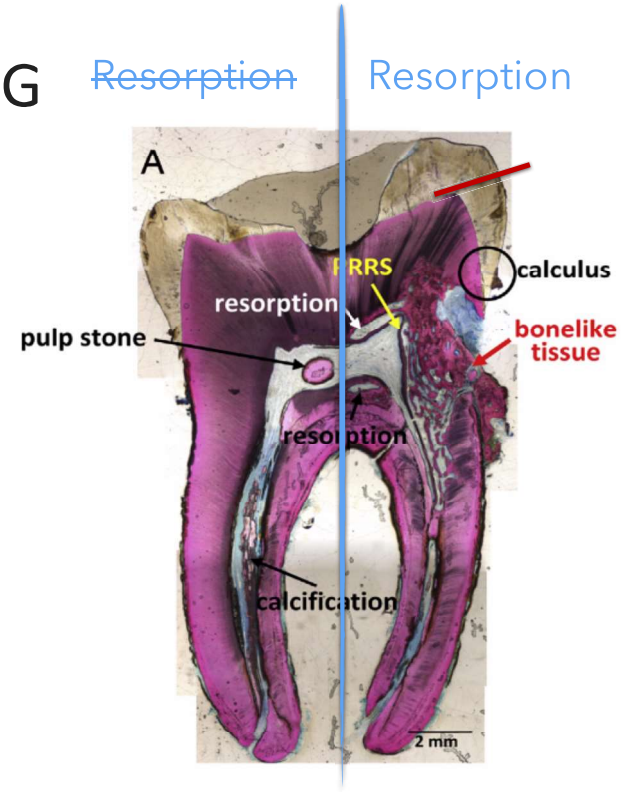
PROTECTION AGAINST BINDING

~~Resorption~~ Resorption



Mavridou et al, J Endod 2016

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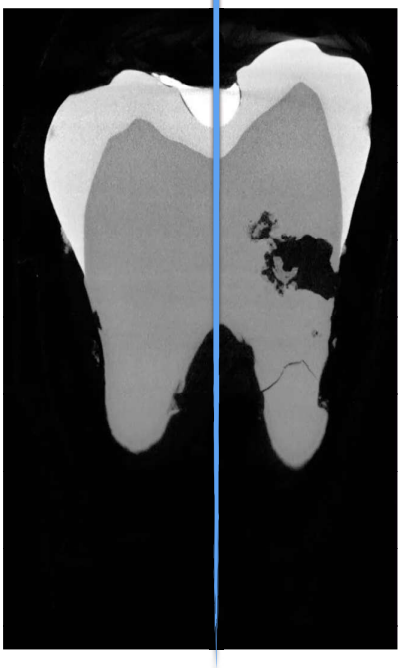
~~Resorption~~ Resorption



Kindly from Prof. Lambrechts (KULeuven)

PREREQUISITES FOR DENTAL TISSUE RESORPTION

1. Inflammation

   Recruitment and activation of clastic cells to the site of injury by various inflammatory cytokines

Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

PREREQUISITES FOR DENTAL TISSUE RESORPTION

1. Inflammation

   Recruitment and activation of clastic cells to the site of injury by various inflammatory cytokines

2. Breach in the organic « barrier »

   Exposure of RGD sequences of the mineralized matrix

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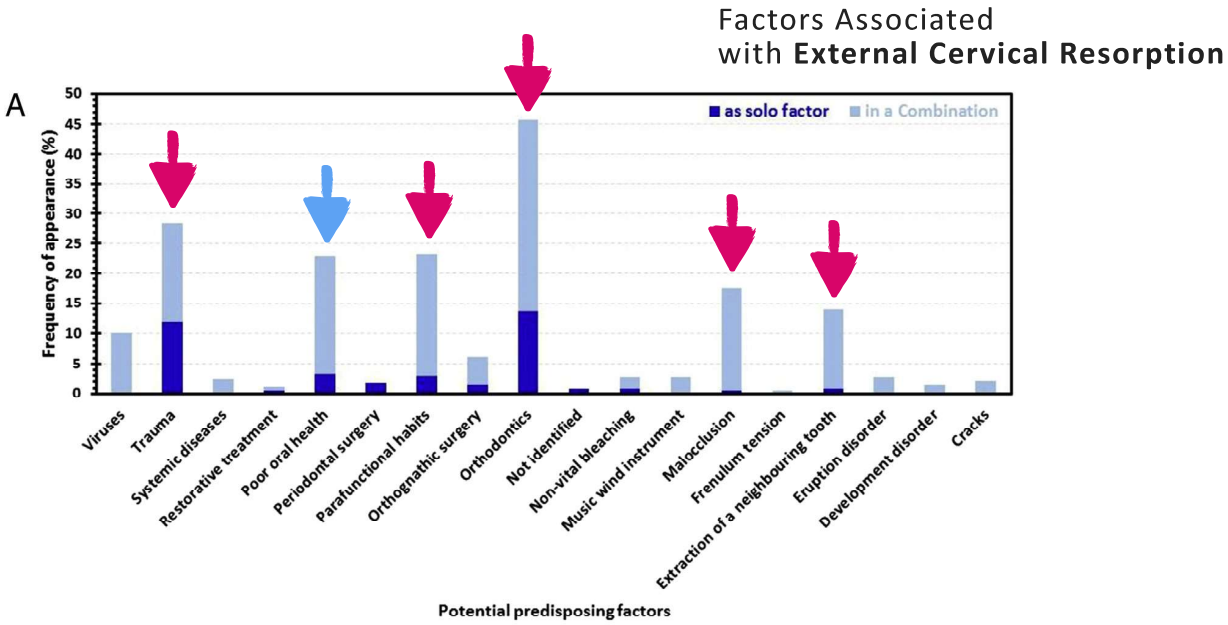
PREDISPOSING FACTORS



Mavridou et al., J Endod 2018

Résorptions radiculaires

Mécanismes

✓Mieux comprendre

& Manifestations cliniques

✓Mieux diagnostiquer

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MANIFESTATIONS CLINIQUES

- ✓ Interne
- ✓ Externe

MANIFESTATIONS CLINIQUES

- ✓ Interne
- ✓ Externe

MANIFESTATIONS CLINIQUES

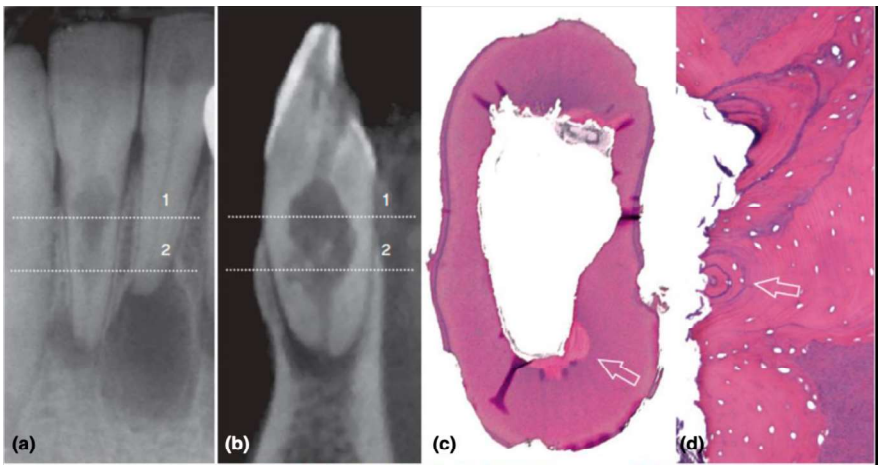
✓Interne

✓Externe

MANIFESTATIONS CLINIQUES

✓Interne

✓Externe



Patel et al., IEJ 2022

Résorption **Interne**

✓Plusieurs facteurs ont été impliqués dans la lésion/destruction de la prédentine

tels que le traumatisme, la pulpite liée aux caries, la chaleur excessive lors des procédures de restauration, le traitement orthodontique, la présence de fissures,…

✓ **Caractéristiques cliniques:**

- Dent asymptomatique, en pulpite, partiellement ou totalement nécrosée
- Test au froid + ou - (en fonction de l'avancée de la pathologie pulpaire)
- Percussion peut être douloureuse

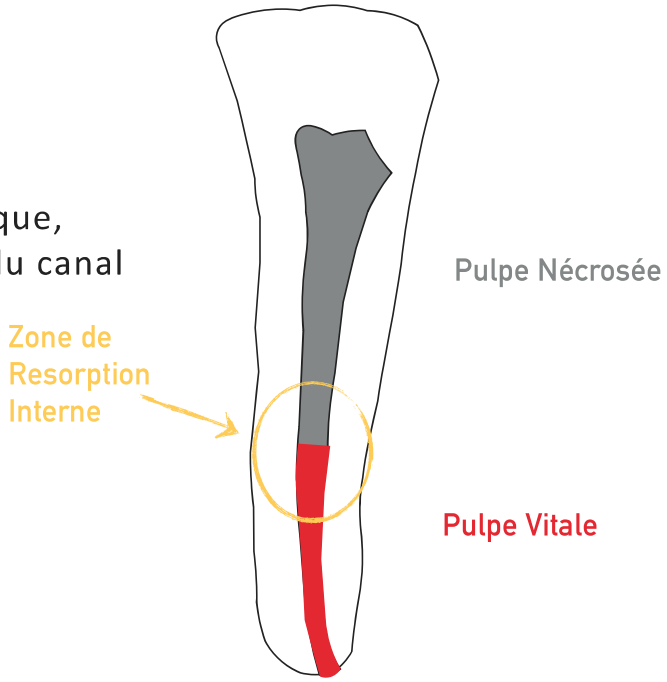
✓Processus dure jusqu'à la **nécrose** complète

Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

Résorption **Interne**

✓ Caractéristiques radiologiques:

- Continuité du canal avec la résorption, symétrique, ronde ou ovale, en "ballonnement" de la paroi du canal



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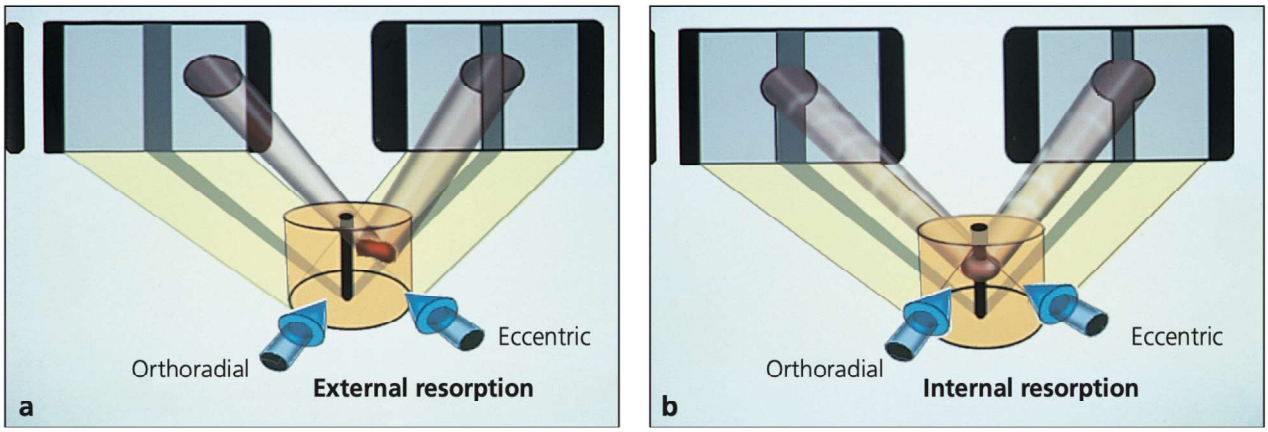
Résorption **Interne**

✓ Caractéristiques radiologiques:

- Centrée sur le canal



Linda G. Levin ; Dental Pulp Chapter 17

MANIFESTATIONS CLINIQUES

- ✓ Interne
- ✓ Externe

MANIFESTATIONS CLINIQUES

✓Interne

✓Externe

CERVICALE
SURFACE
APICALE

✓Caractéristiques cliniques:

- Souvent asymptomatique
- Test au froid généralement normal (couche de protection >< pulpe)
- Percussion non douloureuse
- Porte d'entrée au-dessus ou sous l'attache épithéliale
- Pas de sondage parodontal en regard de la résorption
- Occasionnellement visible sous forme de « pink spot » cervical: aspect rosé de la dent

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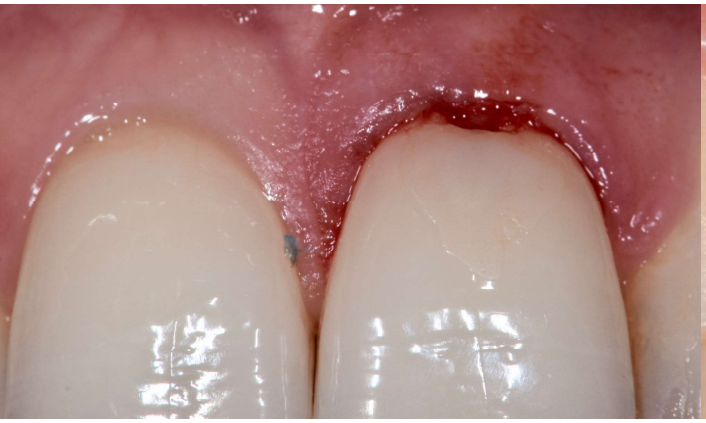
✓Caractéristiques cliniques:



Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

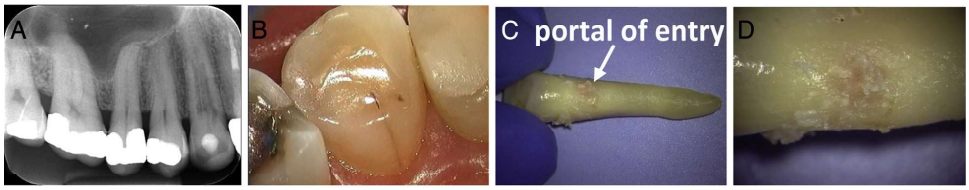
✓Caractéristiques radiographiques:

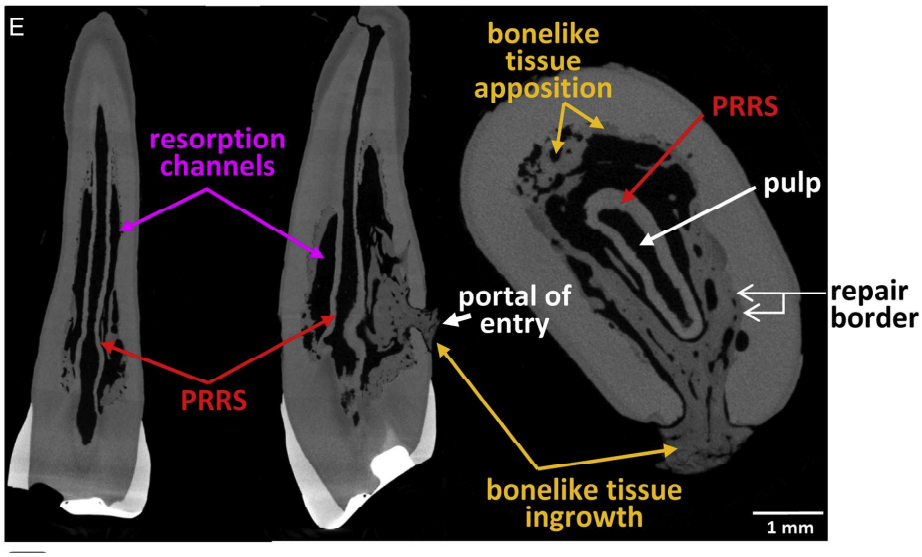
- Superposition du canal par rapport à la lésion
- Aspect en nid d'abeille
- N'est généralement pas centrée sur la canal

Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

Résorption **Externe**

CERVICALE





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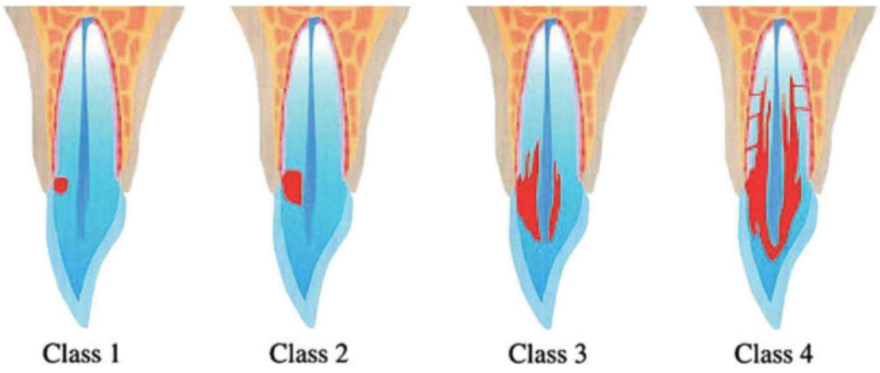
Mavridou J Endod 2016

Classification de Heithersay



Influence sur la **thérapeutique**: intervention ou monitoring

Invasive cervical resorption: An analysis of potential predisposing factors. Heythersay and al, Quintessence, 1999

Résorption **Externe**

CERVICALE

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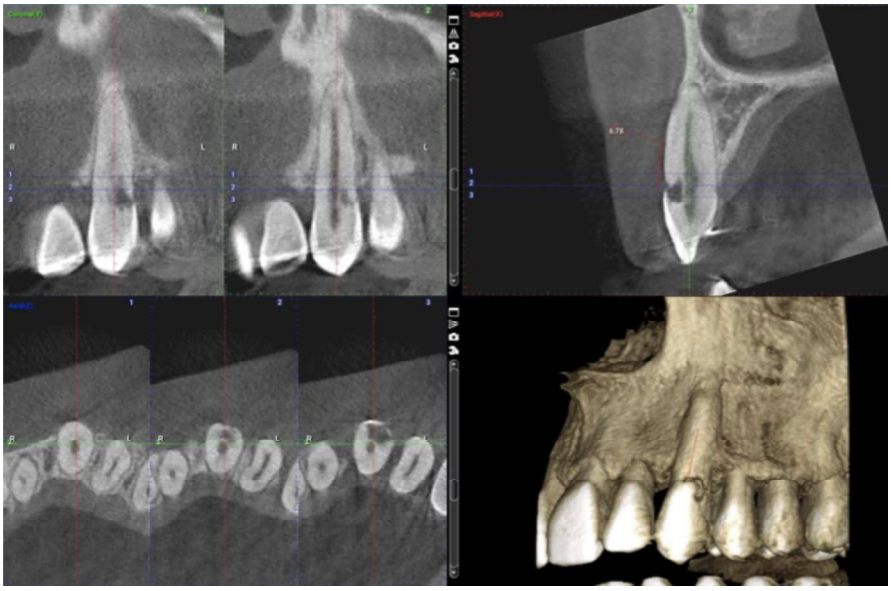
Résorption **Externe**

CERVICALE



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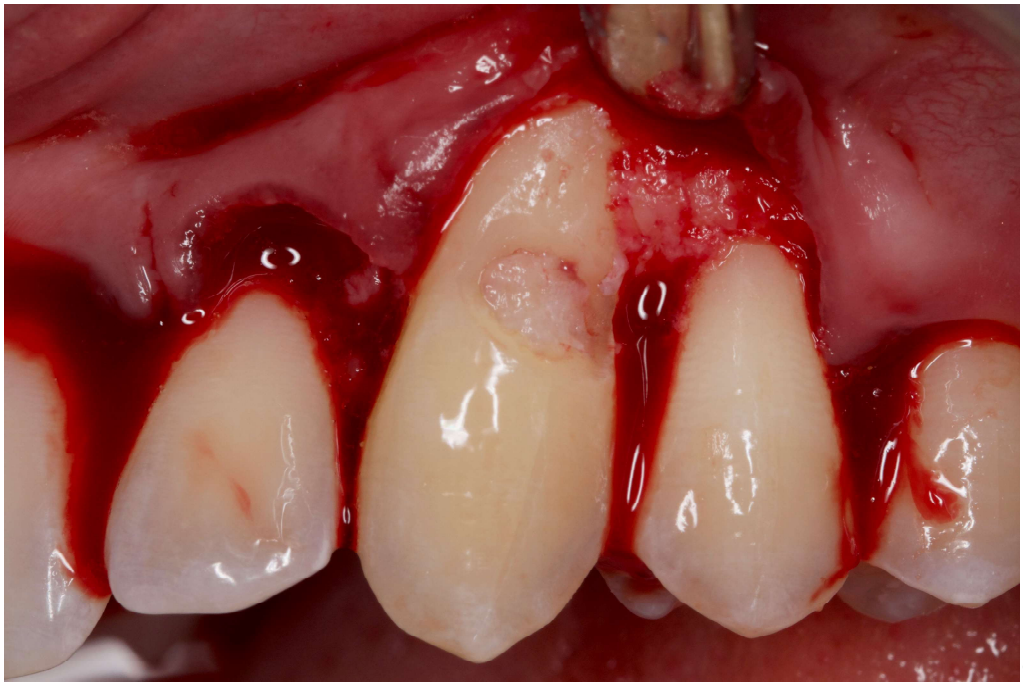

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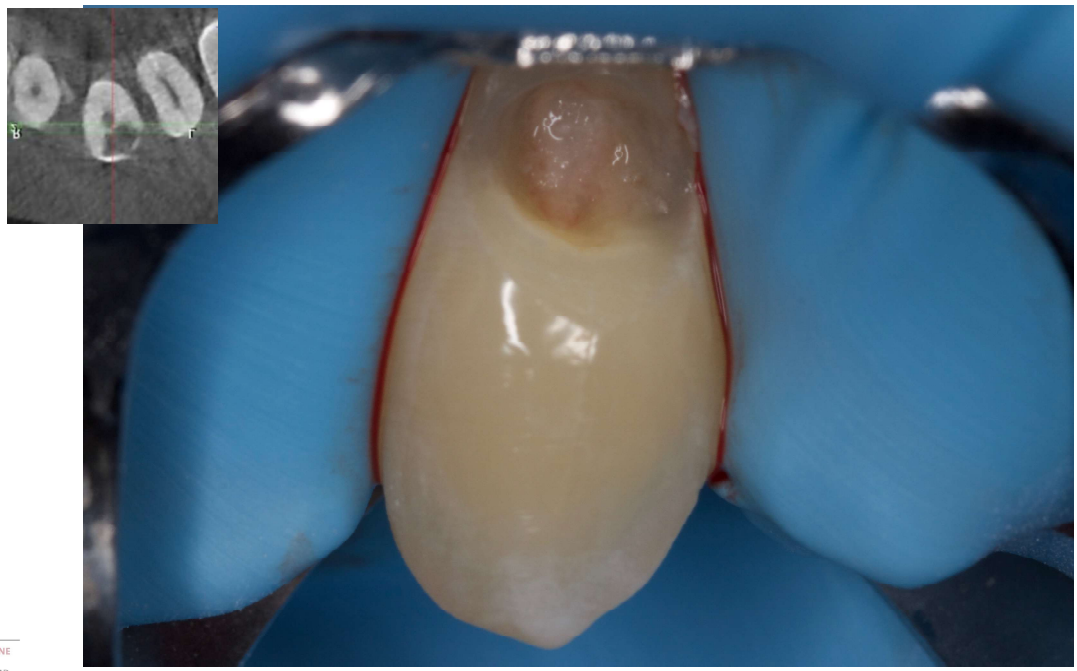

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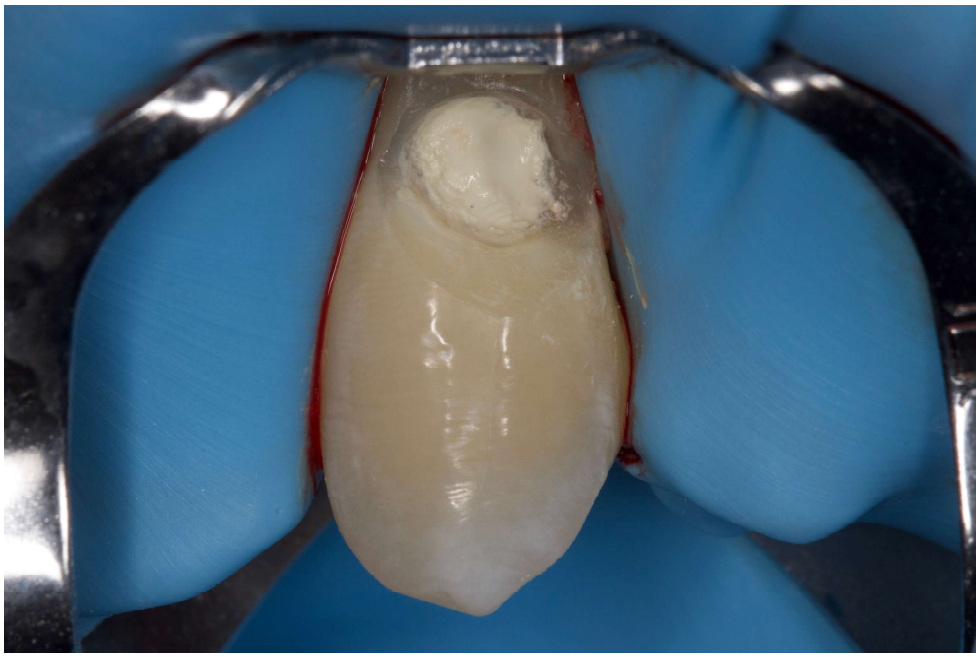

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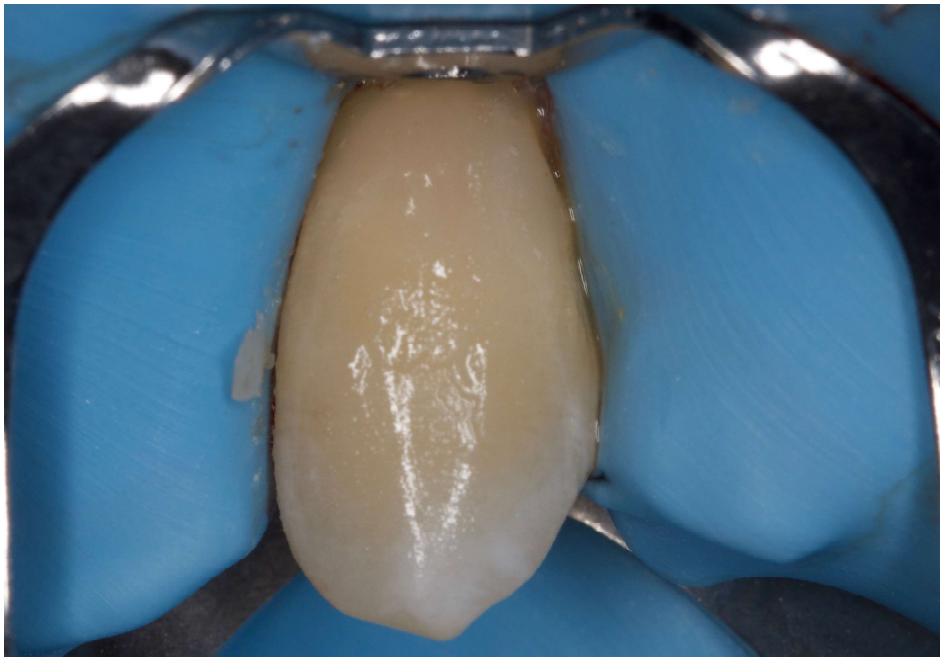

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Résorption **Externe**

CERVICALE

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Résorption **Externe**

CERVICALE

+ 7J

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Résorption **Externe**

CERVICALE

+1 AN

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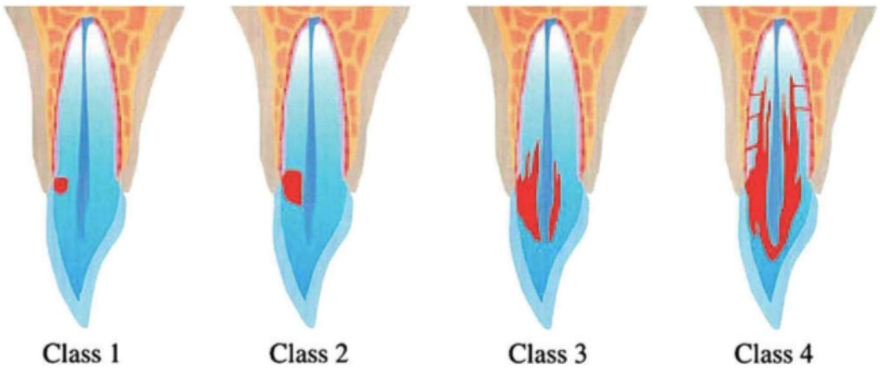

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Résorption **Externe**

CERVICALE

2020

2025

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Résorption **Externe**

SURFACE

✓Caractéristiques cliniques:

- Généralement asymptomatique
- Fistule éventuelle

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Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

Résorption **Externe**

SURFACE

✓Caractéristiques radiographiques:

- Racine « grignottée »
- Fréquente en cas de luxation sévère (5 à 20%) ou avulsion (30% ou plus)

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Prognosis of lunated permanent teeth: the development of pulp necrosis. Andreasen and al, Endod Dent Traumatol, 1985
Effect of luxation injuries on permanent teeth, Crona-Larsson G and al Endod Dental Traumatol, 1991
Replantation of 400 avulsed permanent incisors. Andreassen and al, Endod Dent Traumatol, 1995

✓Caractéristiques cliniques:

- Test au froid négatif

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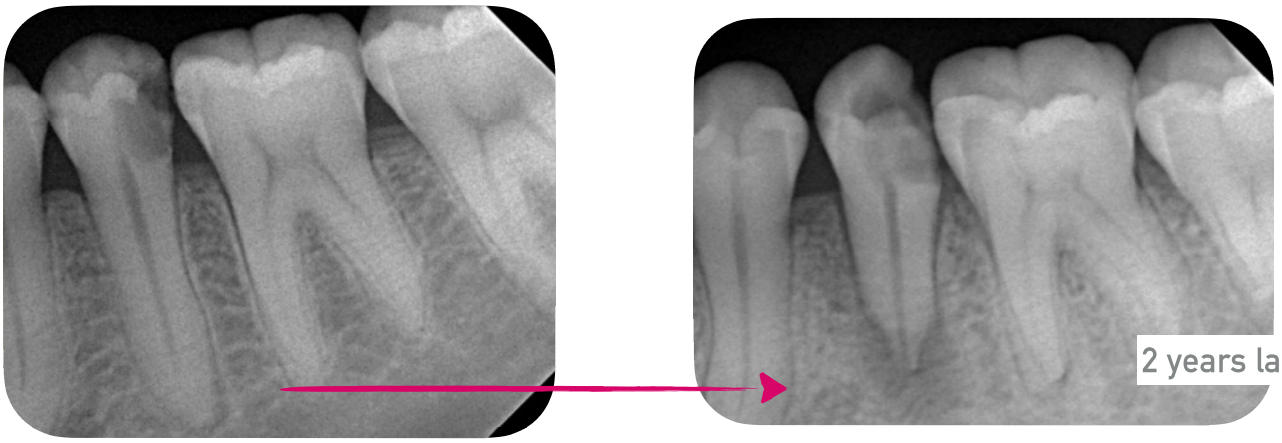
Résorption **Externe**

APICALE

20% détectées radiographiquement
80% détectées histologiquement

✓Caractéristiques radiographiques:

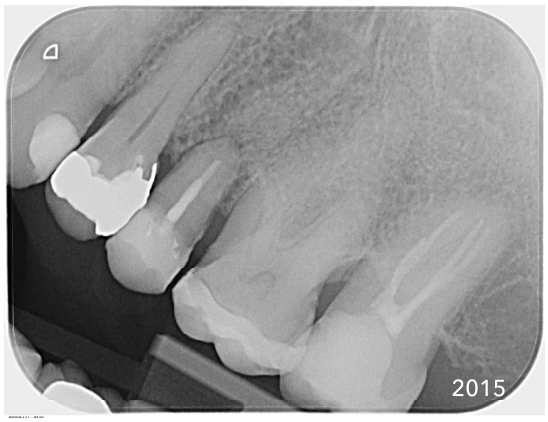
- Racine raccourcie associée à une radioclarté apicale



Laux et al., Int Endod J 2000
Chap. 5 Root resorption_Endodontic Advances and Evidence-Based ClinicalGuidelines, First Edition. Ed. Ahmed & Dummer.

Résorption **Externe**

APICALE



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Résorption **Externe**

APICALE

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✓Traitement

- Eliminer la cause bactérienne
- Instaurer un suivi rapproché

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✓Cas particulier: orthodontie

- Prevalence of apical resorption during orthodontic treatment: 50 to 80 % (CBCT)
- Severe cases: 1 to 5 %

Résorptions radiculaires

Mécanismes

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TABLE 1 Salient clinical and radiographic features of internal and external root resorptions, adapted from Patel and Saberi (2018)

	Internal root resorption		External root resorption				
Type of resorption	**Internal inflammatory resorption**	**Internal replacement resorption**	**External surface resorption**	**External cervical resorption**	**External inflammatory resorption**	**External replacement resorption**	**Transient apical resorption**
Clinical features	Asymptomatic (early), symptoms of pulpitis and/or apical periodontitis (advanced)	Asymptomatic (early), symptoms of pulpitis and/or apical periodontitis (advanced)	None	Asymptomatic (early), symptoms of pulpitis and/or apical periodontitis (advanced), ± probeable periodontal defect with profuse bleeding	Symptoms of apical periodontitis	Variable, none or ankylosis and/or exhibit high-pitched metallic sound on percussion in advanced cases.	None
Clinical appearance	Healthy (vital), discoloured (necrotic), pink spot (rare)	Healthy (vital), discoloured (necrotic), pink spot (rare)	Healthy	Healthy (vital), discoloured (necrotic), pink spot (rare)	Healthy (vital), discoloured (necrotic)	Healthy	Discoloured, usually resolve within 1 year
Location on root	Anywhere	Anywhere	Adjacent to impacted tooth/cyst/tumour, apical in orthodontically treated teeth	Cervical third (early) but can extend to middle or apical third (advanced)	Anywhere	Anywhere	Apical third
Pulp sensibility testing	+ve in (partially) vital cases, −ve in necrotic cases	+ve in (partially) vital cases, −ve in necrotic cases	+ve	Usually +ve, −ve in advanced necrotic cases	−ve	Usually +ve, may exhibit −ve/delayed response due to tertiary dentin formation	−ve or delayed response, usually returns to normal within 1 year
Radiographic features	Oval/round ballooning of root canal	Oval/round ballooning of root canal but with cloudy/mottled inclusions	Flattened/blunted root apex, asymmetrical loss of root, intact root canal	(A)symmetrical radiolucency in early cases, mottled radiopaque appearance in advanced cases. Perforation of root canal in advanced cases	Ragged saucer-shaped indentations along the root surface, adjacent bone loss, periapical radiolucency, Perforation of root canal in advanced cases	Asymmetrical bony replacement of root surface, absence of PDL space, root appears 'fused' to adjacent bone. Intact root canal	Widened PDL space, blurred/loss of apical lamina dura. Intact root canal

Patel et al., IEJ 2022