# Periodontal aspects of orthodontic treatment

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# Overview

- Cause-effect relations
- Physiology of tooth movement
- Periodontal aspects of different tooth movements
- Treatment of patients with healthy periodontium
  - Goals
  - Risks
  - Periodontal procedures supporting orthodontic treatment
- Treatment of patients with attachmentloss
- Periodontological complications of orthodontic treatments

# Cause-effect relations

# Harmonic occlusion and healthy peridontium

- Accessible surfaces
- The thickness of the interdental bone
- Ectopic teeth have long gingival attachment and are more prone to gingival recession

- crossbite, excessive overjet, and crowding cause significant increase in periodontal pathologies compared to control group

- subgingival bacterial samples were taken from anterior crowded and uncrowded teeth and revealed significantly higher pathologic levels of bacterial cells in crowded teeth and as crowding decreased, these levels decreased at a predictable rate

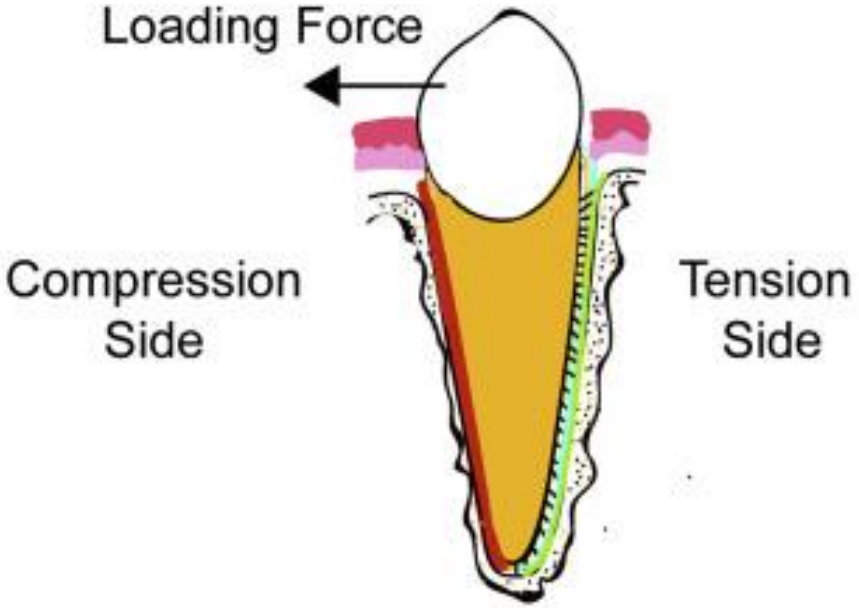
Graber: Orthodontics, 5th Edition
Current Principles and Techniques

# Effect of traumatic occlusion on the peridontium

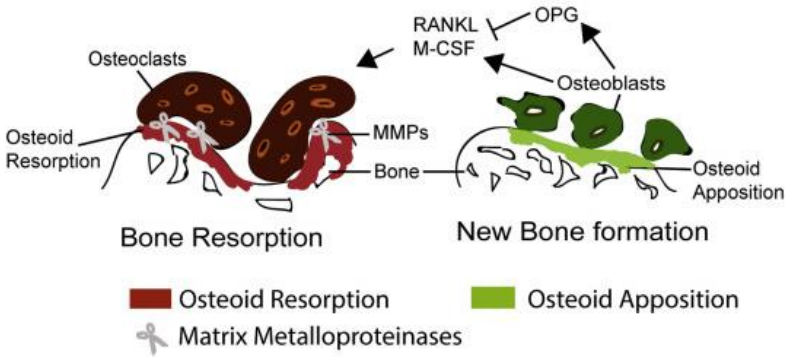
Occlusal trauma =
adaptive or destructive changes in the periodontal structures of teeth due to pathological occlusial forces

- primary trauma
- secondary trauma

# Physiology of tooth movement

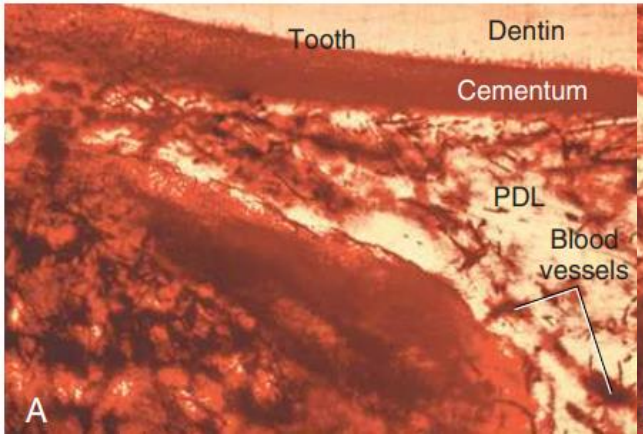


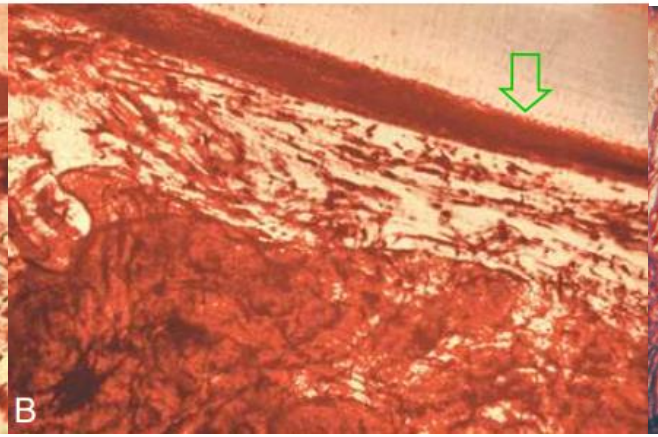

| | Compression | Tension |
|---|---|---|
| Increase | Cox2 → $PGE_2$ → RANKL, M-CSF<br>TNFα<br>MMPs<br>eNOS → NO<br>IL-1β | IL-10 → OPG<br>TGFβ<br>TIMPs<br>iNOS → NO |
| Decrease | OPG | RANKL |
| Outcome | ↑ Osteoclasts<br>↑ Resorption<br>↓ Apposition | ↓ Osteoclasts<br>↓ Resorption<br>↑ Apposition |

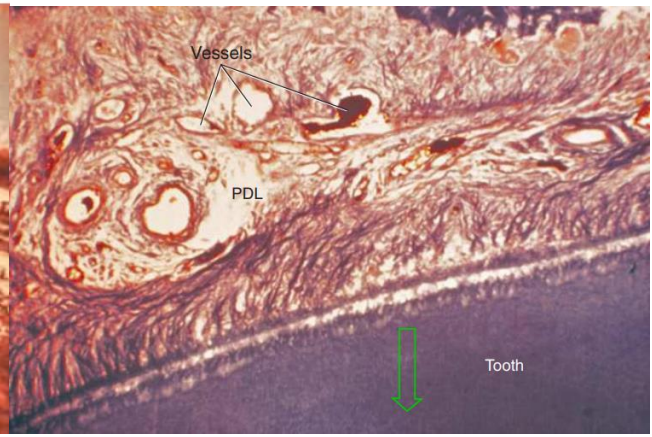



Yina Li, Laura A. Jacox, Shannyn H. Little, Ching-Chang Ko,
Orthodontic tooth movement: The biology and clinical implications,
The Kaohsiung Journal of Medical Sciences,
Volume 34, Issue 4,
2018,
Pages 207-214,
ISSN 1607-551X,

# Effect of continuous optimal force



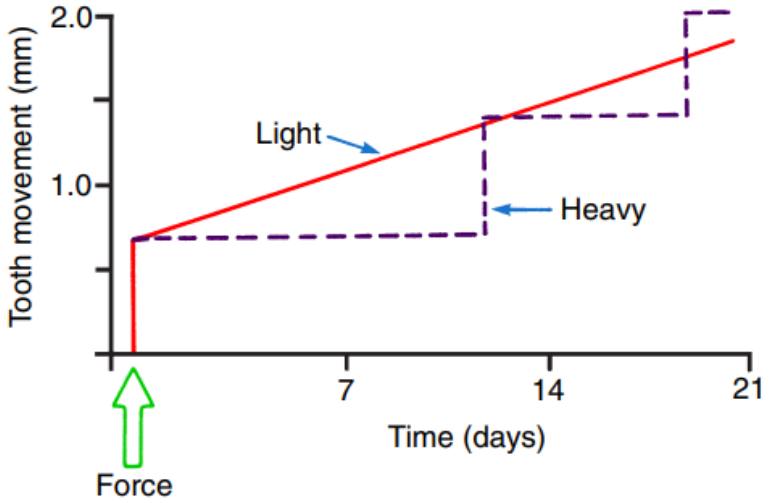



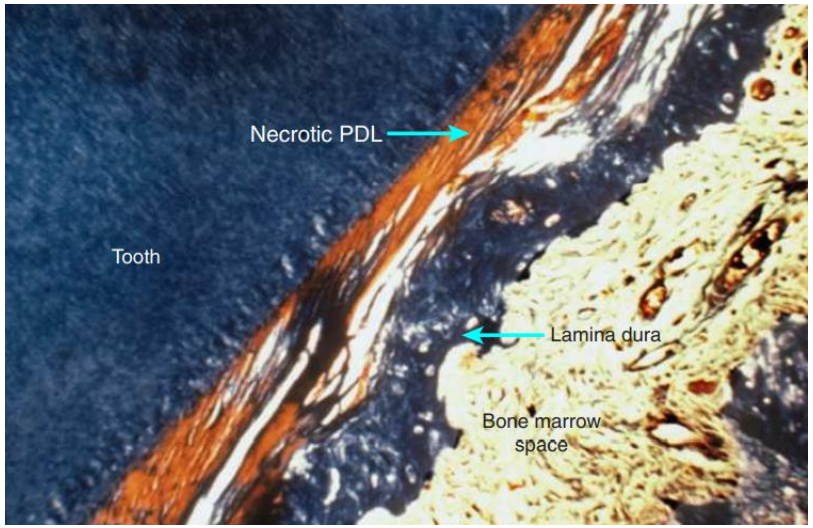




| | |
|---|---|
| <1 second | PDL fluid incompressible, alveolar bone bends, piezoelectric signal generated |
| 1-2 seconds | PDL fluid expressed, tooth moves within PDL space |
| 3-5 seconds | Blood vessels within PDL partially compressed on pressure side, dilated on tension side; PDL fibers and cells mechanically distorted |
| Minutes | Blood flow altered, oxygen tension begins to change; prostaglandins and cytokines released |
| Hours | Metabolic changes occurring: chemical messengers affect cellular activity, enzyme levels change |
| ~4 hours | Increased cAMP levels detectable, cellular differentiation begins within PDL |
| ~2 days | Tooth movement beginning as osteoclasts and osteoblasts remodel bony socket |

W.R. Proffit, H.W. Fields, and D.M. Sarver. :Contemporary Orthodontics, 2012, Elsevier: St. Louis, United States.

# Effect of heavy force



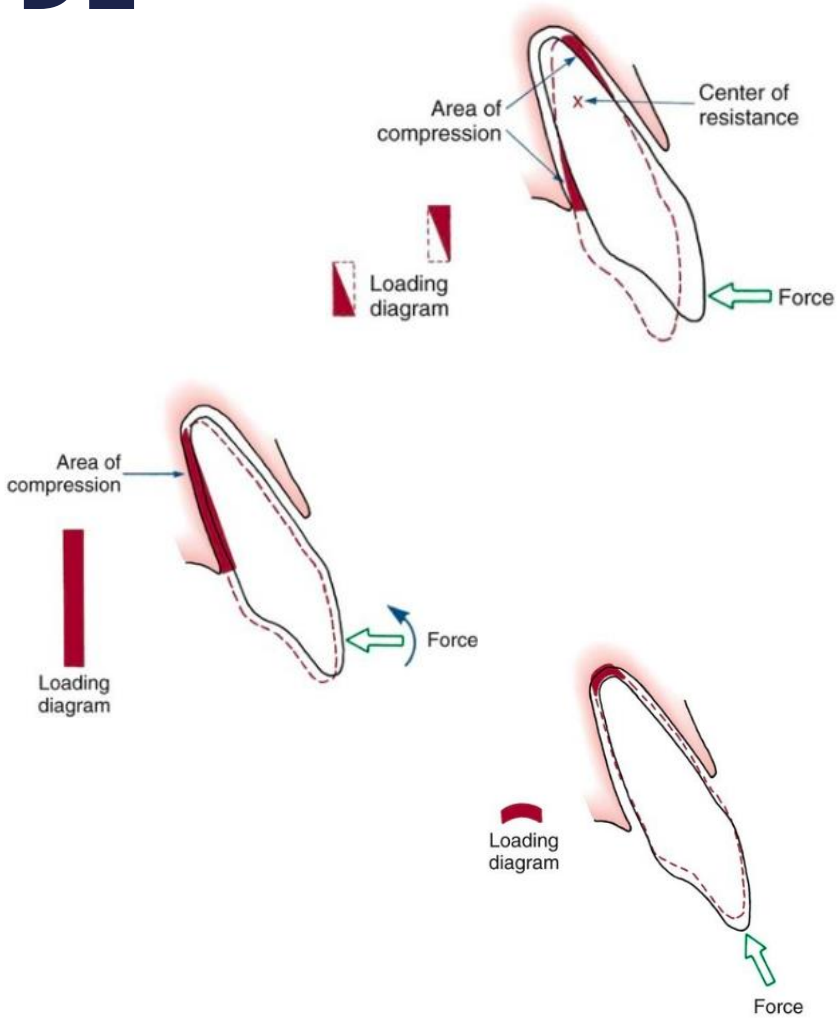

| | |
|---|---|
| <1 second | PDL fluid incompressible, alveolar bone bends, piezoelectric signal generated |
| 1-2 seconds | PDL fluid expressed, tooth moves within PDL space |
| 3-5 seconds | Blood vessels within PDL occluded on pressure side |
| Minutes | Blood flow cut off to compressed PDL area |
| Hours | Cell death in compressed area |
| 3-5 days | Cell differentiation in adjacent narrow spaces, undermining resorption begins |
| 7-14 days | Undermining resorption removes lamina dura adjacent to compressed PDL, tooth movement occurs |

W.R. Proffit, H.W. Fields, and D.M. Sarver. :Contemporary Orthodontics, 2012, Elsevier: St. Louis, United States.

# Stress-strain in the PDL

- Immediate change in position
- Stress- compression
- osteoblast - osteclast activity

!pressure threshold
→ compression of capillaries
→undermining resorption!




Proffit: Contemporary Orthodontics, 5th edition

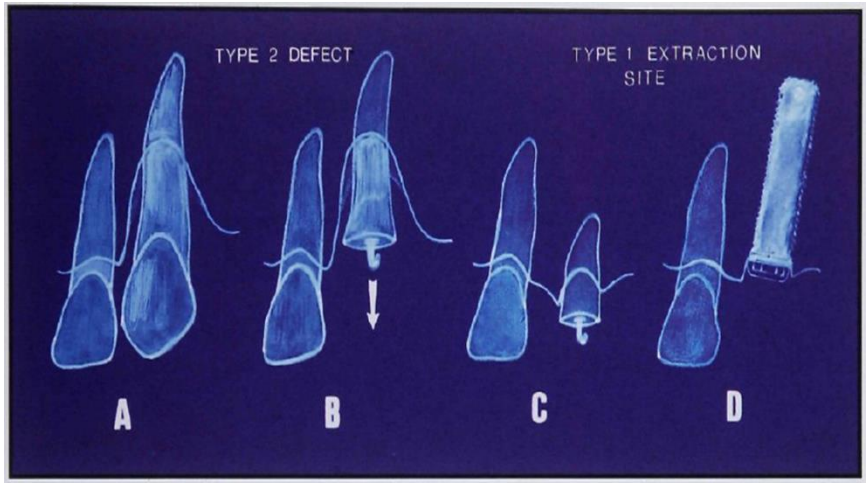
# Jiggling forces

- reaction is similar to pressure reaction on both sides
- PDL widens, tooth becomes loose
- cone- shaped widening of the PDL – adaptive reaction
- in absence of plaque no attachmentloss occurs

# Periodontal aspects of different tooth movements

# Extrusion

- Along with reduction of the clinical crown height
- Reduces
  - Infrabony defects
  - Pocket depth
- Reduces <u>even in presence of inflammation</u>
  - Bleeding on probing
  - pocketdepth




(a) (b)

Figure 8. Improvement of osseous morphology after extrusion. (a) IOPA radiograph pre-extrusion; (b) IOPA radiograph post extrusion.

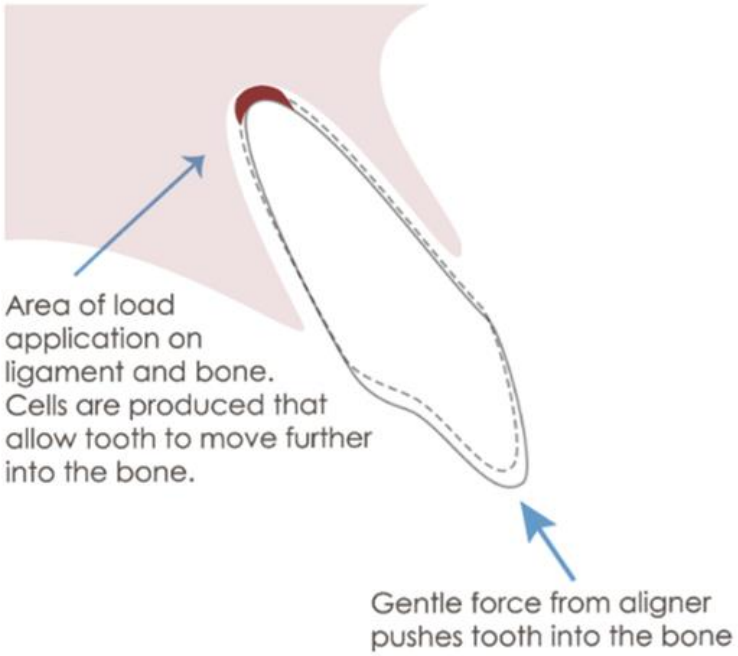
Graber: Orthodontics, 5th Edition Current Principles and Techniques

# Intrusion

- Debated question: do we create pockets or attachment?

- Risks:
  - Root resorption
  - Injury of the pulp
  - Development of root can stop (young individuals)

- Long gingival attachment → chance to relapse

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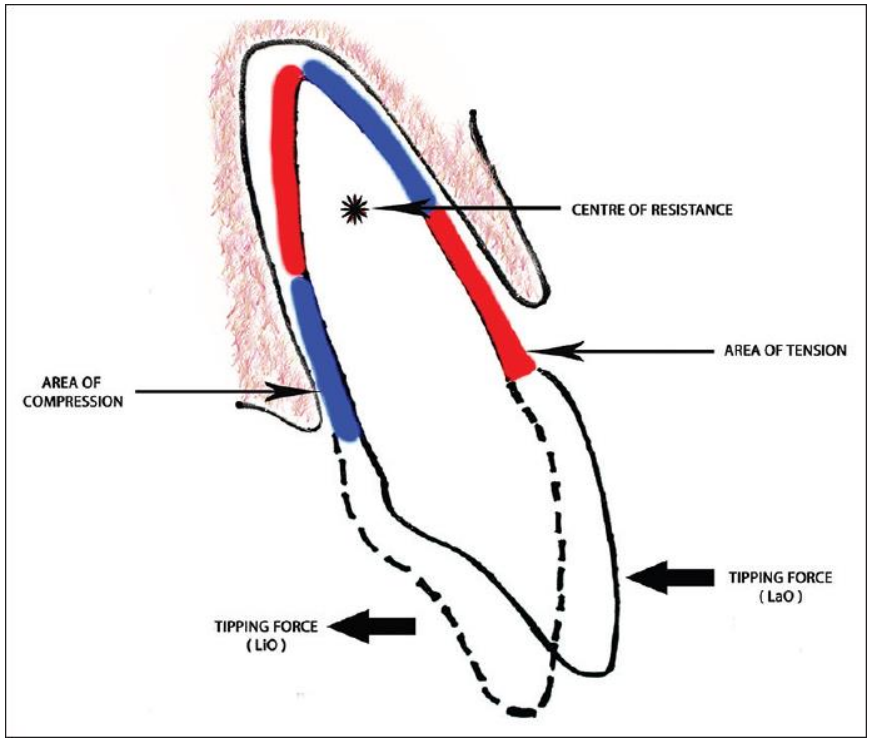
# Tipping

- Initial movement is tipping too
- Pressure is increased at the crest and the apex

→ Potential to receive high pressure from essentially light force

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# Bodily movement into intrabony defects

- Doesn’t have positive effects if inflammation is present
- In absence of inflammation regenerative potential is theorized

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# Peridontal aspects of orthodontic treatment of individuals with healthy periodontium

# Periodontal goals of treatment

Function:

- Teeth should be in bone at the end of treatment

Esthetics: levelled gingival margins

- ~eruptive path of the tooth

# Expected advantages

- Harmonic occlusion distributes load evenly on the teeth and thus prevents overload of individual teeth
- Readily accessible surfaces make practice of good oral hygiene easier

# Peridontal risks of ortho-tx

- Plaque retention
- Good oral hygiene
  is „sine qua non”
- Gingivitis and mild
  inflammation is reported in patient with good compliance and oral hygiene
- Frequent controlls, professional cleaning if needed

# Periodontal procedures facilitating or supporting orthodontic treatment

# Corticotomy

- Remodelling of the alveolar bone is the key of tooth movement
- Remodelling and turnover is increased during healing
- RAP

# Modified corticotomy

- Less invasive
- No-flap surgery
- Piezoelectric cuts

# Fiberotomy

- Indication: decrease relapse of rotated teeth
- Supracrestal elastic fibers are cut
- Edwards: CSF

  C ircumferential
  S upracrestal
  F iberotomy

# Reduced fiberotomy: papilla split

# Gingival recontouring

# Periodontal aspects of orthodontic treatment of patients with attachmentloss

# Peculiarity of tissues

- Adult patients – mature tissues – slower reactions
- More rigid bone
- Less PDL – same pressure is generated by much less force

# Change of the localisation of the center of resistance

# Bigger extrusion effect

"cone effect"

- Anatomy of the apex
- Direction of the Sharpey-fibers

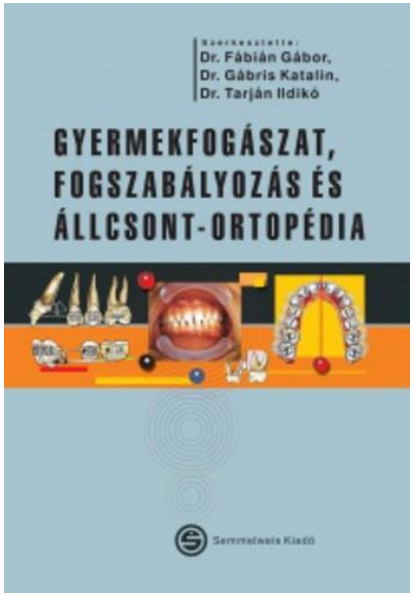
Birte Melsen: Adult orthodontics

# Anchorage problems

- Due to loss of teeth and attachment often inadequate anchorage for the planned tooth movement
- Skeletal anchorage (TADs, implants, miniplates)

# Periodontal complications of orthodontic treatment

# Literature


Dr. Fábián Gábor,
Dr. Gábris Katalin,
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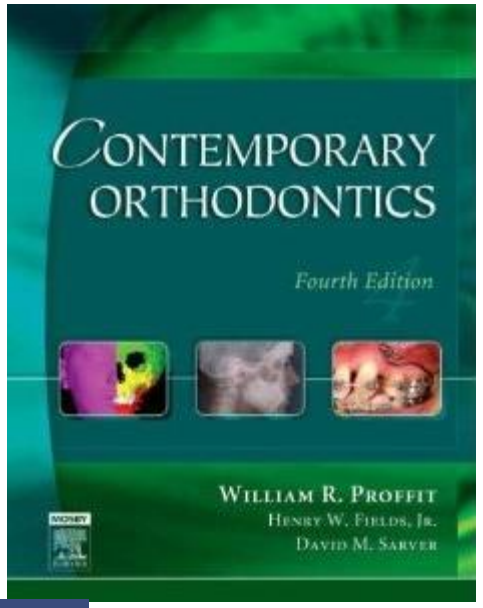
CONTEMPORARY ORTHODONTICS
Fourth Edition
WILLIAM R. PROFFIT
HENRY W. FIELDS, JR.
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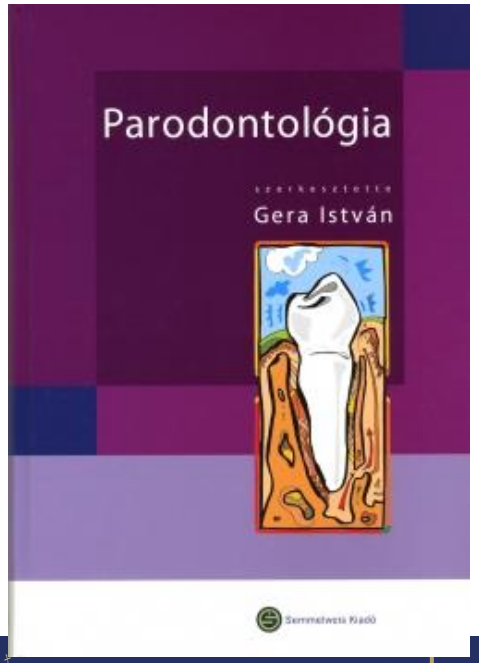
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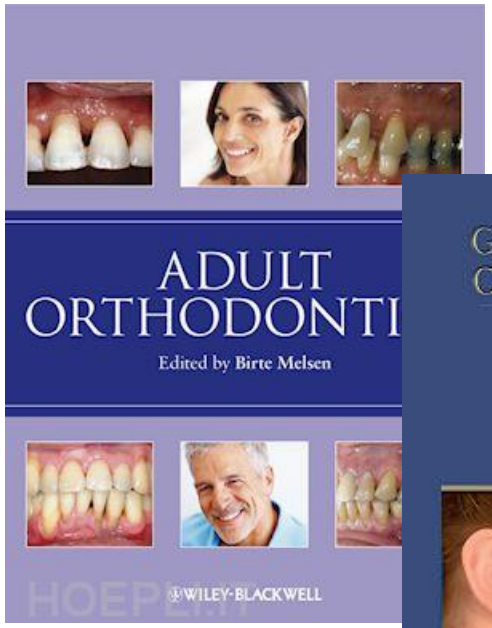
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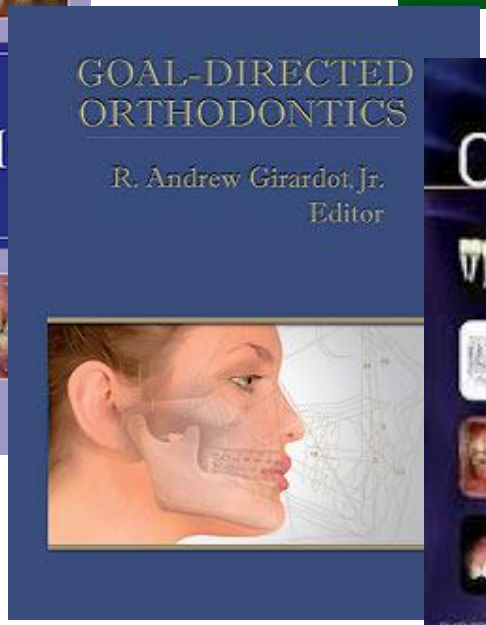
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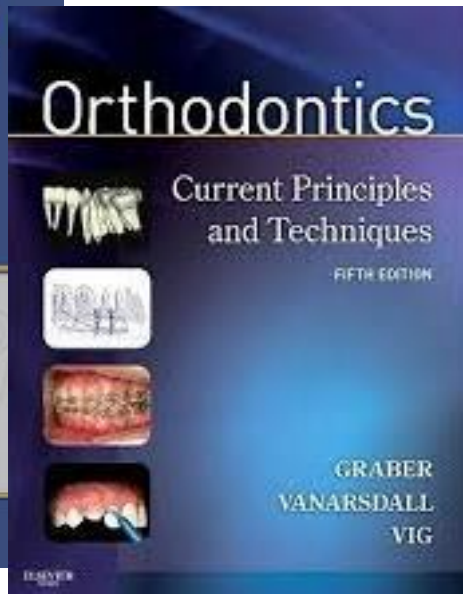
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