Key Concepts

- Decision making
  - typical scenarios for retreatment
  - thought processes and evidence

- Outcomes of retreatment
  - non-surgical
  - alternative treatment, patient autonomy

- Basics of retreatment techniques
  - disassembly
  - reshape and reclean, fill

Decision Making
Retreatment Needs

- **Biological**
  - clinical symptoms: (low grade) pain
  - asymptomatic apical periodontitis

- **Technical**
  - insufficient fill: short, voids
  - suspicion of leakage with deficient crown margins

- **Clinical**
  - post placement needed
  - material-related

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Retreatment of endodontic fillings

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- Aim
  - to assess retreatment outcomes clinically and radiographically

- Methods
  - 410 patients with 660 roots received retreatment, with either “visible technical shortcomings” (n=351) or with “osteitis indication” (n=309)
  - Group 1: short, voids, leakage, treatment was independent of time since fill
  - Group 2: at least 2 years old, clinical symptoms (n=23) or no lesion (n=9)
  - treatment was done in student clinic, with chloroform and Hedström files
  - in multiple visits IKI or Ca(OH)₂ were used and the Kloroperka
  - after 2 years, radiographic assessments were performed, + duplicates (n=33)
  - statistics were done (no details given)

- the technical standard of a root canal filling can be improved frequently
- there is a (low) potential for lesion to form after “technical” retreatments
- removal of apical granulation tissue effectively prepared the site for subsequent implantation

**Results**
- the technical quality was improved in 537/660 cases; the number of longer fillings increase, but also the number of overfills
- there were 21 cases with complications (file fracture and perforation)
- 17 roots had been extracted or apicoectomized
- for recalled roots with technical issues (n=322), overall success was 94%
- for recalled roots with lesions/pain (n=234), overall success was 78% but cases with more than 5mm lesion healed less frequently

**Discussion**
- the technical standard of a root canal filling can be improved frequently
- there is a (low) potential for lesion to form after “technical” retreatments
- removal of apical granulation tissue effectively prepared the site for subsequent implantation

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**The Treatment Plan**

<table>
<thead>
<tr>
<th>Specific Tooth</th>
<th>Dental Diagnosis</th>
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- **Dental Indication**
- **Social Factors**
- **Technical Factors**
- **Decision**
- **Specific Situation**
- **Other Teeth**
- **Decision**
- **Decision**
- **Decision**

- **Treatment Plan**
- **Other Factors**
Case 1

A 14-year old patient developed a facial swelling from tooth #8 after cementation of a PFM crown. The tooth had suffered trauma 2 years earlier with subsequent RCT and cast post placement. The crown is functional. The treating endodontist finds a deep probing (>10mm) palatally and diagnoses a vertical root fracture. His recommendation is extraction and implant.

Microbial ~ Signs & Symptoms

- AP is in dynamic balance
  - bacterial virulence is not static
  - host response somewhat less dynamic

- Changes may elicit response
  - new restoration
  - loss of existing restoration

- Location and type of organisms
  - access to the source possible?
  - can result likely be better?

Decision Making and Evidence

- Restorability
  - anatomy: ferrule, crown root ratio
  - iatrogenic: dentin thickness

- Implant vs retreatment
  - esthetics and other iatrogenic issues
  - p.a. lesion and other biologic issues

- Surgery vs retreatment
  - address the cause for failing RCT?
  - outcomes also depend on techniques
Restorability

- Ferrule (-effect)
  - respects biologic width but provides 1.75mm dentin
  - sealability, resistance form

- Crown-root ratio
  - biomechanics call for maximizing root support
  - little direct and clear evidence

- Dentin thickness
  - 1mm minimum, shown after rough preparation
  - dentin quality changes are limited but quantity counts

Implant vs Endo

- Patient-related factors
  - local: bone quality, quantity, esthetics
  - systemic: age, health, habits, preferences

- Biologic factors
  - placement in cases with p.a. lesions
  - little data on direct outcome comparisons

- Iatrogenic factors
  - clinician expertise is important, anteriors/red esthetics
  - fenestration, dehiscence, palatal placement etc.

Surgery vs Retreatment

- Adressing the source
  - intracanal bacteria: greater therapeutic length
  - the best apical fill can only delay efflux of toxins

- Access
  - remember the etiology
  - other option: intentional replantation?

- Primary vs re-surgery
  - evidence is limited and not all in favor
  - technical quality is improved, microscope use
A 67-year old faculty member is in pain from a tooth that had been root-canal treated 22 years ago. He is in particular sensitive to percussion and biting. There is deep probing (>12mm) mid-buccal and mid-lingual. The existing PFM crown is functional; the patient has an implant-supported crown in area #19. His preference is to retain tooth #31.
Case 3

A 39-year old patient presents with a lost PDF crown and a leaking buildup. There are no clinical symptoms but current as well as older radiographs reveal a radiolucent lesion associated with the distal apex. There is a curved mesial canal and a rather small obturation dimension apically. Clinically it is confirmed that Thermafil was used for root canal filling and that the chamber is bacterially contaminated.
Case 4

A 73-year old patient presents with an upper second molar that is occasionally slightly sensitive to percussion and biting. The root canal treatment was originally done more than 20 years ago and had been retreated due to technical insufficiency about 5 years ago prior to fabrication of new crown. There is moderate probing disto-palatal and there are no signs of coronal leakage. The patient prefers not to intervene at this time.

“Wait And See”

- Effect on host
  - likely, in many cases bacteria are still present
  - understanding for cause/effect relations are limited

- Complications?
  - if no symptoms, low rate of complications
  - there is risk associated with retreatment

- Clinician’s preferences
  - no absolute cut-off for lesion “severity”
  - school of thought
Other Reasons

- Insufficient root canal fill (technical)
  - short fill or voids
  - evidence of missed canals

- Signs of leakage
  - restoration lost for considerable time
  - gross decay

- Material-related
  - corrosion of silver points
  - allergy to filling material?
Retreatment Needed

Silver Cones
- Leakage
  - does occur with breakdown of sealer
  - is compensated for a time with corrosion

- Consequences of corrosion
  - discoloration
  - partial breakdown and fragility

- Incidence
  - depends on locale
  - hopefully will diminish

Retreatment Needed
**Decision Making**

### Continuous disease scale

- **Retreatment**
  - High degree of poor health (Big periapical lesion)
- **No retreatment**
  - Cut off point
  - Perfect health (No periapical lesion)
Retreatment Decisions:

- depend on patients preferences
  - pain, function?
  - cost, dental IQ?

- depend on dentists preferences
  - school of thought
  - conservative vs aggressive behavior

- depend on biology
  - understanding healing time course
  - understanding etiology

Post Removal...

And Now, How?

- Coronal access
  - crowns: leave, access?
  - remove restorative materials

- Buildup material
  - amalgam, composite, cast metal
  - post & various types

- Root canal filling
  - gutta percha
  - silver cones
  - paste
  - carrier-based
To Leave or to Remove

- Yes
  - will reveal morphology, additional problems
  - placement of new crown is advantageous

- No
  - cost, ease of rubber dam placement
  - maintains function and esthetics

Access
- bur kit
- informed consent...

Removal
- cut and crown / bridge remover
- Metalift and maybe intact removal

Removal of Intact Crown

Access Through Crown
“High-Speed Work”

- Penetrating the hard shell
  - enamel: cylinder, round bur
  - porcelain: round diamond
  - non-precious alloy: Transmetal bur

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Inspection

- Pulpal floor
  - location of orifices, overall anatomy

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Hand Instruments

- Diagnostic and therapeutic
  - location of orifices and determination of anatomy
Missed Canals

Locating orifices
- understand the cross-sectional anatomy
- vision and illumination
- NaOCl or dye
- silver cones?

Opening the orifices
- DG16 explorer
- Micro Orifice Openers
- ultrasonic tips
- rotaries, e.g. Sx

Orifice location, refinement
- dentin: round bur, Mueller bur, Munce Discovery
- dentin in coronal root canal third: Gates Gliddens
- dentin for deeper shape: NiTi rotaries
Electric Motors

- Mandatory for NiTi rotaries
  - 250 rpm for intracanal work with curves
  - 500 rpm for GP removal
  - no torque limit

![ATR Tecnika]
![Aseptico Endo DTC]
![SET Endostepper]

Ultrasonic Preparation

- Removal of restrictive dentin
  - focused and controlled under magnification

- Technical parameters
  - mid-level power setting, dry, intermittent

Access to Apex

- Determine canal content
  - gutta percha, with carrier?
  - paste, soft or hard?
  - silver cones?

- Gutta percha removal
  - mechanical: hand, rotary
  - chemical
  - heat

- Constraints
  - time, adverse events
Use of Solvents

- **Type**
  - chloroform is effective but toxic
  - eucalyptic oil less so
  - not essential for bulk removal
  - special solutions are on the market

- **Handling**
  - placed in canal for 30s
  - do not transport in periapical tissues
  - careful with non-latex dam
  - pick up final flush with paper point

Disinfection

- **Bacterial composition**
  - facultative anaerobic, fungus
  - resistant to Ca(OH)$_2$

- **Mechanical enlargement**
  - will follow original shape
  - how large to be effective?

- **Irrigants**
  - NaOCl, CHX?

- **Activation**
  - ultrasonics (PUI)
  - sonics, others
Success/Failure Revisited

- Benefits and risks
  - loss of dentin, veneer chipping
  - expression of GP into periapical tissue
  - perforation laterally or apically

- Effect of disinfection
  - long-term, short-term
  - flare-ups

- Potential pitfalls
  - inability to correct existing shaping errors
  - missed (and not addressed) pathosis

Retreatment (UN, 05)

Case history

- 20 yr old fill
- asymptomatic
- restoration adequate
- very motivated patient

Pre-op radiograph

Final radiograph

Recall radiograph

To be Continued...
Spectrum of Surgery

- Apicoectomy
  - with or without retrograde preparation and filling
  - why is apical curettage rarely effective?

- Perforation repair, fragment removal
  - occasionally, iatrogenic mishaps may be corrected with apical surgery

- Root amputation
  - compare success rates of implants and heroic endodontic treatment...

Steps in Endodontic Surgery

- Data collection and diagnosis, consent
- Premedication if needed
- Local anesthesia
- Flap design and reflection
- Bone removal and preparation of crypt
- Retrograde preparation
- Hemostasis
- Retrograde fill
- Suture
- Post op instructions
Premedication

- **Pain relief**
  - 600 to 800mg ibuprofen before surgery
  - then for 3 days or as needed same dose *tid*

- **Anxiety**
  - Halcyon (short lasting valium derivative)
  - careful instructions and consent

- **Infection**
  - normally no antibiotic prophylaxis indicated
  - patients with other illnesses that require AB: yes

Anatomical Considerations

- **Locally**
  - marginal gingival should be free of inflammation
  - deep pockets should have been eliminated

- **Maxilla**
  - sinus membrane may be violated; molar surgery
  - lingual vs. transanthal approach

- **Mandible**
  - assess distance to mandibular canal and make sure flap retraction does not encroach on nerve
Incision & Flap

Vertical Incision

Flap Design

Treatment plan

- Triangular flap

- sulcular incision extending to at least 2 teeth distal of vertical releasing incision
Triangular Flap

Advantages
• Easy to modify
• Simple repositioning
• Good blood supply

Disadvantages
• Limited access
• Marginal incision
• Tension on flap

Indications
• Cervical resorption
• Perforations to mid root
• Palatal flaps
• Short roots

Flap Design

Treatment plan
• Ochsenbein-Luebke flap

• Submarginal, vertical incisions connected by a scalloped horizontal incision in attached gingiva

Ochsenbein-Luebke Flap

Minimum 2 mm attached gingiva

Lang & Loe 1972
Microsurgical Instruments

- Incision
  - New incisions possible
  - Less trauma

- Retraction
  - Protection of vital structure
  - Prevention of trauma

- Suture
  - Sutures smaller than 6:0
    - May be removed after 48h

Raising The Flap

Correct placement of elevator

Introduction

- When, why
- How
- Discussion

Retraction

- Protection of vital structure
- Prevention of trauma

Incision

- New incisions possible
- Less trauma

Discussion
Apical Root Resection

- Optimal osteotomy size:
  - must accommodate instrument’s size (ultrasonic tip: 3 mm)
  - osteotomy diameter: ca. 4 mm

- Amount of root resected:
  - 3 mm, 0-10° bevel
  - more than 3 mm may yield poor crown-root ratios
  - 3 mm resection ensures removal of apical delta

Resection & Exploration

- Location of root tip
- Diamond vs. steel bur
- Removal of soft tissue
- Inspection of cut surface

Handling of Neoapex

- Location of canals
- Dye application
- Removal of soft tissue
- Inspection of prepared surface
Mirrors & Inspection

- Curettage first (spoon excavator)

- Micro mirrors
  
  - Scratch-free sapphire surface
  
  - Stainless steel surface

  round, rectangular

Surgical Adjuncts

- Stropko insert

Root End Preparation

- Improved Clinical Outcome
  
  - Gutmann
  
  - Molven

- Clinical Trials
  
  - Lustmann
  
  - Hirsch
  
  - Mikkonen

- Histology
  
  - Chong
  
  - Harrison
  
  - Pitt Ford
Retrotips

- Ultrasonically activated tips vs. micro handpiece
- Uncoated vs. coated retrotips
- Micro cracks: clinical consequences

Carr 1995
Velvart 1996
Von Arx 2000

Surgical Instruments

Ultrasonic tips:

- Zirconium nitride coated: cuts dentine smoothly & efficiently
- Other coating materials
- Non-coated types

 Cutting tip
 Variable angles
 Irrigation port

Hemostasis

- Anesthesia: slow, 2 injections in 5min
- 1:50'000 adrenalin, Xylocain 2%
- Caustic substances: FeSO₄
- Effective, impact on healing?
- Physical measures: cotton pellets
- Effective, impact on healing?

Harrison 1991, 1992
Gutmann 1996
Kim 1999
Hoskinson 2005
Hemostasis

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Root End Filling

- Drying, hemostasis
- Application of filling material (MTA)
- Removal of surplus material
- Inspection of finished surface

Root End Filling Materials

- MTA = Mineral trioxide aggregate
- Excellent biocompatibility
- Good physical properties
- Difficult handling
- EBA = Ethoxy benzoic acid
- Base ZnO / Eugenol
- Good physical properties
- Easy handling, difficult mixing
Suturing

- Micro-surgical instruments
- Monofil suture material, size 6:0 or 7:0

Details from Harrison 1991

Needles & Sutures

Releasing incisions or partial thickness flaps:
Monofilament polypropylene 7-0 or 8-0

Inner layers in multilayered flaps:
Polyglactin 7-0 or smaller

Microscopes in Dentistry

Introduction
What, why
How
Discussion

Details from John McSpadden 1977
“To Microscope Or Not…”

- Is it absolutely necessary?
  - No, but magnification helps
  - Adequate and direct light

- Loupes with light source
  - Are a valid alternative
  - Posture? Maximal resolution?

- Endoscope
  - Is also quite expensive and does not allow workflow as easily, needs assessment

Endodontic Retreatment

- Retreatment is preferred over surgery since the etiology is more directly addressed

- A major question is restorability after retreatment and specifically disassembly

- Retreatment is much more successful if existing iatrogenic errors can be overcome

- Overall success rates are lower than for primary treatment, comparison to implants???

Endodontic Surgery

- Surgery is no substitute for substandard endodontic treatment

- With correct indication, endodontic surgery yields high success rates

- The use of the operating microscope makes superior techniques feasible

- Modern retrograde filling materials are highly biocompatible
Success Rates

Are microsurgical techniques more successful?

Cases with endodontic lesions only (PD ≤ 5mm)
Equal number of anterior, premolar and molar teeth
Retrofilling material: SuperEBA
Clinical & radiographic examinations (3, 6, 9, 12 months post-op)

1. Most healing occurred within 7 months
2. Larger lesions healed more slowly
3. Complete healing in 96.8%
4. Failed cases due to undetected fractures

Rubinstein 1999

Success Rates

Kim 00
Harty 70
Rud 72
Grung 90
Altonen 76
Lindemann 87
Malmstrom 82
Nordenram 70
August 96
Block 76
Frank 92
Mikkonen 83
Persson 88
Mattila 68
Ericson 74
Hirsch 79
Friedman 91
Persson 73

Author Year

Surgery combined with RCT 79.6%
Surgery alone 58.9%

1966-2000

Thanks For The Attention!