Functional and esthetic reconstruction of root canal treated teeth

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Endodontically treated teeth – special kind of problem to restore

- Desiccation – not proved
- Loss of tactile function – higher load when bite
- Loss of tooth structure
  - Caries – especially on approximal surfaces
  - Preparation – access cavity
Requirements for restoration

• Proper coronal seal for the root canal filling
  - Prevent the infection by bacteria from the oral cavity

• Protect remaining tooth structure
  – Avoid fracture
  – Prevent recurrent caries

• Functional restoration – Restore original chewing ability

• Esthetics – Especially important on front teeth
Design of restoration

• **Location of the tooth**
  - Front teeth
  - Premolars and molars

• **Degree of destruction**
  - Direct or indirect restoration
  - Intracoronal restoration or crown
  - Using the root canal space for retention
    - post systems
  - Position of the gingival margin of the restoration
    - crown lengthening methods
Core buildup

- Without using post systems
  - Amalgam
  - Composite
  - Glass ionomer cement
Core buildup

• Post systems
  – Custom made
    • Dowel-core
      – Metal
      – Ceramic
  – Prefabricated
    • Adhesive (bonded to tooth with composite type material)
      – Glass fibre/carbon fibre posts
        » Tapered
        » Non tapered
    • Metal (luted to tooth with glass ionomer/phosphate cement)
      – Screw type
      – Passive
Why switch from metal to fiber posts?

Clinical research, noted in the graph below, verifies how much more similar the elasticity of RelyX™ Fiber Post is to human dentin than is the elasticity of metal and ceramic posts – which means a much lower risk of root fracture due to the "wedge effect." If endodontic retreatment is required, it’s reassuring to know RelyX Fiber Posts can be removed easily, without damaging the tooth.

![Elasticity Modulus of Dentin and Post Materials](image)

[Source: 3M internal data and Materials Science and Engineering: An Introduction, 8th Ed., Wiley]
Dowel-core preparation

• The length of the dowel (b):
  – From two-thirds to three quarters the length of the root
  – The minimum length is the length of the crown (a)
  – While at least 4mm of the root canal filling should be remained at the end of the canal (c)

• The diameter of the dowel:
  – One-third the diameter of the root

• Coronal part:
  – Unsupported tooth structure is removed
  – Ferrule effect: the crown should surround at least 2mm tooth structure towards apical direction from the margin of the dowel-core
Dowel-core preparation

In teeth with one root canal

In maxillary premolars

In maxillary molars

In mandibular molars
Front teeth vs. premolars and molars

• Forces from different direction – different requirements

• **Anterior teeth**: forces from lateral direction

• **Premolars and molars**: forces along the axis of the tooth
Reconstruction of front teeth

• Direct:
  – Composite filling
  – Composite filling + glass fibre post

• Indirect:
  – Porcelain fused to metal crown
  – Zirconium based crown
  – Full ceramic crown
Reconstruction of premolars and molars

(cusps must be reduced to avoid fracture!!!)

• Direct:
  – Composite filling – if approximal surfaces are intact

• Indirect:
  – Ceramic or composite onlay
  – Porcelain fused to metal crown
  – Zirconium based crown
  – Full ceramic crown
Crown lengthening methods

- **Biologic width**: vertical dimension of supraalveolar soft tissues
  
  1.07 mm connective tissue attachment
  
  0.97 mm epithelial attachment
Crown lengthening methods

- **Clinically**: at least 2.5-3mm should be held between the alveolar bone and the margin of the restoration
Crown lengthening methods

- Surgical crown lengthening
- Orthodontic extrusion