POST AND CORE

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TOPICS

- Intro
- Why use a post?
- When to use a post
- Differences in posts
- Ideal dimensions
- Common pitfalls
- How to use a post
- Buildup material
- Considerations
- Conclusions
Endodontically treated teeth:

- Loss of structural integrity
  - Access cavity is not the main culprit. The marginal ridge is more important
  - Loss of intracoronal and intraradicular dentin (Trabert 1978)
  - Cuspal deflection
- Change in composition - Loss in collagen cross linking, moisture, nutrients
  - Not as important as structural integrity (Gutman, 1992)
- Endo treated teeth “6x more likely to survive than those with intracoronar restorations” (Aquilino, 2002)
WHY USE A POST?

• Not enough tooth structure
• Crown preps need the FERRULE EFFECT: (Sorensen, 1990)
  • 1.5-2mm of tooth structure below the core
  • Adds retention, but primarily adds resistance form
• A post adds: (Schwartz, 2004)
  • Resistance: ability to withstand lateral and rotational forces
    • Improved by: increased length of post, rigidity of post, anti-rotational features
    • Post increases buildup resistance to lateral forces (15% → 48%)
  • Retention: ability to withstand vertical dislodging forces
    • Improved by: increasing length, diameter, parallelism, active vs passive
• Does NOT add strength (Cohen, 2002)
• Ideal post distributes forces along LENGTH of root
ANTERIORS

- Minimal loss of tooth structure may be restored with composite resin (Sorensen 1984)
- Post is of little or no benefit in a structurally sound anterior tooth, increases chance of nonrestorable fracture (Heydecke 2001)
- If an anterior tooth needs a crown, a post if often indicated
  - Must be able to resist lateral and shearing forces
MOLARS

- Endodontically treated molars should receive cuspal coverage (Kane 1991)
- Most do NOT require a post
  - Pulp chamber and multiple canals provide adequate retention for core buildup
- Must be able to resist VERTICAL forces
- In molars with extensive loss of tooth structure, place post in the LARGEST, STRAIGHTEST canal (Schwartz, 2004)
  - Palatal of maxillary molars
  - Distal canal of mandibular molars
PREMOLARS

- Bulkier than anterior teeth
- Often single rooted with small pulp chambers
- More subject to LATERAL forces than molars (Schwartz, 2004)
- If a crown is indicated, more likely than molars to require a post
WHEN TO USE A POST

Non-Vital

Evaluate remaining tooth structure

- 50% or more remaining
- Less than 50% remaining

No post, consider direct core material
- Consider dowel system

- Pre-Fab Post and Core
  - Para Post system
  - Fibercore post system
  - Ceramic post
  - Luminex system

- Cast Post and Core (Morphologic Post)
  - Custom Duralay pattern
  - Type IV metal
  - Milled Zirconium post
DIFFERENCES IN POSTS

- Type:
  - Prefabricated (Direct)
    - Stainless steel
    - Ceramic
    - **Fiber reinforced resin**
  - Morphologic (Indirect)
    - **Cast metal**
    - Milled zirconia
- Shape: parallel vs tapered
- Insertion: active vs passive

Deciding what to use

**Non-Vital**

Remaining intracanal and coronal tooth structure

- Post needed
  - Indirect
    - Custom-Cast post and core
      - Salt and Pepper Method
      - Syringe Method
  - Direct
    - Prefabricated System: Ceramic, Fiber Resin or Para post
- No post is needed
  - Alloy
- Resin Build Up
PREFABRICATED (DIRECT)

- Historically required removal of dentin to create post space
  - Newer dentin-bonding techniques allow elimination of structural complications associated with oval or ribbon-shaped canals (Gluskin, 2002)
- Use in roots with large cross-sections
  - Maxillary incisors
  - Maxillary canines
  - Maxillary molar palatal root
- Composition:
  - Stainless steel
  - Ceramic
  - Fiber reinforced resin
MORPHOLOGIC (INDIRECT)

- Does NOT require removal of dentin to create post space
  - Post is made to fit existing canal
  - Used when wall thickness is minimal
    - Wall thickness <1mm predisposes tooth to fracture (Kanca, 1992)
- Use in narrow, ribbon-shaped roots (Gluskin, 1995)
  - Mandibular incisors
  - Maxillary and mandibular premolars
  - Mandibular molar distal roots
- Less retentive than parallel-sided posts in roots with large diameters
- Requires minimal stress during cementation
- Can act as a wedge during occlusal loading
- Composition:
  - Cast metal
  - Milled zirconia
PARALLEL VS TAPERED

- In teeth with WIDE root cross-sections:
  - Parallel posts are more retentive than tapered or morphologic posts (Sorensen, 1984)

- In teeth with NARROW root cross-sections:
  - Morphologic posts offer greater retention (Gluskin, 1995)

- Key points: (Schwartz, 2004)
  - 1) Parallel is more retentive
  - 2) Parallel has less “wedging” effect
  - 3) Parallel has a higher success rate
  - 4) Tapered requires less dentin removal
    - Primarily indicated when root morphology is thin and delicate
ACTIVE VS PASSIVE

• Active
  • Retained by engaging walls of canal
  • Introduces more stress into root
  • Only to be used in roots with maximum remaining dentin (Felton, 1991)
    • i.e. short roots in which maximum retention is needed

• Passive
  • Retained by luting or bonding agent
MODULUS OF ELASTICITY

- High modulus = high stiffness
IDEAL DIMENSIONS:

- **Length (Gluskin, 2002)**
  - 2/3 length of the canal
  - Minimum of equal coronal and radicular lengths
  - One-half the bone supported length of the root
  - Preservation of the endodontic seal (3-5mm)

- **Diameter (Schwartz, 2004)**
  - Should not exceed 1/3 diameter of the tooth at the CEJ
  - No less than 1mm at midroot and beyond
COMMON PITFALLS

• “As post diameter increases, resistance to root fracture is directly related to remaining tooth structure.” (Schillingburg, 1982)

- Too Much Taper
  
  Can cause fracture when vertical forces are applied

- Inadequate Post Length
  
  Increases risk of root fracture
  Must be below crest of bone

- Violation Of Post Size
  
  Increases risk of fracture due to large size of cast post and core
HOW TO USE A POST

• Morphological:
  • Step 1: shoulder prep, then canal prep – maintain the apical endo seal (~4mm)
  • Step 2: pattern fabrication – w/ acrylic or composite, then send to lab
  • Step 3: finishing and cementation

• Pre-fabricated:
  • Step 1: prep the largest canal – maintain the apical endo seal (~4mm)
    • If multi-rooted, counter-sink the other canals for added retention (gates glidden)
  • Step 2: etch, rinse, dry
  • Step 3: Prime & Bond (do NOT cure)
  • Step 4: fill with Fluorocore, place fiber post, light cure
MORPHOLOGICAL POST FABRICATION

Note Anti-Rotational Groove

Rubber Stopper
CEMENTATION VS BONDING

- Morphological (Indirect)
  - Cast post & core → cement w/ Rely-X
  - Zirconia → cement w/ Rely-X
- Prefabricated
  - Stainless steel → cement w/ Rely-X
  - Ceramic → cement w/ Rely-X
  - Fiber → BOND w/ dual-cure adhesive resin (i.e. Prime&Bond w/ Fluorocore)

* REMEMBER: do NOT use RMGI (expansion) or light-cure adhesive resin (cannot cure)
BONDING THE FIBER POST

1) Clean the post space
2) EDTA, rinse
   - Removal of smear layer can overcome inhibitory effects of eugenol towards resin polymerization (Mayhew, 2000)
3) Phosphoric acid etch (15 seconds), rinse, dry with paper points
4) Apply dual cure bonding resin (i.e. Prime&Bond)
   - Multiple coats recommended for complete impregnation (Sano, 1995)
   - Do NOT light cure
5) Inject dual cure cement into post space (i.e. Fluorocore)
   - Light cure
6) Continue core build-up, then prepare crown
BUILDUP MATERIAL

• Amalgam
  • 343 – 510 MPa compressive strength (after 7 days)
    • CANNOT be prepped for crown immediately
  • Good physical and mechanical properties, but low tensile strength (Mollersten, 2002)
  • Possible esthetic problems
  • Possible amalgam tattooing during crown prep

• Composite resin
  • 334 MPa compressive strength (immediately after polymerization)
    • CAN be prepped for crown immediately
  • Fracture resistance comparable to amalgam, and cast post&cores
  • High tensile strength (Mollersten, 2002)

• Glass Ionomer
  • Insufficient compressive strength (Gateau, 2001)
CONSIDERATIONS

• Modulus of Elasticity (Newman, 2003)
  • Flexible post allows movement of the core, preventing fractures
    • Flexibility → increased microleakage
  • In teeth with minimal tooth structure, may be necessary for a post to have a higher modulus of elasticity
    • Stiffness → compensates for smaller diameter

• Retrievability (de Rijk, 2000)
  • Metal and fiber posts can be removed easily
  • Ceramic and zirconium posts are very difficult/impossible to retrieve

• Failure mode (Schwartz, 2004)
  • Flexible posts → failures are more likely to be restorable
  • Composite cores → tend to fail more favorably than amalgam/gold
**PRICING**

- Prime & Bond - $110 per bottle
- Fluorocore - $150 per 3 tubes
- Rely-x - $260 for 50 individual cartridges
- Fiberpost - $170 for package of 30
- Drills - $16 each
RECAP: WHEN TO USE A POST

- **Anteriors:**
  - If structurally sound – restore w/ composite (no post&crown)
  - If not structurally sound – restore w/ post&crown

- **Premolars:**
  - If structurally sound – restore w/ composite (no post&crown)
  - If not structurally sound – restore w/ crown (maybe w/ post. Premolars need posts more often than molars)

- **Molars:**
  - If structurally sound – restore w/ crown
  - If not structurally sound – restore w/ crown (most don’t need posts, but sometimes do)
RECAP: POST TYPES

- Trends in clinical practice and literature are towards using **FIBER POSTS**
  - Absorbs stress – 50% more resistance to fracture than metal posts (Saupe, 1996)
  - Esthetic
  - Dentin bonding techniques conserve root structure
  - No corrosion
  - Removable
  - Favorable failure mode
  - Greater retention in flared canals than morphologic posts (Tjan, 1997)
- Use of stainless steel, zirconia, ceramic, and active posts is less common
- Consider using a morphologic post for:
  - SMALL, ribbon shaped canals
  - Teeth w/ minimal structure, when rigid posts compensate for a smaller diameter
- Parallel > tapered in terms of retention
CONCLUSIONS

• “Despite innovative designs...the amount of remaining dentin and root morphology may be the ultimate factors in resistance to fracture” (Gutman, JL. The Dentin-Root Complex. 1992, Journal of Prosthetic Dentistry.)

• Remember:
  • Posts DO NOT strengthen teeth
  • Always use the smallest diameter that will do the job – don’t sacrifice tooth structure
  • Know your ROOT ANATOMY
REFERENCES