IT'S ALIVE: REVASCULARIZATION OF NECROTIC PULP TISSUE IN IMMATURE TEETH

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Background Reference: Regenerative Endodontics: A Review of Current Status and a Call for Action, Peter E. Murray, Franklin Garcia-Godoy, and Kenneth M. Hargreaves, J Endod, 2007

Background

- Approximately $400 billion spent treating Americans suffering some type of tissue loss or end-stage organ failure
    - 20,000 organ transplants
    - 500,000 joint replacements
    - Millions of dental and oral craniofacial procedures
- Where might regenerative procedures be beneficial?
    - replacement of oral tissues affected by
    - inherited disorders
    - trauma
    - neoplastic or infectious diseases

What is Regenerative Endodontics?

- …biologically-based procedures designed to predictably replace damaged, diseased, or missing structures, including dentin and root structures as well as cells of the pulp-dentin complex, with live viable tissues, preferably of the same origin, that restore the normal physiologic functions of the pulp-dentin complex.

Objectives

- Regenerate:
    - pulp-like tissue, ideally, the pulp-dentin complex
    - damaged coronal dentin, such as following a carious exposure
    - resorbed root, cervical or apical dentin

What is Revascularization/Regeneration?

Challenges in treating the incompletely developed root

- Cleaning and shaping of blunderbuss canal is difficult
- Necrotic debris in wide root canal is difficult to completely disinfect
- Thin, fragile lateral dentinal walls can fracture during mechanical filing/obturation
- Risk of extending material beyond apex

Management of the Open Apex

- Traditional Apexification
- One Step Apexification
- Revascularization/ Regeneration

How can bacteria be removed from the canal?

- Triple antibiotic paste Banchs & Trope JOE, 2004
- Calcium hydroxide Chueh & Huang JOE, 2006
- Formocresol Shah & Logani JOE, 2008

Triple Antibiotic Paste

- Sato T, Hoshino E, Uematsu H, Noda T. In vitro antimicrobial susceptibility to combinations of drugs on bacteria from carious and endodontic lesions of human deciduous teeth. Oral Microbiol Immunol. 1993 Jun;8(3):172-6.
- Sato I, Ando-Kurihara N, Kota K, Iwaku M, Hoshino E. Sterilization of infected root-canal dentine by topical application of a mixture of ciprofloxacin, metronidazole and minocycline in situ. Int Endod J. 1996 Mar;29(2):118-24.
- Hoshino E, Kurihara-Ando N, Sato I, Uematsu H, Sato M, Kota K, Iwaku M. In-vitro antibacterial susceptibility of bacteria taken from infected root dentine to a mixture of ciprofloxacin, metronidazole and minocycline. Int Endod J. 1996 Mar;29(2):125-30.
    - “These results may indicate that the bactericidal efficacy of the drug combination is sufficiently potent to

eradicate bacteria from the infected dentine of root canals."

Common Features of Revascularization/Regeneration Cases
- Canal disinfected
- Blood clot (or substitute) in canal
- MTA barrier, or equivalent, placed over blood clot
- Final restoration
- Follow up

Retrospective Analysis of 48 Regendo Cases
- Bose, Nummikoski, Hargreaves JOE (in press) 2009
  - Obtained scanned original images from 48 regendo cases

- Case Selection for Revascularization/Regeneration Treatment
  - Tooth with immature apex and necrotic pulp secondary to
    - trauma
    - pulp exposure 2o to dental anomoly
    - caries
  - Apex open > 1.5 mm
  - Pulp space not needed for post/core, final restoration
  - Compliant patient

Interpretation of Case Studies
- Source of Cells?
- Residual pulp cells?
- Apical tissues / Apical papilla?
- Circulating stem cells?
- Source of Scaffold?
- Fibrin clot
- Dentinal walls
- Source of Growth Factors?
- Plasma derived growth factors
- Growth factors embedded in dentinal matrix

Considerations for a Regendo Protocol
- First Appointment
  - Local anesthesia, rubber dam isolation, access
  - Copious, gentle irrigation (Max-I-Probe needle) with 20ml NaOCl and 10ml 0.12% chlorhexidine
  - Dry canals
  - Mix 1:1:1 ciprofloxacin:metronidazole:minocycline (alternative: Ca(OH)2 paste)
  - Deliver into canal system via Lentulo spiral, MAP system or Centrix syringe
  - If triple antibiotic paste is used, ensure that it remains below CEJ (minimize crown staining)
  - Seal with 4mm Cavit
  - Dismiss patient for 3-4 weeks
- Second Appointment
  - Anesthesia with 3% mepivacaine without vasoconstrictor, rubber dam, isolation
  - Copious, gentle irrigation (Max-I-Probe needle) with 20ml NaOCl
  - Dry with paper points
  - Create bleeding into canal system by over-instrumenting (endo file, endo explorer)
  - Stop bleeding 3mm from CEJ
  - Place CollaPlug
  - Place 3-4mm MTA and reinforced glass ionomer
- Follow-up
  - Radiographic and clinical exam should reveal regeneration of growth of root and increased width of dentinal walls.
  - No pain or soft tissue swelling should be evident.