EXPOSING MYTHS IN AESTHETIC OPERATIVE DENTISTRY- 2008

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1. PEARL Practice Based Research Network
   a. Translation to practice
   b. NIDCR plan clinical effectiveness studies
   c. PEARL Network studies
      i. Class I RBC Postoperative hypersensitivity – preop +, post-op new 18%
      ii. Deep caries treatment outcomes
      iii. Risk factors for osteonecrosis of the jaw
      iv. Endodontic treatment and restoration outcomes ~ 20% failure at 3.9 yrs
      v. Analgesic effectiveness
      vi. Randomize clinical trial of hypersensitive noncarious cervical lesions
2. Caries detection, diagnosis and new modes of treatment
   a. Occlusal hidden caries and change in caries presentation
   b. European studies of OHC
   c. Caries detection methods
      i. Sensitivity and specificity
      ii. Visual and radiographic examination
      iii. Diagodent
         1. efficacy - Lussi AS, et al. (1999): "Performance and reproducibility of a laser fluorescence system for the detection of occlusal caries *in vitro*." Caries Res 33: 261-266.
         2. limitations
      iv. QLF systems
         1. visualization and quantification of lesion change
   d. CAMBRA approach
      i. Useful websites
         1. http://oralhealth.dent.umich.edu/CDRAM/CariesHome.htm
         2. www.db.od.mah.se/car/data/riskbasic.html
         3. www.dent.ucla.edu/ce/caries/index.html
         4. www.fdiworldental.org/resources/ assets/guidelines/caries.html
      ii. Fluoride as a therapeutic agent vs preventive -Baelum V, Machiulskiene V, Nyvad B, Richards A, Væth M. Application of survival analysis to carious lesion transitions in intervention trials. Community Dent Oral Epidemiol 2003; 31: 252–60.
         1. 5000 ppm dentifrice and spit do not rinse approach
      iii. Salivary stimulation and xylitol products
         1. concern with xerostomia causing drugs and physician failure to caution
   e. Caries classification systems
      i. ICCS from ICDAS (ICDAS for research)
         1. Surface, caries location on surface, stage of lesion, *later activity*
   f. Does all caries need to be remove in deep lesion:
      i. Mertz-Fairhurst, EJ et al.: Clinical performance of sealed composite restorations placed over caries compared with sealed and unsealed amalgam restorations, JADA 115:689-694, 1987.
      ii. Mertz-Fairhurst, EJ et al: Ultra conservative and cariostatic sealed restorations: Results at Year 10, JADA 129:55-66, 1998
         1. paired Class I molar and premolar lesions restored with caries radiographically present and not over 50% of dentin depth
         2. CompS/C – sealed composite over dentin caries (no dentin removed)
         3. AGS - minimum amalgam restoration and sealant placed
         4. AGU - conventional extension for prevention amalgam restoration

	(recurrent caries)-	(all failures)
CompS/C	1%	12%
AGU	17%	17%
AGS	2%	2%

5. CompS/C group - no progress of caries in sequential standardized radiographs

iii. Primary teeth - Ribeiro CCC, et al (1999): A clinical, radiographic, and scanning electron microscopic evaluation of adhesive restorations on carious primary teeth", Quintessence Int 30:591-599.

iv. Key references
1. Kidd EAM (2004): "How 'clean' must a cavity be before restoration?", Caries Res 38:305-313
2. Maltz M, et al (2002): "A clinical, microbiologic, and radiographic study of deep caries lesions after incomplete caries removal", Quintessence Int 33:151-159.
3. Thompson et al (2008): "Treatment of deep carious lesions by complete excavation or partial removal: A critical review", JADA 139: 705-712

g. Early lesion progression – Michigan study
   i. Only a minor number progressed over 5 years

h. Sealant effectiveness
   i. Evidence for care in technique

i. Ozone and clinical outcomes
   i. Dahnhardt, J. E., T. Jaeggi, et al. (2006). "Treating open carious lesions in anxious children with ozone. A prospective controlled clinical study." Am J Dent 19(5): 267-70
   ii. Dahnhardt, J. E., M. Gygax, et al. (2008). "Treating sensitive cervical areas with ozone. A prospective controlled clinical trial." Am J Dent 21(2): 74-6.

3. RMGI and Fluoride Release
   a. RMGI advantages
      i. Strength, seal (water uptake and swelling, 2-4%)
   b. Efficacy as a liner (P.E. Murray studies 2000-2004)
      i. Pulpal inflammation and bacterial presence
      ii. RMGI and IRM equivalence
      iii. Indirect pulp cap equivalence to CaOH in humans – Costa CA, Giro EM, do Nascimento AB, Teixeira HM, Hebling J (2003): "Short-term evaluation of the pulpo-dentin complex response to a resin-modified glass-ionomer cement and a bonding agent applied in deep cavities", Dent Mater 19(8):739-46.
   c. Affected caries and the low permeability layer
      i. Dentin tubule calcification in affected dentin ahead of bacterial front
      ii. RMGI placed before etching dentin (critical in deep lesions to limit hypersens.
   d. Clinical role of fluoride release ?
      i. Studies of GI restorations replacement rates
         1. Mjor, IA: "Glass-ionomer cement restorations and secondary caries: A preliminary report", Quintessence Inter 27:171-174, 1996.
         2. Mjor, I. A. (1998). "The location of clinically diagnosed secondary caries." Quintessence Int **29**: 179-189.
      ii. Clinical results with glass ionomers Class II tunnel preparations
         1. results all negative!!
            a. Horsted-Bindslev P, Heyde-Petersen B, Simonsen P, Baelum V (2005). Tunnel or saucer-shaped restorations: a survival analysis. Clin Oral Investig 9(4):233-8.

4. Bonding to Dentin
   a. Basis of dentin bonding is penetration into collagen structure between tubules
      i. Wet bonding (moist) is S.O.P.
         1. cotton pledget or light air
         2. surface can be re-wet if dentin opaque after drying
   b. Dentin Bonding Critical Factors (one bottle = combined systems)
      i. Wet/moist dentin

        ii. Application of primer/adhesive
        iii. Gentle evaporation of solvent (6 cm or more distance to start)
        iv. Adequate light cure – use a meter to check your light
        v. Shiny surface on dentin = assure coverage
            1. reapply if necessary – excess removed with dry brush or pledget
        vi. thick layers are useful as a "stress breaking liner"
    c. Total etch, and self etch approaches
        i. Total etch decalcifies dentin
            1. 3 Step – etch, primer (dried), hydrophobic resin applied
            2. 2 Step – etch, multiple dried coats of primer/resin combination
                a. Water permeable layer formed – problems for self cure and dual cure cements or composites
        ii. Self etch
            1. 2 Steps with primer followed by hydrophobic resin
            2. 1 Step = primer + adhesive
                a. Water permeable layer formed – self cure and dual cure problems
    d. Shrinkage stress and bonding agents
        i. Increasing bonding agent thickness reduces the stress on the bond
            1. manufacturers adding thickening agents
    e. Reduction of bonds to dentin with time
        i. Exposed collagen degradation
            1. attempt to inhibit with chlorhexidine
        ii. Resin incorporation of water
            1. no bond degradation in oil storage of bonded tooth specimens
            2. manufacturers changing formulations
    f. Bleaching and interference with polymerization
        i. Neutralization of peroxides with 10% sodium acorbate for 10 min
    g. Systematic review of Clinical Trails – Peumans M, et al (2005): "Clinical effectiveness of contemporary adhesives: a systematic review of clinical trails," Dent Mat 21: 864-881
        i. Cervical dentin (Cl V restoration retention)
            1. GI >3 Step etch + rinse > 2 step self etch > 2 step etch + rinse > 1 step self etch
    h. Self etch systems and bonds to enamel (reduced)

5. Bisphenol A (BPA) and Dental Resin Based Composites and Sealants
    a. Bisphenol A potentially a minor contaminate in composites and sealants
        i. Almost all undetectable amounts
        ii. Sealants concern as BPA is an estrogenic mimicking molecule but exposure is a placement if present
        iii. Composite and sealants are only degraded to BPA very very small amounts in the mouth (estimate a few nanogm per year under the right enzymatic conditions)
    b. BPA body burden recently associated with cardiovascular disease and diabetes - Iain A. Lang; Tamara S. Galloway; Alan Scarlett; et al. (2008): "Association of urinary Bisphenol A concentration with medical disorders and laboratory abnormalities in adults," JAMA 300:1303-1310.
        i. Message is to note the daily burden in the population = 0.6-72 µg/d
    c. Sealant worst case (one time exposure – assumed 10 days)
        i. 1 gm of sealant with 0.01% BPA (very high amount) = 10 µg/d over 10 days if all released.
        ii. Ivoclar products have no BisGMA and hence no BPA contamination possible

6. Resin Based Composite (RBC) Restoration
    a. ASK NOT WHAT COMPOSITE TO USE BUT HOW TO BEST USE THE COMPOSITE YOU HAVE
    b.
        i. technology has advanced to hybrid or blend materials
            1. particle size tending toward 1 or less (Point 4 from Kerr = 0.4 μm
            2. microfiller in 0.04 μm range included to increase filler, change handling
            3. variations are in method of filler manufacture and filler volume
    c. RBC wear
        i. Particle technology change: 4 year wear ≤ amalgam wear in occlusal contacts
    d. Major reason for failure in controlled clinical studies
        i. Bulk facture just as for amalgam (not recurrent caries)
            1. problem of low fracture toughness
    e. RBC posterior usage and survival analysis
        i. Survival now equivalent in insurance databases
        ii. Do not change dentists
    f. Technology to reduce fracture toughness (yet to be independently verified)
        i. Ceram X use or irregular shape nanofillers
    g. Polymerization shrinkage the major problem in RBC posterior usage
        i. Preparation configuration and the "C" factor (ratio bonded:unbonded surface)
            1. worst case Cl I, C=5
            2. pulpal floor or axial wall debond problem = fluid reservoir + flow path to pulp
        ii. Shrinkage to bonded surface and not to the light source
        iii. Fluid flow from pulp during curing process –- Ciucchi B, et al (1997): "Volume of the internal gap formed under composite restorations in vitro," J Dent 25:305-12
            1. filling technique and bonding interaction
        iv. Class I pulpal wall gaps in load cycled restorations
        v. Flowable composite and shrinkage wall gaps - Cho, BH, et al. (2002): "Effect of Interfacial Bond Quality on the Direction of Polymerization Shrinkage Flow in Resin Composite Restorations" Oper Dent 27:297-304.
        vi. Shrinkage stress measurements with flowable provided no advantage
            1. Braga RR, Hilton TJ, Ferracane JL (2003): "Contraction stress of flowable composite materials and their efficacy as stress-relieving layers", J Am Dent Assoc 2003; 134(6):721-8.
        vii. Class II in vivo study showing axial wall debonds in extracted teeth
            1. Lopes GC et al (2004): " Effect of posterior resin composite placement technique on the resin-dentin interface formed in vivo", Quintessence Int 35:156-161.
        viii. Shrinkage stress reduction with low modulus liner (RMGI)
            1. Ferracane J (2008): "Glass ionomer liner reduces contraction stress," Oper Dent 33, 247-257
        ix. Ramped of delayed light (Soft Start) curing not more effective for stess reduction in vivo
            1. Chan DCN, Browning WD, Frazier KB, Brackett MG (2008): "Clinical evaluation of the soft-start (pulse-delay) polymerization technique in Class I and II composite restorations", Oper Dent 33:265-271
    h. Manufacturers approaches to polymerization shrinkage (2.5-1.6% by volume)
        i. Filler changes – particles sizes and careful size grading for best packing
        ii. Resin technology
            1. Silorane technology in 3M/ESPE Filtek LS (low shrinkage)
                a. Different bonding agent and polymerization mechanism
                b. Extensive confirmation in laboratory studies
    i. RBC cavity designs
        i. Preserve enamel – use of slots when ever possible
    j. Problem of RBC adaptation in cavity preparations

i. NYU studies on proximal walls and pulpal floor in test dye
ii. Studies on use of flowable and combination techniques to limit voids - Opdam NJM, et al (2003): "Voids and porosities in Class I micropreparations filled with various resin composites", Oper Dent 28: 9-14
    1. Flowable had poor adaptation
    2. "snow plow" technique best (uncured flow + syringable or use layer of uncured bonding agent + syringable)

7. All ceramic restorations
    a. Emerging problem of zirconia core restoration veneer chipping (large chips) in posterior restorations in 3 months to 3 year range
        i. Not seen with metal-ceramic restorations
    b. Monolithic ceramic inlays and onlay (Empress type) have good clinical results
    c. Zirconia because of its high strength and fracture toughness is being used for extensive restorations (ignoring the emerging chipping problem)
    d. Ceramics fail by two basic mechanisms
        i. Thick - fail by surface damage
        ii. Thin -flex and fail from undersurface (tensile zone)
        iii. Layer crowns (alumina or zirconia core) to support veneering porcelain and prevent flexural failure
            1. alumina crowns fail by bulk fracture
            2. zirconia now failing in veneer (no framework exposure)
    e. Laboratory duplication of zirconia chipping now possible
        i. Working with a large number of manufacturers to solve this problem
    f. General recommendation

In high stress areas (molar teeth or posterior bridges) use metal ceramic restorations (MCR)

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