Clinical Decision Making for Posterior Restorations

David C. Sarrett, DMD, MS
October 1, 2009
Dentist’s decisions are influenced by many factors

- Education
- Comfort zone – complexity of systems
- Time
- Fee potential
- Advertising myths
- Science knowledge
- Opinion leaders
- Anecdotal experiences
- No generally agreed upon algorithms or practice guidelines
- Few agreed upon clinical facts
Some clinical decision are easy

- Obvious signs and symptoms related to condition of dental restorations
  - Most clinicians would agree on the need for treatment
  - Treatment would likely vary
Secondary caries as cause for restoration failure

• In practice-based studies it accounts for about 50% of the reported failures of restorations (Mjör, 2005)
• In controlled clinical trials 4% to 8% over ten years (Hickel et al., 2007)
• Overused diagnosis (Mjör and Toffenetti, 2000)
Annual failure rates of posterior stress-bearing restorations (Manhart et al. 2004) as benchmarks

<table>
<thead>
<tr>
<th>Material</th>
<th>Annual Failure Rate</th>
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<tbody>
<tr>
<td>Amalgam</td>
<td>3.0%</td>
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<td>2.2%</td>
<td>2-17</td>
</tr>
<tr>
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<td>3-5</td>
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<tr>
<td>Tunnel GI</td>
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<td>2.9%</td>
<td>2-11</td>
</tr>
<tr>
<td>Ceramic inlay/onlay</td>
<td>1.9%</td>
<td>2-11.5</td>
</tr>
<tr>
<td>Cast Gold inlay/onlay</td>
<td>1.4%</td>
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Posterior composite restorations failures

• Brunthaler et al. (2003)
  – Bulk fracture most common reason for failure for periods up to 5 years
    ▪ 1 to 14% -most below 5%
    ▪ 14% was Solitaire
  – Secondary caries most common reason for failure periods beyond 5 years
    ▪ 3 to 16%
    ▪ Higher percentage for longer observation periods
  – Failures due to pain
    ▪ Most 2 to 8%
    ▪ One was 15% due to biting pain
    ▪ Only 5 of 24 studies reported failures due to pain
Better to not change dentists

- Bogacki et al. 2002
  - Insurance claims data to compare survival of composite and amalgam restorations
- Changing dentist results in lower survival probability

![Graph showing survival probability over time for different dentists and materials.](image)
What decisions must be made by dentists when restoring posterior teeth?

- Direct vs. indirect method – let us focus only on direct restorations for this presentation
- What restorative material category to use?
  - Amalgam
  - Composite
  - Compomer
  - Glass ionomer/composite sandwich
- What isolation method is best or possible?
- What type of cavity preparation will be needed?
  - Classic cavity walls and angles
  - Conservative disease only driven cavity preparation
What decisions must be made by dentists when restoring posterior teeth?

- What adhesive to use?
  - 3-step: etch, primer, adhesive (two bottle system)
  - 2-step: etch, adhesive (one bottle system)
  - Self etch system
- What base or liner, if any to use?
- What matrix to use?
- What placement methods to use?
- What curing methods to use?
- What contouring and polishing instruments to use?
Composite vs. Amalgam

- According to Bogacki et al. (2002) the use of composite has increased and more restorations are place with composite than with amalgam (includes anterior composite)
- Composite restorations outnumber amalgam restorations
Annual failure rates of posterior stress-bearing restorations (Manhart et al. 2004) as benchmarks

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Cavity preparation options
Disease driven design
Bottom Line

• Using in vitro bond strength data for purchasing decisions not recommended
  – High variability
  – Useful for researchers and manufacturers
  – Lack of standardized methods
  – No info on bond deterioration

• Cannot tell the dentist the “best” product

• ADA ACE Panel Discussion
  – Total-etch still preferred for reliability
  – Self-etch may produce less sensitivity
  – Consider compatibility with cements and restoratives
  – All still require good isolation
Are the adhesives with fewer steps as effective as total-etch systems plus two steps?

- Annual failure rates 1.5 to 5.4% (2.9% mean)
- Studies ranged from 2 to 5 years
- Compare with benchmark 2.2%
- The clinical findings are leaning toward Yes
Getting the Most Out of Flowable Composites:
A Panel Looks at Strengths and Weaknesses

Five members of our expert panel discuss important properties of flowable composites, as well as provide their take on the most useful applications for the product. Also, read why the panel advocates not using flowables as liners. The experts also provide recommendations on particular clinical techniques when using flowable composites.
Flowable Composites

• Dentists surveyed indicated that the most common use of a flowable composite was as a liner material under a restorative composite,

• This would indicate that viscosity, radiopacity and shrinkage effects would be important properties for them to consider.
Flowable Composites

• The expert panelists agreed that this was not the best application for flowables. Better applications include clinical situations such as marginal repair and small, non-load bearing restorations.

• For these situations, strength and fracture toughness values as well as low water sorption and water solubility values would be important properties in addition to viscosity and low shrinkage.
Does the use of flowable composite used as a liner improve clinical performance?

- One clinical study on internal adaptation showed no difference
- Two studies of two-year length showed no differences
- In the short-term, it does not appear to have any affect
Caries excavation is completed. A light-cured glass ionomer (Resin-modified glass ionomer) was placed as a base in the distal area prior to placing a composite restoration.
Flowable Composite used as a Pit & Fissure Sealant - in combination with a Hybrid Composite

Following use of a total-etch adhesive system, the distal area was restored with a hybrid composite and all remaining fissure areas were restored with a flowable composite.
Endodontically treated tooth to be restored with a composite. The pulp chamber floor has multiple features that present a challenge to void-free adaptation of the hybrid composite.

Flowable? Glass Ionomer or Resin-modified GI? Warmed Composite?
Large, accessible Composite restoration

Cavity preparation to be restored with a hybrid composite. Void-free adaptation of the composite is possible, no flowable composite needed.
Composite restoration completed without use of a flowable composite.
## Posterior composite materials – ADA Professional Products Review Vol. 1, Issue 1

<table>
<thead>
<tr>
<th>Product</th>
<th>Filler</th>
<th>Particle Size</th>
<th>Volume Fraction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aelite LS Posterior</td>
<td>Silica, strontium glass</td>
<td>0.05-4 μm</td>
<td>74</td>
</tr>
<tr>
<td>Esthet-X</td>
<td>Barium-fluoro-aluminum-boro-silicate glass</td>
<td>10-20 nm 002-25 μm</td>
<td>60</td>
</tr>
<tr>
<td>Filtek Supreme Plus Universal Restorative</td>
<td>Zirconia silica with cluster agglomerates</td>
<td>0.75-7 μm 06-14 μm</td>
<td>595</td>
</tr>
<tr>
<td>Gradia Direct Posterior</td>
<td>Fluoro-alumino-silicate glass, organic filler</td>
<td>0.016-16 μm</td>
<td>65</td>
</tr>
<tr>
<td>Grandio</td>
<td>Silica glass</td>
<td>0.6-20 nm 0.74 μm</td>
<td>714</td>
</tr>
<tr>
<td>Heliomolar HB</td>
<td>Silica, yttrium fluoride and copolymers</td>
<td>0.04-0.2 μm</td>
<td>46</td>
</tr>
<tr>
<td>Herculite XRV</td>
<td>Barium-alumino-boro-silicate glass, colloidal silica</td>
<td>0.6 μm (avg.)</td>
<td>59</td>
</tr>
<tr>
<td>Venus</td>
<td>Silicone dioxide, barium-aluminum-boron-fluoride silica glass</td>
<td>0.01-0.04 μm 0.7-2.0 μm</td>
<td>61</td>
</tr>
</tbody>
</table>
Figure 6b. Heliomolar HB sample placed 2 mm from the light tip when using the composite manufacturer’s recommended cure time (20 seconds).

Figure 6d. Tetric EvoCeram sample placed 2 mm from the light tip when using the composite manufacturer’s recommended cure time (20 seconds).
Figure 8. Mean battery life of tested LED curing lights

- Smartlight IQ2
- Fusion
- Aurora
- Bluephase 16i
- Demi
- Bluephase G2
- Q-Lite

Average Number of 30-Second Cure Cycles
Figure 2. **Percentage decrease in irradiance between the 2- and 9-mm distances.**

![Graph showing percentage decrease in irradiance between 2- and 9-mm distances for various dental curing units.

- **Sapphire:** 20%
- **Bluephase 16i:** 68%
- **Bluephase G2:** 30%
- **Aurora:** 53%
- **Demi:** 52%
- **Fusion:** 35%
- **Q-Lite:** 55%
- **SmartLight IQ:** 38%
- **Optilux 501:** 19%

*2mm from sensor*  
*9mm from sensor*  

ANSI/ADA Specification 48 minimum requirement for irradiance of visible light curing units?
Figure 3. Beam footprints taken with light tip at 2 and 9 mm from a target.*

* Distances between circles equal 2 mm.
Figure 4. **Normalized spectral distribution curves for selected lights.**

* This is a representative curve for the single-peak LED curing lights: the Aurora, Bluephase 16i, Demi, Fusion, Smartlite IQ2, and the Q-Lite all have the same shape but with different peak wavelengths, effective spectral range and full spectral range. See Table 2 and Figure 5 for a comparison of these parameters among the different LED curing lights.
Key Factors for Success with Posterior Composite Restorations

- Conserve tooth structure
  - caries risk assessment
  - focus on caries removal
- Controlling the operating environment
  - tissue management
- Understanding how to achieve quality bonding
- Composite placement technique
  - void free placement
  - anatomical buildup to avoid carving
- Maximum curing of composite
Step by Step Procedure for Class II Composites

- Remove restorative materials and open access for caries removal
  - Use 330 bur in high speed/water
  - No rubber dam/ cotton roll isolation now
- Tissue removal and management
  - Remove tissue with 330 bur in high speed/water
  - Control bleeding
- Isolation with rubber dam or cotton rolls
- Dentinal caries and stain removal
  - #4 or #6 round bur in slow speed handpiece
- Enamel smoothing
  - 330 bur or 7902 pointed finishing bur in high speed without water spray
- Use a bitine ring system
- Many new types available
• Trim proximal excess
  – 12b scapal blade
• Complete occlusal anatomy with bur
  – 330 and #4 or #6 round burs
  – slow speed handpiece
Polishing posterior composite

• Surface finish
  – Filler – high hardness
    ▪ Difficult to polish
    ▪ Become rough with wear
  – Hybrid/Nano composites
    ▪ Softer glass fillers
    ▪ Range of particle sizes
After several years
Diamond paste and rubber polishers
ADA Professional Product Review - Overview

Dave Sarrett, DMD, MS
Editor, Professional Product Review
Dave Sarrett, DMD, MS
Editor, PPR

Mandy Chia, DDS, MBA
Director, PPR

John Kuehne, DDS
Director, ADA Laboratories

Nina Koziol
Tim O'Shea

Lab Staff

Spiro Megremis
Janice Lord
The genesis of ADA Professional Product Review

Seal Program for Consumer Dental Products to continue

Seal Program for Professional Dental Products phased out in December 2007
Our Target Audience

- US Active Dentists: 180,000
- 155,000 ADA members
- GPs: 77%
- Specialists

ADA American Dental Association®
The Publication – the product and the placement

- A quarterly newsletter packaged with JADA since July 2006 as a benefit to members
- Online access for 155,000+ members and subscribers
- Each issue features 1 to 3 product categories
ADA Professional Product Review
– taking steps to close the information gap

Product category knowledge in dental material course

Individual brand decision and product comparison

Limited number of products in clinical training

New products and new technology in the market place

Product claims

Evidence and clinical relevance of product claims
ADA Professional Product Review - Content

**Lab components**

- **ADA headquarters**
  - Chicago, IL

- Test products according to ANSI/ADA & ISO specifications or other standards
- Develop clinically relevant test methods in consultation with experts and manufacturers
- Generate reliable and reproducible lab data

**Clinical Components**

- Members sign up voluntarily to provide their clinical impression
- 1900 ACE sign up since summer 2006
- Active ACE evaluators – 700
- Expert panel discussion
- Product forum at ADA annual session

ADA American Dental Association®
Additional contributions of the lab component of ADA PPR

Published literature & standards
(ISO/ANSI Standards,
ADA Specs./Guidelines)

Manufacturers

External consultant review

Protocol Development & Pilot Testing

Communicate

Laboratory evaluation
in the ADA Laboratories

Enhance future Standards by pioneering new Test methods
July 16, 2009 | dentalproductsreport.com

WEB EXCLUSIVE

Part 1: Exclusive Q&A with editor for ADA Product Review

Find out why the ADA’s Professional Product Review is important to you.

by San Goff, Executive Editor

Dr. David C. Farrett has served as the editor of the ADA Professional Product Review (PPR) since its inception in 2006. He recently spoke with DPR about how the publication got started, how it has grown, and how the ADA plans to expand it in an effort to better serve their members in terms of learning about professional product usage and helping them determine which products and equipment might fit best with their practices.

Below is a question-and-answer
ADA Professional Product Review – the process

**Category Selection**
- Member survey
- Industry input

**Product Selection**
- Planning survey
- Market share information
- New technology
- Notify the manufacturers

**Product Acquisition**
- Purchase products
- Discuss loaning possibility
- Manufacturer technical table

**Laboratory protocol development**
- Send draft protocol to mfg
- ADA consultants input
- Finalize protocol based on feedback
- Sent final protocol to the manufacturers

**Laboratory testing**
- Notify mfg for unexpected events
- Send test results to the mfg prior to publishing

**ADA member input**
- Evaluation survey

**Expert panel discussion**
- Address clinical issues
  - Interpret survey and lab testing results
  - Master clinicians
  - Industry input

**Product Forum/evaluation at ADA Annual Session**
- Provide draft questionnaire to mfg for input
The ADA Professional Product Review™ (PPR) will evaluate flowable composite resins, curing lights and restoration polishing systems. Your input on the following will help direct the choice of products evaluated. Please take a few minutes to answer the following:

1. Have you used a flowable composite resin product in your practice in the past 12 months? If Yes, please specify which one(s) you have used. If No, skip to Q 2.

   Other ______________________

2. If you have not used a flowable composite in the past 12 months, please tell us why:

3. For which applications do you use flowable composites? (Select all that apply.)

4. What features are most important to you in a flowable composite? (Please rank the top 5 features with “1” being most important.)

5. If a material claims to be radiopaque, would you expect the radiopacity to be as dense as dentin or enamel?

6. Which flowable composite resin products would you like the ADA PPR to evaluate?

   (Select up to 5.)

   Other: ______________________________
2008 PPR reader survey results

Q – Into which area should PPR expand?

- Clinical techniques: 38
- New technology: 22
- Therapeutics: 19
- Practice enhancement tools: 7
- Disposable products: 4
- Ergonomics: 4
- Software: 3
- Other: 3

ADA American Dental Association®
Dental Therapeutics

- Antibiotics and premedication
- Analgesics
- Sedative – anti-anxiety
- Xerostomia
- OTC products
  - toothpaste, mouth rinse and dry mouth products
- Remineralizing agents
- Fluoride varnish
- Steroids
- 20 most commonly prescribed medication and their oral affects
- TMJ medication
Top requests

Clinical techniques
- Composite restoration (bonding)
- Endodontic treatment
- Laser
- Periodontal treatment
- Crown and bridges
- Implant
- Veneer

New technology
- Laser
- CAD/CAM
- Digital radiograph
- Implant
- Bonding agents
58% indicated they would make major purchases in the next 12 months

- Digital radiograph (n=61)
- Dental operatories (chairs, units) (n=35)
- Laser (n=17)
- Panoramic radiograph (n=15)
- Computer (n=14)
- CAD/CAM system – CEREC, E4D (n=14)
- Intraoral camera (n=10)
- Digital impression system (n=9)
- Handpieces (n=10)
- Autoclave, compressor, CBCT
### Top 30 categories selected by ADA members to be evaluated by PPR

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Date</th>
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<tbody>
<tr>
<td>Adhesives</td>
<td>Curing lights (LED) (10/06)</td>
<td></td>
</tr>
<tr>
<td>Anesthetics</td>
<td>Desensitizing agents (10/07)</td>
<td></td>
</tr>
<tr>
<td>Apex locators</td>
<td>Digital Impression materials (powderless)</td>
<td></td>
</tr>
<tr>
<td>Artificial saliva</td>
<td>Digital radiography (7/06)</td>
<td></td>
</tr>
<tr>
<td>Bonding agents (1/07)</td>
<td>Files (rotary endo) (10/06)</td>
<td></td>
</tr>
<tr>
<td>Caries detection devices (7/08)</td>
<td>Fluoride rinses, gels and varnishes</td>
<td></td>
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<tr>
<td>Cements (resin) (10/06)</td>
<td>Gingival retraction</td>
<td></td>
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<td>Cements (temporary)</td>
<td>Implants (mini)</td>
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<tr>
<td>Composites</td>
<td>Implants (other)</td>
<td></td>
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<tr>
<td>Composites (posterior) (7/06)</td>
<td>Lasers (soft tissue)</td>
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<tr>
<td>Loupes</td>
<td>Nightguards/NTI</td>
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<td>Occlusal splints for TMD</td>
<td>Oral cancer screening devices</td>
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<td>Post materials</td>
<td>Restoration polishing systems</td>
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<td>Temporary bridge materials</td>
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<td>Temporary materials</td>
<td>Temporary crown materials</td>
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<tr>
<td>Ultrasonic scalers</td>
<td>Veneer materials</td>
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Date in parenthesis indicated the publication date of previous evaluation

**ADA** American Dental Association®
Overall feedback

How has the ADA Professional Product Review impacted your practice?

- Very Helpful: 17.2%
- Helpful: 63.2%
- Neutral: 18.4%
- Unhelpful: 0.7%
- Very Unhelpful: 0.5%

Per cent of Respondents
School Pilot Program
Generating clinically relevant data from preclinical & clinical settings

U. of Maryland – Dean Stohler, Dr. L DePaola
In-vitro comparison of iTero digital impression device vs. conventional impression technique

U. of Alabama – Dr. John Burgess
A Randomized, Prospective Clinical Evaluation of All Ceramic Crowns made from Digital and Conventional Impressions

U. of Pacific – Dr. Marina Wasche
Evaluation of the Cadent iTero digital Impression Device, user survey and patient survey
New, Enhanced Content

- Multiple product categories and comprehensive single categories
- Interviews, reviews and special reports:
  
  “Is an Electric Handpiece in your future?” (Spring ‘09)

  “Deconstructing the Product Evaluation Process” (Summer ‘09)

  “It’s all About Color: Digital shade-matching instruments” (Summer ‘09)

  “Special Report: Addressing Concerns about Lead” (Winter ‘09)
Product Evaluation Forums @ Annual Session

’05 – LED Curing Lights

’06 – High-Speed Air Turbine Handpieces

’07 – Intraoral Cameras

’08 – Electric Handpieces

’09 – Shade-Matching Devices
2007 Intraoral Cameras: 220 dentists evaluated 8 different products
“...This was a great way for me to evaluate several different systems all in one place in an unbiased location.”

– Dr. Bradley Barnes
ADA News, April 2008
2009 Product Forum: Digital Shade Matching Devices
Online venues for members to access at their convenience – CE Credits and Podcast

- **CE online**
  - Collaboration with ADA Center for Continue Education and Life Long Learning

- **Podcast**
  - Underway: Three downloadable Audio Podcasts available in 2009
  - Expert panels discussing product categories evaluated in the *Review.*
Pioneer new test methodologies

Dental Unit Water Line Cleaners

Rotary Endodontic Files: Fatigue Testing

ADA American Dental Association®
Pioneer new test methodologies

Polishing Systems:
• Controlled Speed, Pressure and Contact Time

Elastomeric Impression Materials: New Viscosity Test Method
ADA Polishing System
In This Issue

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