I. Isolation

A. Rubber dam

1. Rubber dam materials
   a. Hygenic, Coltène-Whaledent – thin, medium, heavy, extra heavy; several colors
   b. Ivory, Heraeus Kulzer – medium weight; green or blue
   c. Non-latex – Hygenic, Coltène-Whaledent; DermaDam, Ultradent

2. Rubber dam clamps (Ivory, Heraeus Kulzer)

<table>
<thead>
<tr>
<th>Clamp #</th>
<th>Ivory Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>For small lower anteriors and premolars that are irregularly positioned</td>
</tr>
<tr>
<td>2</td>
<td>General purpose lower bicuspoid clamp</td>
</tr>
<tr>
<td>27N</td>
<td>Universal bicuspoid clamp</td>
</tr>
<tr>
<td>7</td>
<td>General purpose lower molar clamp</td>
</tr>
<tr>
<td>8</td>
<td>General purpose upper molar clamp</td>
</tr>
<tr>
<td>14</td>
<td>For partially erupted or undersized teeth</td>
</tr>
<tr>
<td>56</td>
<td>For all large molars</td>
</tr>
<tr>
<td>212</td>
<td>Anterior cervical clamp</td>
</tr>
</tbody>
</table>

B. Retraction cord – Ultrapak (Ultradent) – size range: #000–#3
C. Expandex lip retractor (Parkell); OptiView (Kerr); ComfortView (Premier)
D. Isolite and others for posterior areas
II. Enamel bonding

A. Basic concepts
   1. Microscopic roughening; increased surface area; resin tags
   2. Adequate etch can be achieved with 15-sec application of 35-40% phosphoric acid, but 30 sec might be better.
   3. Beveling increases surface area, improves blending of restoration, and might reduce “white line margins.”
   4. Variations
      a. Primary vs. permanent – primary enamel (and young permanent enamel) requires a longer etching time.
      b. Fluorosis – fluorosed enamel requires a longer etching time.
      c. Ends vs. sides of enamel rods – bond strengths to the sides of enamel rods are lower than those to ends of rods.
      d. Cervical enamel – bonding to cervical enamel is less effective than bonding to other areas.

B. Products – among many others:
   1. Scotchbond Universal Etchant (3M ESPE)
   3. Ultra-Etch (Ultradent)

C. Relationship with dentin bonding
   1. Etch-&-rinse adhesives bond equally well to moist and dry enamel.
   2. Self-etch systems do not etch enamel as well as phosphoric acid.

III. Dentin bonding

A. Basic concepts
   1. Dentin bonding is inherently more difficult (and less predictable) than enamel bonding.
   2. Resin adhesion to dentin is primarily micromechanical.
   3. Polymerization contraction force of composite resins is the biggest obstacle to effective bonding (as measured by retention, marginal seal, and lack of post-operative sensitivity).
   4. Proper clinical technique (following directions, understanding the product and process) is critical to success with any adhesive.

B. Available methods
   1. Etch-&-rinse (or “total-etch”)
      a. Three-step: [etch]+[prime]+[bond] (“fourth-generation”)
      b. Two-step: [etch]+[prime+bond] (“one-bottle”) (“fifth-generation”)
   2. Self-etch
      a. Two-step: self-etch *primers*: [etch+prime]+[bond]

C. Examples of products
   1. Three-step etch-&-rinse
      a. Adper Scotchbond Multi-Purpose Plus (3M ESPE)
      b. All-Bond 2 and All-Bond 3 (Bisco)
      c. OptiBond FL (Kerr Corporation)
2. Two-step etch-&-rinse
   a. Adper Single Bond Plus (3M ESPE)
   b. ExciTE (Ivoclar Vivadent)
   c. Gluma Comfort Bond & Desensitizer (Heraeus Kulzer)
   d. MPa Direct (Clinician’s Choice)
   e. One-Step Plus (Bisco)
   f. OptiBond Solo Plus (Kerr Corporation)
   g. Prime & Bond NT, XP Bond (Dentsply Caulk)

3. Self-etch primer systems
   a. AdheSE (Ivoclar Vivadent)
   b. Clearfil SE Bond and Clearfil SE Protect (Kuraray America)
   c. OptiBond XTR (Kerr Corporation)
   d. Peak SE (Ultradent)
   e. Surpass (Apex Dental Materials) – actually a 3-step self-etch system

4. All-in-one self-etch adhesives
   a. Adper Easy Bond and Scotchbond Universal (3M ESPE)
   b. All-Bond SE (Bisco) – can also be used as a self-etching primer system
   c. Bond Force (Tokuyama)
   d. Brush & Bond (Parkell)
   e. Clearfil S³ Bond Plus (Kuraray America)
   f. G-Bond (GC America)
   g. iBond SE (Heraeus Kulzer)
   h. OptiBond All-in-One (Kerr)
   i. Xeno IV (Dentsply Caulk)

D. Criteria for selecting a bonding system
   1. Clinical performance (retention, margin quality, post-op sensitivity, etc.)
   2. Laboratory performance (particularly bond strength)
   3. Your need for versatility ("universal" vs. direct composite only)
   4. Ease of use
   5. Cost per application

E. Bonding self-cure and dual-cure composites
   1. Acidity and permeability of simplified adhesives adversely affect bonding of self-cure and dual-cure materials (as in composite foundations).
   2. Three-step etch-&-rinse systems are the best option.
   3. Two-step etch-&-rinse systems can be mixed with a catalyst, or can be covered with a hydrophobic resin (such as Bond-Link [Den-Mat] or the bonding agent from a three-step system).

IV. Prevention of hyperalgesia; pulp protection and therapy

A. Pulp protection/prevention of post-op sensitivity
   1. Never desiccate dentin with strong, continuous blasts of compressed air.
   2. Under amalgam, use an adhesive or desensitizer (Gluma Desensitizer [Heraeus Kulzer], G5 [Clinician’s Choice]) plus RMGI liner in deeper preps.
   3. Options for composite restorations (especially Class I and II)
      a. RMGI liner (Vitrebond Plus [3M ESPE])
      b. Flowable composite on floors
c. Self-etch adhesive system
4. For bonded crowns, allow some self-curing of resin cement before light activation.

B. Direct pulp capping
1. Use clinical judgment – is it worth attempting or not?
2. Very important – stop the hemorrhage! Use NaOCl or chlorhexidine.
3. Place calcium hydroxide (Dycal [Dentsply Caulk]) on exposure site.
4. Place RMGI liner (Vitrebond Plus) for strength and seal.
5. Keep an eye on newer materials (Biodentine, Septodont; TheraCal, Bisco).

C. Partial – or Cvek – pulpotomy
1. Remove superficial 1-2 mm of pulp tissue using sharp diamond rotating at high speed with water spray.
2. Follow direct pulp capping procedure.

D. Hyperalgesia (dental hypersensitivity)
1. Prevention with crown preparations—“immediate dentin sealing”
   a. Etch-&-rinse adhesive: brief etch (5-10 sec), apply adhesive and air-thin. Self-etch material can be used as an alternative.
   b. Desensitizer (Gluma Desensitizer) at prep or delivery appointment
   c. Use RMGI for cementation (see section X)
2. Treatment (e.g., exposed cervical dentin)
   a. Desensitizer (Gluma Desensitizer or G5)
   a. Adhesive: very brief etch (5 sec) or clean with hypochlorite or pumice, apply adhesive or similar material (e.g., Seal & Protect [Dentsply Professional]). Brush & Bond and other self-etch systems are another option.
   c. Crystal precipitation to seal tubules (D/Sense II [Centrix])
   d. Fluoride varnish (Duraphat [Colgate Oral Pharmaceuticals], Vanish [3M Omnij])
   e. At-home option: KNO₃ dentifrice (Sensodyne [GSK])

V. Direct composite resins

A. Classification of composite materials
1. Macrofill (conventional)
   a. Particle size: 15-50 μm
   b. Advantage: strength
   c. Disadvantages: wear resistance, polishability
2. Midifill (fine particle)
   a. Particle size: ~ 5 μm
   b. Advantage: strength, improved wear and polishability
   c. Disadvantages: wear resistance, polishability still less than desired
3. Minifill
   a. Particle size: ~ 1 μm
   b. Advantages: strength, much better wear and polishability
4. Microfill
   a. Particle size: 0.04 \( \mu m \)
   b. Advantages: excellent polishability, translucency, wear, flexibility
   c. Disadvantages: polymerization shrinkage, high thermal expansion coefficient, water sorption, chipping and fatigue fracture

5. Nanofill
   a. Newest development in composite filler technology
   b. For reference, 1 nm = 0.001 \( \mu m \)

6. Hybrid
   a. Particle sizes: “macro” (~1 \( \mu m \)) plus "micro" (0.04 \( \mu m \))
   b. Advantage: universal materials
   c. Disadvantage: retain polish less than microfills

7. Micro-hybrid (or “extended range” micro-hybrids)
   a. Particle size: less than traditional hybrids (e.g., Point 4 = 0.4 \( \mu m \))
   b. Advantages: better optical properties and polishability
   c. Disadvantage: somewhat reduced strength

8. Flowable
9. Packable

B. Examples of products
1. Macrofill (conventional): Adaptic, Concise
2. Midifill (fine particle): Prisma-Fil (Dentsply Caulk)
3. Minifill: Z100, Z250 (3M ESPE)
4. Microfills
   a. Durafill VS (Heraeus Kulzer)
   b. Epic TMPT (Parkell)
   c. Renamel (Cosmedent)
   d. Heliomolar (Ivoclar Vivadent) – only microfill OK for Class I and II
5. Hybrids
   a. Charisma (Heraeus Kulzer)
   b. XRV Herculite (Kerr Corporation)
6. “Extended range” micro-hybrids
   a. Esthet-X HD (Dentsply Caulk)
   b. Gradia Direct (GC America)
   c. Point 4 (Kerr Corporation)
   d. Venus (Heraeus Kulzer)
   e. Vit-l-scence (Ultradent)
7. Nanofills
   a. Filtek Supreme Ultra (3M ESPE) – true nanofill
   b. Kalore (GC America), Herculite Ultra (Kerr), Simile (Pentron), TPH\(^3\), Ceram X (Dentsply Caulk), Tetric EvoCeram (Ivoclar Vivadent) – technically \textit{nano-hybrids}
8. Flowables – many are available, including:
   a. Esthet-X Flow (Dentsply Caulk) – thixotropic
   b. Filtek Flow (3M ESPE) – nanofill
   c. Flow-It (Pentron)
   d. Heliomolar Flow (Ivoclar Vivadent) – microfill
   e. SureFil SDR (Dentsply Caulk) – low stress, bulk application
   f. Tetric EvoFlow (Ivoclar Vivadent) – very radiopaque
9. Packables – for posterior composites
   a. ALERT (Pentron)
   b. Filtek P60 (3M ESPE)
   c. Solitaire 2 (Heraeus Kulzer)
   d. SureFil (Dentsply Caulk)

10. Silorane-type – low-shrinkage material for posterior composites
   a. Filtek LS (3M ESPE)
   b. Must be used with its dedicated adhesive.

C. Anterior (Class III, IV)
   1. Bevel for retention and blending. Scallop the bevel to improve blending on Class IV’s.
   2. Extent of preparation is determined by size of defect; mechanical retention usually is not necessary.

D. Posterior (Class I, II)
   1. Isolation is critical, and rubber dam is the preferred method.
   2. Size of defect and convenience form determine preparation size.
   3. There is no consensus about beveling of occlusal margins.
   4. Post-operative sensitivity is more likely in Class I than in any other composite restorations. See section IV-A for information re: prevention.
   5. Matrix choices
      a. Tofflemire type – e.g., 0.010” Ho bands (Young Dental)
      b. Sectional w/ bitine ring – Composi-Tight 3D (Garrison Dental), V3 Ring (TrioDent), Palodent Plus (Dentsply Caulk)
   6. WedgeWands (Garrison Dental)
   7. Gingival increment of Class II – use flowable material (composite or compomer), RMGI, or compomer.
   8. Place and light-cure composite incrementally, not in bulk.
   9. After finishing and occlusal adjustment, can use a resin surface sealer to correct white line margins, or to seal margins as a matter of routine (BisCover [Bisco], OptiGuard [Kerr], PermaSeal [Ultradent]).

E. Cervical (Class V)
   1. Rubber dam with #212 clamp can be used for isolation, but cotton roll and retraction cord are usually more convenient.
   2. Bevel enamel for retention and blending.
   3. If desired, a small retention groove can be placed at gingival aspect using #1/4 round bur, but is usually not necessary.
   4. Use a sable artist’s brush to help contour and smooth the composite.
   5. Avoid aggressive finishing of the composite gingivally. This can damage the cementum and cause post-operative sensitivity.

F. Composite placement instruments
   1. Almore Microfil Contouring Instrument #1 (Clinician’s Choice)
   2. IPC interproximal carver (GC America)
   3. Compo-Sculp instruments (Suter Dental)

G. Visible light-curing
   1. Available curing devices
      a. Conventional quartz-tungsten-halogen (QTH): Optilux 501 (Demetron/Kerr), Spectrum 800 (Dentsply Caulk)
b. LED units (from many manufacturers): bluephase 20i (Ivoclar Vivadent), Demi Plus (Demetron/Kerr), Elipar S10 (3M ESPE), SmartLite Max (Dentsply Caulk), Valo (Ultradent)
c. High-intensity QTH (e.g., Optilux 501 boost mode w/ TurboTip)
d. Plasma arc curing (PAC) lights: Sapphire (Den-Mat)
e. Argon lasers

2. Curing methods
   a. Continuous standard or high-intensity (most conventional QTH units, PAC lights, lasers)
   b. Stepped (Spectrum 800 has manual step mode)
   c. Ramp cure (Elipar TriLight [3M ESPE])
   d. Pulse delay (VIP [Bisco])

3. Check light intensity output periodically using the unit’s built-in radiometer, or a hand-held radiometer (Curing Radiometer, Demetron/Kerr)

4. LED lights might require specially calibrated radiometer (Demetron; Ivoclar Vivadent)

H. Finishing and polishing
1. General “tips”
   a. Move from material toward tooth.
   b. Use discs at incisal edges, restoration margins.
   c. Use rubber cups for gingival margins, resin veneers, etc.
   d. Use rubber points for lingual and occlusal surfaces, etc.
   e. Polishing pastes improve shine, at least initially.

2. Carbide finishing burs
   a. #7406, 7801, 7901 (Dentsply Professional)
   b. Regular 12-fluted or ET finishing burs (Brasseler)
   c. RAPTOR style (Bisco, Brasseler)

3. #12 scalpel blade (generic)

4. Abrasive rubber/point/cups
   a. Astropol Finishers/Polishers (Ivoclar Vivadent)
   b. Enhance and PoGo (Dentsply Caulk)
   c. D-Fine Polishers (Clinician’s Choice)
   d. ET Ilustra (Brasseler)
   e. FlexiPoints, FlexiCups (Cosmedent)
   f. Jiffy Polishers (Ultradent)

5. Interproximal strips
   a. Compo Strips (Premier) and VisionFlex (Brasseler)
   b. Epitex Strips (GC America)
   c. Sof-Lex Finishing and Polishing Strips (3M ESPE)

6. Finishing discs
   Sof-Lex and Sof-Lex XT Pop-On Discs (3M ESPE)

7. Polishing brushes: Clinician’s Choice, Ultradent, Kerr
VI. Other tooth-colored direct restorative materials

A. “Continuum” of tooth-colored restorative materials
   1. Glass ionomers (e.g., Fuji IX, Chemfil Rock): acid/base reaction; fluoride release
   2. Resin-modified glass ionomers: acid/base reaction plus methacrylate polymerization; fluoride release
   3. Polyacid-modified composites (“compomers”): primarily methacrylate polymerization; some fluoride release
   4. Composite resins: methacrylate polymerization; little or no fluoride release

B. Resin-modified glass ionomers
   1. Fuji Filling, Fuji II LC (GC America)
   2. Ketac Nano (3M ESPE)

C. Compomers
   1. Compolass F (Ivoclar Vivadent)
   2. DyRact eXtra (Dentsply Caulk)

D. Indications
   1. Class V restorations (use RMGI for most fluoride release)
   2. Primary tooth restorations (Class I and II)
   3. Small crown build-ups and block-outs
   4. Gingival increment of Class II posterior composite
   5. Temporary restorations

VII. Ceramic inlays and onlays

A. Types of materials available
   1. Feldspathic porcelains – but these are weak, and other materials are better.
   2. Pressed ceramics (IPS Empress or eMax [Ivoclar Vivadent]) – can be etched with HF acid and bonded to the tooth.
   3. Various industrially-fabricated “blocks” for CAD/CAM milling

B. Preparation guidelines
   1. Use a flat-ended diamond with rounded edges to provide rounded internal line angles (e.g., Two-Striper #587.4, Premier) and butt-joint cavosurface margins.
   2. Pulpal depth, occlusal isthmus width, and cuspal coverage should all be about 2 mm.
   3. Opposing walls should diverge more than those for gold inlays (perhaps as much as 5-15°).

C. Bonding – use a dual-cure resin cement (Dual Cement [Ivoclar Vivadent], Rely-X ARC [3M ESPE], NX 3 [Kerr], Duo-Link [Bisco]).

VIII. Porcelain veneers

A. Basic concepts
1. These are designed to be conservative restorations – preparation usually is necessary, but should be restricted to enamel as much as possible. Clinical studies indicate that enamel preparations provide the greatest long-term success.

2. Shade selection – light shades (e.g., A1 or lighter) work most of the time, but can use other shades, especially in canines and cervical areas.

3. To block out discolored teeth, ask the lab to use opaque porcelain; do not try to do this with the cement or opaque resins, which give unpredictable results.

4. If cervical area of teeth is not discolored, ask lab to use translucent porcelain in this area for best blending with tooth ("contact lens effect").

B. Tooth preparation

1. If alignment of the teeth is to be changed, can make a shim on a duplicate model from a pre-tx wax-up. Load the shim with bis-acryl temporary composite and apply to the teeth. Prepare depth grooves through the composite into the teeth. This will ensure uniform thickness of the veneers (which will have the same contour as the wax-up).

2. As a general rule, 0.5 mm of labial enamel should be removed (slightly less in cervical areas). Remove 0.7 mm from discolored teeth. (For pressed ceramics, more reduction is necessary – lab prefers up to 1.0 mm in most areas.)

3. Finish line is a definite chamfer, which should approach, but not break, proximal contacts.

4. Preparation diamonds include:
   a. Two-Striper #767.78 (Premier)
   b. 850-016 (Nixon kit [Brasseler])
   c. LVS #3 and #4 (LVS kit [Brasseler]) – two-grit; finer at tip

5. Depth gauge diamonds (Brasseler) are recommended.

6. Shorten tooth to accommodate 1.0 mm of porcelain at incisal edge.

7. Lingual finish line is a chamfer no farther than 1.0 mm from incisal edge.

8. Check proximal contacts. If tight, lighten using CompoStrips (Premier) or VisionFlex Strips (Brasseler). Do not open the contacts.

C. Provisionals – two methods

1. Spot-etch enamel; free-hand direct composite veneers.

2. Use pre-op impression or vacuum-formed matrix for bis-acryl material.

D. Try-in and cementation

1. Remove provisionals, if any. Clean teeth with pumice. Place retraction cord as needed.

2. Try in each veneer individually – and dry – to check for fit.

3. Try in all veneers together wet, to check color and overall fit.

4. If necessary, check again with the resin cement (work quickly to avoid setting) or appropriate try-in paste. Always check versus a translucent shade; the translucent will work most of the time.

5. Veneers should have been etched by the lab already. If any areas appear unetched, treat briefly with HF acid gel (Pulpdent, Ultradent). Use a silane coupling agent, which can improve bond of resin to ceramic by about 25%. Follow manufacturer’s instructions.

6. Cement veneers two at a time, beginning with the central incisors.
7. Appropriate cements include:
   a. Calibra (Dentsply Caulk)
   b. NX 3 (Kerr)
   c. Rely-X Veneer Cement (3M ESPE)
   d. Variolink Veneer or Variolink II (Ivoclar Vivadent)
   e. Any restorative composite extruded through a "ribbon tip" (Centrix) to thin it, or flowable composite.

8. As a general rule, do not “mix and match” adhesives and cements from different manufacturers.

9. Remove excess cement before light activating. Desired goal in clean-up is simple removal using a #12 scalpel blade.

10. Remember that porcelain attenuates the curing light. Make sure to use adequate curing times, as the veneer cement (except for extremely thick veneers) is cured only by visible light.

11. Check occlusion carefully, including excursions, and adjust as needed.

12. Minimize finishing, but some will be necessary, particularly at lingual margins. Use – in order, microfine diamonds, 30-fluted carbide finishing burs, rubber porcelain polishers (Brasseler), diamond polishing paste (Truluster [Brasseler], Diashine [VH Technologies]).

IX. All-ceramic crowns

A. Types of materials available
   1. Pressed or milled glass ceramics (IPS Empress, eMax [Ivoclar Vivadent]) – can be etched with HF acid and bonded to the tooth.
   2. Alumina-core high strength ceramics (InCeram [Vident], Procera AllCeram [Nobel Biocare]) – these cannot be etched effectively.
   3. Zirconia-core high-strength ceramics (Cercon [Dentsply], Lava [3M ESPE]) – these cannot be etched effectively.
   4. Selection of material is based on need for strength and translucency/opacity. The pressed ceramics will allow more of the underlying tooth shade to “shine through”. Use an alumina or zirconia ceramic when the tooth is discolored, or a metal post is present.

B. Preparation guidelines for zirconia
   1. Internal line angles should be rounded, and the finish line should be a definite chamfer (Sorensen prep kit for Lava [Brasseler]).
   2. Incisal/occusal reduction should be 1.5-2.0 mm.
   3. Lingual clearance on anteriors should be 1.0-1.5 mm.
   4. Facial reduction should be 1.0-1.5 mm.

C. “Minimal reduction” crown preparations (“360° veneers”) are OK in some instances. These crowns must be bonded.

D. Cementation/bonding
   1. IPS Empress or eMax – use a dual-cure resin cement. Do not hurry to light-activate (rapid application of curing light might contribute to post-op sensitivity). Remove excess before light activation or after very short light exposure.
2. Alumina ceramics – any cement can be used. For bonding, Panavia (Kuraray America) is an adhesive resin cement shown in clinical trials to be a particularly effective for these ceramics.

3. Zirconia ceramics (Lava, Cercon) – any cement can be used. RelyX Unicem (3M ESPE) is a good choice for these ceramics when slightly more retention is desired. When even more retention is needed, consider Multilink (Ivoclar Vivadent) or Clearfil Esthetic Resin Cement (Kuraray). Use a zirconia primer to treat the internal surface.

X. Ancillary materials for indirect restorations

A. Impression materials and techniques
   1. Current precision impression materials
      a. Polyvinylsiloxanes (PVS) (addition silicones) – Aquasil Ultra (Dentsply Caulk), Virtual (Ivoclar Vivadent), Affinity (Clinician’s Choice), Examix (GC America), Honigum (DMG), Imprint III (3M ESPE), Affinis Precious ( Coltène-Whaledent), many others
      b. Polyethers – Impregum, Impregum Soft, Permadyne (all 3M ESPE)
   2. Choosing a class of material – either type is fine!
      a. PVS: more products and variations available; possibly slightly better physical properties
      b. Polyether: more hydrophilic; better “true” working time
   3. Automatic mixing/dispensing devices
      a. Pentamix 3 (3M ESPE)
      b. Volume Mixer (Kerr)
   4. Dual-cord retraction technique
      a. Prepare tooth to gingival margin.
      b. Pack small (000, 00, or 0) cord; complete preparation.
      c. Place larger second cord dipped in hemostatic solution of choice; leave in place 5-10 minutes.
      d. Rinse, leave wet, remove top cord, and dry with compressed air.
   5. Tips for impression making
      a. Use tray adhesive; allow to dry for at least 10 minutes.
      b. Place syringe tip close to margin.
      c. Push, don’t pull material.
      d. Use a “stirring” motion; go around prep twice if possible.
      e. Never remove tip from material.
      f. Observe working and setting times.

B. Provisionals
   1. Types of resin provisional materials
      a. Acrylic (polymethymethacrylate) – e.g., Crown and Bridge Resin (Dentsply Caulk)
      b. Acrylic (polyethylmethacrylate) – e.g., Snap (Parkell)
      c. Bis-acryl composites – Integrity (Dentsply Caulk), Luxatemp (DMG), Tuff-Temp (Pulpdent)
   2. Types of provisional cements
      a. ZOE – TempBond (Kerr)
      b. Non-eugenol – TempBond NE (Kerr)
c. Resin – TempBond Clear (Kerr)

C. Cements

1. Types
   b. Resin-modified glass ionomers – Rely-X Luting Plus (successor to Vitremer; 3M ESPE), FujiCem (GC America)
   c. Composite resins
      i. Conventional (classified by curing method)
         – self-cure: C&B Luting (Bisco)
         – dual-cure only: see section VIII-C
         – VLC w/ dual-cure option: see section IX-D-7
      ii. Adhesive resins
         – phosphates: Panavia F or 21, Clearfil Esthetic Resin Cement (Kuraray), Multilink (Ivoclar)
         – 4-META: C&B Metabond (Parkell), M-Bond (Tokuyama/Morita)
      iii. Self-adhesive resins: Rely-X Unicem (3M ESPE), Maxcem Elite (Kerr), G-Cem (GC America)

2. Which cement for specific clinical indications?
   a. Conventional crown and bridge: conventional or resin-modified glass ionomer
   b. Resin-bonded bridge or metal restoration needing extra retention: adhesive resin cement
   c. Porcelain veneers: VLC resin cement
   d. Ceramic inlays and onlays: dual-cure resin cements using either etch-&-rinse adhesive (e.g., RelyX ARC, 3M ESPE, DuoLink, Bisco) or self-etch primer (e.g., Clearfil Esthetic Resin, Kuraray; Multilink, Ivoclar Vivadent) with selective etch
   e. For veneers and inlays/onlays, VLC cements such as Variolink II (Ivoclar Vivadent) or Calibra (Dentsply Caulk) can be used in their dual-cure mode. For veneers, they should be used in VLC mode.
   f. All-ceramic crowns: resin cements: Strong all-ceramics can be cemented conventionally; weak all-ceramics (PJC, IPS Empress) must be bonded. Choice of cement is dictated by amount of retention and support needed. For example, with zirconia crowns, RMGI is normally sufficient. If more retention is needed, a self-adhesive resin cement (e.g., RelyX Unicem) is indicated. For the most retention, a resin cement with self-etch primer (such as Clearfil Esthetic Resin) should be used.

XI. At-home bleaching

A. General considerations
   1. All ADA-approved products contain 10% carbamide peroxide.
   2. Bleaching is time- and dose-dependent.
   3. Concentrations ranging from 15% to 30% are available. Higher concentrations bleach faster, but final result is same and these tend to have more side effects unless used with short application times.
4. For reference, 10% carbamide peroxide = 3.3% hydrogen peroxide.
5. Yellow/brown stains respond more quickly than gray stains. Tetracycline stains can be bleached, but this takes many months.

B. Products available
   1. Hydrogen peroxide
      a. Crest Whitestrips Advanced Seal (Procter & Gamble)
      b. Day White ACP, Nite White ACP Turbo (Discus Dental)
      c. Perfecta Bravo, Perfecta REV (Premier)
   2. Carbamide peroxide
      a. Nite White ACP (Discus Dental)
      b. Nupro White Gold (Dentsply Professional)
      c. Opalescence PF (Ultradent)
      d. Visible White (Colgate Oral Pharmaceuticals)
      e. Trio (Premier)

C. Treatment of tooth sensitivity (primary side effect of bleaching)
   1. Passive approach – discontinue bleaching for a day or two, then resume with shorter application times.
   2. Active approach – apply a desensitizing gel (Ultra-Eze [Ultradent]) containing fluoride and potassium nitrate, or use desensitizing toothpaste (can be used before bleaching as a preventive measure).

Notes:
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13
# Directory of Manufacturers

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M ESPE</td>
<td>3M Center, Building 275, St. Paul, MN 55144</td>
<td><a href="http://tinyurl.com/ynb6vx">http://tinyurl.com/ynb6vx</a></td>
</tr>
<tr>
<td>Almore International (direct)</td>
<td>P.O. Box 25214, Portland, OR 97298</td>
<td><a href="http://www.almore.com">www.almore.com</a></td>
</tr>
<tr>
<td>Apex Dental Materials (direct)</td>
<td>875 Piperway, Sandwich, IL 60548</td>
<td><a href="http://apexpidentalmaterials.com">apexpidentalmaterials.com</a></td>
</tr>
<tr>
<td>Bisco, Inc. (direct)</td>
<td>1100 W. Irving Park Road, Schaumburg, IL 60193</td>
<td><a href="http://www.bisco.com">www.bisco.com</a></td>
</tr>
<tr>
<td>Brasseler USA (direct)</td>
<td>One Brasseler Boulevard, Savannah, GA 31419</td>
<td><a href="http://www.brasselerusa.com">www.brasselerusa.com</a></td>
</tr>
<tr>
<td>Centrix, Inc. (direct or dealer)</td>
<td>770 River Road, Shelton, CT 06484-5458</td>
<td><a href="http://www.centrixdental.com">www.centrixdental.com</a></td>
</tr>
<tr>
<td>Clinician's Choice (direct)</td>
<td>P.O. Box 1706, New Milford, CT 06776</td>
<td><a href="http://www.clinicianschoice.com">www.clinicianschoice.com</a></td>
</tr>
<tr>
<td>Colgate Palmolive</td>
<td>300 Park Avenue, New York, NY 10022</td>
<td><a href="http://tinyurl.com/r7qaf">http://tinyurl.com/r7qaf</a></td>
</tr>
<tr>
<td>Coltène-Whaledent</td>
<td>235 Ascot Parkway, Cuyahoga Falls, OH</td>
<td><a href="http://www.coltenewhaledent.com">www.coltenewhaledent.com</a></td>
</tr>
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<td>Colgate Palmolive</td>
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<td><a href="http://tinyurl.com/r7qaf">http://tinyurl.com/r7qaf</a></td>
</tr>
<tr>
<td>Dentsply Caulk</td>
<td>P.O. Box 359, Milford, DE 19963</td>
<td><a href="http://www.caulk.com">www.caulk.com</a></td>
</tr>
<tr>
<td>Discus Dental (direct)</td>
<td>8550 Higuera Street, Culver City, CA 90232</td>
<td><a href="http://www.discusdental.com">www.discusdental.com</a></td>
</tr>
<tr>
<td>Garrison Dental Solutions (direct)</td>
<td>100 Dewitt Lane, Spring Lake, MI 49456</td>
<td><a href="http://www.garrisondental.com">www.garrisondental.com</a></td>
</tr>
<tr>
<td>GC America</td>
<td>3737 W. 127th Street, Alsip, IL 60803</td>
<td><a href="http://www.gcamerica.com">www.gcamerica.com</a></td>
</tr>
<tr>
<td>DMG/Zenith</td>
<td>242 South Dean Street, Englewood, NJ 07631</td>
<td><a href="http://www.zenithdental.com">www.zenithdental.com</a></td>
</tr>
<tr>
<td>Dentsply Professional</td>
<td>P.O. Box 7807, York, PA 17404-0807</td>
<td><a href="http://www.professional.dentsply.com">www.professional.dentsply.com</a></td>
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<td>GC America</td>
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<tr>
<td>Heraeus Kulzer, Inc., USA</td>
<td>99 Business Park Drive, Armonk, NY 10504</td>
<td><a href="http://www.heraeus-kulzer.com">www.heraeus-kulzer.com</a></td>
</tr>
<tr>
<td>Premier Dental Products</td>
<td>Box 61574, Plymouth Meeting, PA 19462</td>
<td><a href="http://www.premusa.com">www.premusa.com</a></td>
</tr>
<tr>
<td>Ivoclar Vivadent</td>
<td>175 Pineview Drive, Amherst, NY 14228</td>
<td><a href="http://www.ivoclarvivadent.us.com">www.ivoclarvivadent.us.com</a></td>
</tr>
<tr>
<td>Procter &amp; Gamble</td>
<td>8700 Mason Montgomery Road, Mason, OH 45040</td>
<td><a href="http://www.dentalcare.com">www.dentalcare.com</a></td>
</tr>
<tr>
<td>J. Morita USA, Inc. (direct or dealer)</td>
<td>9 Mason Road, Irvine, CA 92618</td>
<td><a href="http://www.jmoritausa.com">www.jmoritausa.com</a></td>
</tr>
<tr>
<td>Kerr Corporation</td>
<td>1717 W. Collins Avenue, Orange, CA 92667</td>
<td><a href="http://www.kerrdental.com">www.kerrdental.com</a></td>
</tr>
<tr>
<td>Pulpdent Corporation</td>
<td>P.O. Box 780, Watertown, MA 02272</td>
<td><a href="http://www.pulpdent.com">www.pulpdent.com</a></td>
</tr>
<tr>
<td>Suter Dental (direct)</td>
<td>P.O. Box 1329, Chico, CA 95928</td>
<td><a href="http://www.suterdental.com">www.suterdental.com</a></td>
</tr>
<tr>
<td>Kuraray America</td>
<td>101 E. 52nd Street, 26th Floor, New York, NY 10022</td>
<td><a href="http://www.kuraray-am.com">www.kuraray-am.com</a></td>
</tr>
<tr>
<td>TrioDent (direct)</td>
<td>85 Eastland Avenue, Rochester, NY 14618</td>
<td><a href="http://www.triodent.com">www.triodent.com</a></td>
</tr>
<tr>
<td>Nobel Biocare (direct)</td>
<td>22715 Savi Ranch Parkway, Yorba Linda, CA 92887</td>
<td><a href="http://www.nobelbiocare.com">www.nobelbiocare.com</a></td>
</tr>
<tr>
<td>Ultradent Products, Inc. (direct)</td>
<td>505 West 10200 South, South Jordan, UT 84095</td>
<td><a href="http://www.ultradent.com">www.ultradent.com</a></td>
</tr>
<tr>
<td>Parkell, Inc. (direct)</td>
<td>300 Executive Drive, Edgewood, NY 11717</td>
<td><a href="http://www.parkell.com">www.parkell.com</a></td>
</tr>
<tr>
<td>VH Technologies (direct)</td>
<td>14150 NE 20th #225, Bellevue, WA 98007</td>
<td><a href="http://www.vhtechnologies.com">www.vhtechnologies.com</a></td>
</tr>
<tr>
<td>Pentron Clinical (direct)</td>
<td>53 North Plains Industrial Road, Wallingford, CT 06492</td>
<td><a href="http://www.pentron.com">www.pentron.com</a></td>
</tr>
<tr>
<td>Vident (direct)</td>
<td>P.O. Box 2340, Brea, CA 92821-6250</td>
<td><a href="http://www.vident.com">www.vident.com</a></td>
</tr>
<tr>
<td>Young Dental</td>
<td>13705 Shoreline Court, Earth City, MO 63045</td>
<td><a href="http://www.youngdental.com">www.youngdental.com</a></td>
</tr>
</tbody>
</table>
References on Materials in Esthetic and Adhesive Dentistry

Christensen Clinicians Report
(Gordon & Rella Christensen)
3707 North Canyon Road, Suite 6
Provo, UT 84604
www.cliniciansreport.com

J. of Esthetic & Restorative Dentistry
(Harald Heymann, editor-in-chief)
Blackwell Publishing
2121 State Avenue.
Ames, IA 50014-8300
http://tinyurl.com/yxy3y2

Practical Reviews in General and Cosmetic Dentistry
Oakstone Medical Publishing
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The Dental Advisor
(John Farah & John Powers, editors)
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Ann Arbor, MI 48106-1583
www.dentaladvisor.com/

REALITY and REALITY Now
(Michael Miller, editor-in-chief)
11757 Katy Freeway, Suite 200
Houston, TX 77079
www.realityesthetics.com

Disclosure: Dr. Swift is the associate editor for JERD and a contributor to Practical Reviews.