

Systemic and Nutritional Dentistry



**Institute for Natural Dentistry
Biocompatible Restorative
Material Selection
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“Currently, no dental material has been shown to be carcinogenic in dental applications in patients. However, carcinogenesis is often exceedingly difficult to prove or disprove conclusively.”

John C. Wataha
Phillips Science of Dental
Materials, 11th Edition
(Ed: Anusavice)

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OBJECTIVES

Dental Material Selection is the “prima non facie” of systemic dentistry. The goal of this lecture is to bridge the gap between the patient’s systemic reactivity and the quagmire of dental materials, chemistry, function and application.

Presented here is a Dental Material “Materia Medica” from which a dental physician may reference a repertory (The Clifford Reactivity Test) and prescribe a suitable material for a patient.

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I. Theoria

1. Perspective
2. Evaluation
3. Dental Material Assessment
4. Corrosion
5. Systemic Entry
6. Systemic Effects
 - A. Cytotoxicity
 - B. Allergenicity
 - C. Mutagenicity
 - D. Carcinogenicity
 - E. Immunotoxicity

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II. The “Materia Medica”

1. Preparation
 - A. Cleansing Agents
 - B. Desensitizers
 - C. Liners
 - D. Bases
2. Adhesives
 - A. Etchants
 1. Dentin / Enamel
 2. Porcelain
 - B. Adhesives:
 1. All Purpose
 2. Light Cured

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3. Composite Restoratives

- A. Microfill
- B. Hybrids
- C. Flowables
- D. Packables
- E. Reinforced Fibers
- F. Resin Glass Ionomers (Class V)
- G. Tints
- H. Polishing Pastes

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4. Core Restorations

- A. Pins
- B. Posts-fiber
- C. Posts-prefab
- D. Cast posts
- E. Core Materials
 - 1. Light Cured
 - 2. Dual Cure
 - 3. Self Cure

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5. Impression Materials

- A. Alginates
- B. Vinyl Polysiloxane Adhesives
- C. Polyether
- D. Polyether Adhesives
- E. Bite Registration

6. Provisionalization

- A. Inlay / Onlay Temps
- B. Crown and Bridge Temps
- C. Provisional Cements
- D. Reinforcement Materials

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7. Cast Gold Restorations

- A. Type I: Inlays
- B. Type II: Onlays
- C. Type III: Crowns, Onlays and Abutments
- D. Type IV: Crowns and Abutments
- E. Solders

8. Ceramo-Metal Restorations

- A. Type III: Crowns, Ant. Bridges
- B. Type IV: Post Bridges (3 units)
- C. Type IV: Post Bridges (3+ units)
- D. Solders
- E. Porcelain Repair
(Silane Coupling Agents)

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9. Indirect Resin Systems

- A. Inlays, Onlays, Crowns
- B. Anterior Bridges

10. All Ceramic Systems

- A. Crowns and PLV
 - 1. Feldspathic
 - 2. Pressable Glass Ceramics
 - 3. Reinforced Slip Cast Core Crowns
 - 4. CAD-CAM
 - 5. Opaques
 - 6. Polishing Pastes

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10. All Ceramic Systems (cont)

- B. Anterior Bridges
 - 1. Reinforced Slip Cast Core Crowns
 - a. 3 units
 - b. 6 units
- C. Posterior Bridges
 - 1. Reinforced Slip Cast core Crowns

11. Cements

- A. Traditional Cements
- B. Resin Light and Dual Cure (PLV)
- C. Resin Dual Cure (All Metal-Free Restorations)
- D. Resin Glass Ionomer (Metal-Free)

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12. Root Canals

- A. Gutta Percha
- B. Resins
- C. Sealers
- D. Provisional Materials
- E. Canal Medicaments
- F. Canal Cleansers
- G. Pulp Caps

13. Implants

- A. Fixtures
 - 1. Pure Titanium
 - 2. Titanium Alloys
 - 3. Ceramic
 - 4. Bioactive Ceramics

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- 13. Implants (cont)
 - B. Posts
 - C. Crowns
 - D. Frameworks
- 14. Dentures
 - A. Teeth Porcelain
 - 1. Acrylic
 - B. Acrylic Resins
 - C. Reline / Rebase Materials
 - D. Denture Liners
 - E. Denture Adhesives
 - F. Maxillofacial Prosthetic Materials

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- 15. Orthodontics
 - A. Archwires and wires
 - B. Brackets and Solders
 - C. Cements
 - D. Acrylics
 - E. Ortho Resins
- 16. Pedodontics
 - A. Compomers
 - B. Sealants
 - C. Temporary Crowns
- 17. Preventive
 - A. Prophylaxis Pastes
 - B. Fluorides

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- 18. Surgical
 - A. Bone Grafting
 - 1. Cadaver Bone
 - 2. Bioactive Glasses
 - B. Guided Tissue Regenerative
 - C. Sutures
- 19. Whitening / Bleaching Agents
 - A. Power
 - B. Assisted
 - C. Home Bleaching
- 20. Mouth Guards and Splints
- 21. Anaesthetic Preservatives
- 22. Electrochemical RXNS

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DISCLAIMER

My intention is to present the wide array of dental materials in a clear and precise manner and not to endorse or disparage any dental products. To be completely objective, I have quoted “REALITY” in those cases where products must be named in order to carry my point.

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I. THEORY

1. PERSPECTIVE

Chronic Degenerative Diseases (CDD) such as Arthritis, Arteriosclerosis, Heart Disease, Diabetes, Cancer etc, although uncommon less than 100 years ago, are epidemic today. Indeed, cancer is expected to inflict 1 in 2 Americans and heart disease has now been linked to periodontal disease.

The conscious (i.e. intuitive) and aware (i.e. media educated) patients are both asking “IS MY DENTAL WORK CONTRIBUTING TO MY CDD RISK?”

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2. EVALUATION

HISTORY – gives us symptoms of toxicity, allergenicity, EMD, foci, stress, caries etc.

EXAMINATION – gives us signs of the presence of these issues.

BLOOD CHEMISTRY – presents information relative to blood counts, health status and condition of various organs.

BIOCOMPATIBILITY TESTS – blood test for restorative materials

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EVALUATION

BIOCOMPATIBILITY TESTS

Tests the reactive metals, chemicals and compounds used in dentistry against your blood to determine if you elicit an immunological reaction to them.

This information can be utilized to make several decisions:

1. What existing materials to replace
2. What materials to replace them with.

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3. DENTAL MATERIALS ASSESSMENT

Materials, whether composed of alloys, resins, ceramics, etc, are composed of ionizable groups which dissociate from the material via corrosion or off gassing and elicit a local and systemic response.

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4. CORROSION

Corrosion may be caused by:

- Mechanical Forces (Eg chewing, brushing)
- Electrochemical Forces (Eg galvanism)
- Thermal Forces (Eg heat)

Corrosion may occur via:

- Dissociation
- Ionization
- Separation
- Volatility (off gassing)

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5. SYSTEMIC ENTRY / EXPOSURE

Exposure to corrosion products may occur via the various routes of entry:

1. Ingestion: Absorption into the blood and lymph channels
2. Inhalation: vapor absorption directly into capillaries
3. Absorption: directly into any mucosal membranes with the bloodstream or lymph.

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6. SYSTEMIC EFFECTS

Reactivity is not self-evident when two or more materials are combined to form a compound (E.g. sodium and chlorine)

Reactivity may take one of several forms:

- Cytotoxicity
- Allergenicity
- Mutagenicity
- Carcinogenicity
- Immunotoxicity

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Cytotoxicity

Def: A non-allergic mediated inflammatory reaction which may result in cell death. Cell death is determined by the dose of the toxin (hence, dose – dependent).

Known Toxins: Mercury

Lead

Nickel

Beryllium

Palladium

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Allergenicity

Def: A host dependent sensitivity to a substance resulting in an inflammatory response

Character of an Allergic Reaction:

Sensitization Dose – initial exposure to an antigen in which antibodies are produced.

Hypersensitivity Dose – subsequent exposure resulting in a Type I through Type VI Hypersensitivity Reactions

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Allergenicity

Gell and Coombs Hypersensitivity Classification:

Type I: Immediate Atopic or Anaphylactic Reaction (antigen reacts with mast cells or basophils)

Type II: Cytotoxic Reaction

Type III: Immune Complex Reaction

Type IV: Delayed Cell Mediated Reaction

Type V: Antibody Stimulating Reaction

Type VI: Antibody Dependent, Cell Mediated Cytotoxicity Reaction

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Mutagenetic Reaction

Def: A reaction in which the base pairs of the DNA molecule are altered.

Causes: Biological errors (natural)

Radiation

Chemicals

Metals (Nickel, Copper, Beryllium)

Some RCT sealers

Some Resins

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Carcinogenetic Reaction

Def: A reaction in which cells mutate resulting in unrestricted cell division and loss of cell death

Characteristics:

Initiation

Promotion: Antiapoptosis

Growth Factors

Proangiogenesis

Progression

Metastasis

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Immunotoxicity

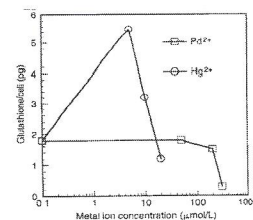
Def: A generic term used to describe inflammatory reactions in which the cause of the reaction is uncertain.

Perspective

As more knowledge is obtained on how cells react to materials, the “boundaries” between toxicity, allergenicity, mutagenicity and carcinogenicity is starting to become less defined and less important.

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Immunotoxicity

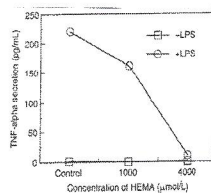


Glutathione content of Human Monocytes after subtoxic exposure to mercury and palladium ions measured at 24 hours post exposure.

Note: GSH is the cells first line of defense against toxic exposures and its decrease indicates toxicity.

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Immunotoxicity



Graph showing HEMA (Hydroxyethylmethacrylate) effect on Human Monocyte TNF-alpha secretion after stimulation by LPS (Lipopolysaccharide), an important periodontal etiological factor. The monocyte is not killed by the HEMA, but its ability to respond to a challenge is severely limited.

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Dental Material MATERIA MEDICA

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II. Materia Medica 1. PREPARATION

Cleansing Agents

Product	Active Ingredient
Concepsis (Vitrident)	2% Chlorhexidine
Preppies (Whip Mix)	Pumice
Cavity Cleanser (Bisco)	2% Chlorhexidine Gluconate
Ultracid F (Ultradent)	EDTA
	Benzalkonium Chloride
	1% Sodium Fluoride
Tubulicid Red (Global)	2% EDTA
	Benzalkonium Chloride
	1% Sodium Fluoride

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DESENTIZERS

Product	Active Ingredient
Gluma (Kulzer)	5% Glutaraldehyde 35% HEMA
Super Seal (Phoenix)	Potassium Oxalate Based Salt
Seal and Protect (Dentsply / Caulk)	Triclosan Di and Trimethacrylate resins PENTA, nanofillers Acetone
ALL Bond DS (Bisco)	Primer A: NTG-GMA, acetone, and ethanol
Microprime (Danville)	Primer B: BPDM, acetone and ethanol 35% HEMA 5% Benzethonium Chloride Sodium Fluoride 10 PPM
Ultra EZ (Ultradent)	3% Potassium Nitrate 0.11% w/ fluoride ion

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Linings (Resin / Glass Ionomers)

Product	Active Ingredients
Fuji Lining LC (GC)	Aluminofluorosilicate glass Polyacrylic Acid Tartaric Acid Camphoquinone Dibutyl hydroxy toluene HEMA
Vitrebond (3M ESPE)	Fluoroaluminosilicate glass Photoinitiator Methacrylate modified Polycarboxylic acid HEMA

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BASES & BUILDUPS (Resin / Glass Ionomer)

Product	Active Ingredients
Fuji II LC (GC)	same as Fuji Lining LC
Vitremer (3M ESPE)	same as Vitrebond
Geristore (Den Mat)	Barium fluorosilicate glass Silica Aromatic dimethacrylate HEMA Initiators and Stabilizers

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2. ADHESIVES

ETCHANTS- Dentin / Enamel

Products	Active Ingredients
Ultra Etch 35%	Phosphoric Acid
Ultra Etch AB (Ultradent)	Gels
UniEtch	Colors
UniEtch with BAC (Bisco)	Silica
Etch-Rite (Pulpdent)	[note: most of these etchants can remove the smear layer]
Gluma Etch 35 (Kulzer)	
Enamel Etch (Cosmedent)	
Gel Etchant (Kerr)	
Opti Bond Solo (Optibond)	Lactic and Citric Acid Ethyl Alcohol

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ETCHANTS-Porcelain

Products	Active Ingredients
Porcelain Etch (Ultradent)	9.5% Hydrofluoric Acid
Oral Ceram Etch (Gresco)	9.5%
Porcelain Etch Gel (Pulpdent)	9.6%
Porcelain Etchant (Bisco)	4%
Porceletch (Cosmedent)	9.5%

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ADHESIVES-ALL PURPOSE

Products	Solvents
Optibond (Kerr)	Ethanol, water
Prime and bond DC (Dentsply /Caulk)	Acetone, Ethanol
Scotchbond (3M Espe)	Ethanol, water
All bond 2 (Bisco)	Acetone, Ethanol, water
One Step (Bisco)	Acetone

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ADHESIVES-Light Cured

Product	Solvents
Optibond Solo Plus (Kerr)	Ethanol
Clearfil SE Bond (Kuraray)	Water
Gluma Comfort Bond + Desensitization (Kulzer)	Ethanol, water
PQ1 (Ultradent)	Ethanol
Single Bond (Espe)	Ethanol, water

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3. COMPOSITES

MICROFILLS

Product	Indications
Renamel and IV Restorations	Anterior Class III (Cosmedent)
Durafil VS (Kulzer)	Composite Laminate
Heliomolar (Ivoclar)	Veneers
Filtek All (3M ESPE)	
Matrixx Ant. Microfill (Discus)	
Micronew (Bisco)	

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HYBRIDS

Product	Indications
Esthet X (Dentsply)	Posterior Composites
Renamel Hybrid (Cosmedent)	Anterior Class IV (note: blend better than microfills)
Point 4 (Kerr)	
Vitalecence (Ultradent)	
XR V Herculite (Kerr)	
Renamel Sculpt (Cosmedent)	

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FLOWABLE

<u>Products</u>	<u>Notes:</u>
Flow It! ALC (Pentron)	Indicated in deep proximal boxes and Class V Abrasion Lesions
Revolution 2 (Kerr)	All are light cured
Tetric Flow (Ivoclar)	Except “2B”s which are Dual Cure and Self-Cure.
Renamel Flowable Microfill and Hybrid (Cosmedent)	EMD: match hybrid or microfil to flowable to decrease EMD generated by two different composites
Filtek Flow (3M Espe)	
Bisfil 2B (Bisco)	
StarFill 2B (Danville)	

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PACKABLE COMPOSITES

<u>Products</u>	<u>Notes:</u>
Prodigy Condensable (Kerr)	EMD-match to Flowable / hybrid
Filtek P60 (3M)	Indication (?) – Class II boxes
Heliomolar HB (Ivoclar)	
Renamel Pack (Cosmedent)	
Pyramid (Bisco)	
SureFil (Dentsply)	
Virtuoso Packable (Den-Mat)	
Matrixx Post. Hybrid (Discus)	

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REINFORCED FIBERS (Fiberglass)

<u>Product</u>	<u>Composites</u>
Ribbond (Ribbond)	Polyethylene
Connect (Kerr)	Polyethylene
Splint-It (Pentron)	“S2 Glass” (a proprietary glass blend)

Indications:

- To increase flexural strength of the restoration
- Restorations: Periodontal Splints
Resin bonded bridges
Natural tooth pontics
Dentures

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RESIN / GLASS IONOMERS

<u>Products</u>	<u>Indications</u>
Fuji II (GC)	Liners (see Liner Section)
Fuji IX GP (GC)	Bases (see base Section)
Vitremer (3M)	Buildup and Cores when small sections of the preparation need augmentation
Geristone (Den-Mat)	Restorations: Class I Primary Teeth Note: can be placed without etching

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TINTS AND OPAQUES

<u>Products</u>	<u>NOTE:</u> Most tints are metallic oxides:
Creative color (Cosmedent)	Brown (Iron/Nickel oxide)
Kolor + Plus / belle Glass HP Opaque (Kerr)	Green (Copper oxide)
	Yellow-Brown (Titanium oxide)
Tetric Color (Ivoclar)	Lavendar (Manganese oxide)
	Blue (Cobalt oxide)
	<u>NOTE:</u> Opacity: Cerium oxide Zirconium oxide Titanium oxide Tin oxide

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POLISHING PASTES

<u>Product</u>	<u>Composition</u>
Prisma-Gloss / XF (Dentsply)	Aluminum oxide
Insta-Glaze HVB (Taub)	Fine Diamond Particles (for higher luster)
Enamelize (Cosmedent)	
Composite (Shofu)	

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IV. CORE RESTORATIONS

PINS

<u>Product</u>	<u>Composition</u>
Filpin (Filhol Dental)	Titanium
Minim TMS (Whaledent)	Gold

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POSTS: Metal Free

<u>Product</u>	<u>Composites</u>
Aestheti-Plus (Bisco)	Quartz Fibers in Epoxy Matrix
Para Post Fiber White (Whaledent)	Fiber Reinforced Resin
Cerapost (Brasseler)	Zirconium Oxide

Indications: Esthetics
Chainside Post is an option

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POSTS: Metal

<u>Product</u>	<u>Metal</u>
Para – Post (Whaledent)	Titanium or Stainless Steel
Flexi – Post (EDS)	Titanium or Stainless Steel
OptiPost (Brasseler)	Titanium

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CASE POSTS

NOTE: EMD Concerns

Whenever possible, ask the laboratory to fabricate the cast posts out of the same gold the crowns or bridgework is being fabricated from.

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CORE MATERIALS

Light-Cured

Large particle composites which cure more deeply than hybrids

Eg. Clearfil photo-cure (Kuraray)
Bisfil Cure (Bisco)

Note: Can utilize hybrid to perform build ups.

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Dual Cure

Large particle composites

Eg: LuxaCure Automix Dual (DMG)
Core Paste Syringeable (DenMat)
Build It! FR (Dentron)

Self Cure

Can build up deeper levels
No trauma to pulp from lights
Eg: Core Paste (DenMat)
Encore (Centrix)
Bisfil II / Cure Flo (Bisco)

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5. IMPRESSION MATERIALS

Impression materials are maintained in the mouth only for a limited period of time, therefore, the question of biocompatibility arises: Is it possible to use one impression material or not?

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IMPRESSION MATERIALS

1. Alginate / Hydrocolloid
2. Vinyl Polysiloxane

Products	Notes:
Aquasil (Dentsply)	Easy removal
Splash (Discus)	Slight hydrophilic
Affinis (Coltene)	Latex contamination
Flexitime (Kulzer)	affects set
3. Polyethylene

Products	Notes:
Permadyne (Espe)	Difficult removal
Penta Soft (Espe)	Hydrophilic
Impregum (Espe)	Bad taste and smell
Polyjel NF (Dentsply)	

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Bite Registration Materials

Product	Notes
Jet Bite (Coltene)	Vinyl Polysiloxanes
Peppermint Snap (Discus)	
Vanilla (Discus)	
Blu-Mousse (Parkell)	
Regisil Rigid (Dentsply)	
Ramitec (Espe)	

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6. PROVISIONALIZATION

Inlays and Onlays

Products	Notes:
EZ-Temp (Cosmedent)	Light cured Semi-flexible (when set)
Systemp (Ivoclar)	No matrix necessary Easy Cleanup
First-fill (Dentron)	after removal

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Crown and Bridge

Product	Notes:
Luxatemp (DMG)	Bis-acryl composites Flexible material
Luxatemp Solar Plus (DMS)	Easy to remove Sensitivity (place desensitizer before temp placement).
Integrity (Dentsply)	

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Provisional Cements

Products	Composition
Temp Bond NE (SDS / Kerr) (DMG)	Poly organic acids Natural Resins, Fatty Acids, Additives
Temp Bond Clear (SDS / Kerr)	Zinc Oxide Resin
Durelon (Espe)	Polycarboxylate Acid
Provilink (Ivoclar)	Resin

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7. CAST GOLD RESTORATIONS

1905 Taggart's "Lost Wax Technique"

1932 ANSI / ADA Specification No. 5

Type		Min. Gold	Vicker's Hardness
I	Soft	83	50- 90
II	Medium	78	90-120
III	Hard	78	120-150
IV	Extra-Hard	75	>150

Copper, silver or platinum were used to strengthen gold.

Platinum was used to prevent silver tarnishing in low gold alloys.

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Hardness and Function Classification

Cast Gold Restoration

Type I (Soft) Yellow Gold

(Inlays)

Type II (Medium) Yellow Gold

(Onlays)

Type III (Hard) Yellow Gold

Low Gold

Silver Palladium

(Onlays, Crowns, Abutments)

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Cast Gold Restoration (cont)

Type IV (Extra-Hard) Yellow Gold

Low Gold

Silver Palladium

(Crowns, Abutments, Partial

Frameworks)

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8. CERAMO-METAL RESTORATIONS

In the 1950's, techniques were being developed to fuse gold to porcelain but laboratory failures were occurring due to porcelain's lower coefficient of thermal expansion. Two important changes allowed gold to bond to porcelain:

1. Porcelain - soda and potash raised the porcelain coefficient
2. Gold - the addition of platinum and palladium lowered it's coefficient.

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Bond Stress

The Bond Stress Test was developed to test porcelain debonding at the interface (Bond Strength is less than the cohesive strength of porcelain)

By the addition of less than 1% of:

Iron

Indium

Tin

...the bond strength was tripled.

NOTE: these metals provide an oxide film which increase bond strength.

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Metallurgy

Copper - "hardens" or strengthens the alloy

- increases tarnishing;

- 'reddens' the gold alloys

- causes greening effect on porcelain

Silver - minimizes the reddening effect of copper

Gallium - added to silver free alloys to compensate for decreased thermal expansion

Zinc - acts as an oxygen scavenger to decrease porosity in the castings

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History

Feldspathic Porcelain

- Typical PFG and PLV

Aluminous Porcelain Crowns

McLean

Ceramic Crowns

Glass-Ceramics (Dicor)

Pressed Foil Crowns

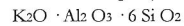
Eg Captek

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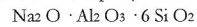
Feldspathic Porcelain: Composition

Feldspars:

Potassium Feldspar (K_2O = "potash")



Sodium Feldspar (Na_2O = "soda")



Other additives:

Pigments, opacifiers, glasses

(to control temperature)

Silica (SiO_2): (forms)

Crystalline quartz

Crystalline Cristobalite

Crystalline tridymite

Non crystalline fused silica

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Pressable Glass Ceramics

Technique: "Hot-pressed," core ingots are heated into molten glass which is centrifuged into a refractory model to produce a core which is then veneered with a thermally compatible ceramic.

2 types:

1. Leucite – reinforced core
(Eg IPS Empress)
Indications: crowns
2. Lithia Disilicate reinforced core
(Eg IPS Empress 2 and ENS)
Indications: bridges ?

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Reinforced Slip Cast Core Crowns

A slurry of a specific glass material is slip cast or a refractory die to produce a partially sintered core which is then infiltrated with glass. A compatible ceramic is veneered over it.

Types:

In Ceram Spinel ($MgO-Al_2O_3$)

Indications: Anterior Crowns

In Ceram Alumina (Al_2O_3 ceramic)

Indications: Ant and post crowns

3 unit anterior bridge

In Ceram Zirconia (ZrO_2 sintered)

Indications: Posterior bridges (3 unit)

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Reinforced Slip Cast Core Crowns

Types: (cont)

Cercon Zirconia ZrO_2 sintered

Indications: Posterior bridges (FPDs)

[Note: 2x strength of Empress 2]

Procera All Ceram Dry pressed and sintered Al_2O_3

Indications: crowns and FPDs

Zirconium Bridge

Indications: 57mm ingot

(6 unit Anterior bridge)

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CAD-CAM

A ceramic block is milled by a diamond-coated disc programmed by a computer which "read" an impression.

Blocks:

Vitabloc MK II (feldspathic)

Dicor MGC (Machinable Glass Ceramic)

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II. CEMENTS

Traditional Cements

Most cements come in two component systems: base and catalyst. Bases are usually powders and catalyst are liquid.

Catalysts are usually acidic solutions (proton donors) and powders basic (proton acceptors) consisting of either glass or metallic oxide particles.

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Acid-Base Reactions

Material	Formulation
Zinc Phosphate	Powder: Zinc Oxide (90%) and Magnesium Oxide (10%) Liquid: Phosphoric Acid
Zinc Oxide - Eugenol (EBA Modified)	Powder: Zinc Oxide Liquid: Eugenol (Ethoxybenzoic acid)
Zinc Polycarboxylate	Powder: Zinc Oxide and Magnesium Oxide or Stannous Fluoride (10-15%) Liquid: Polyacrylic Acid
Glass Ionomer	Powder: Fluoro aluminosilicate glass Liquid: Polyacrylic acid-Polybasic Carboxylic Acid Water

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Resin Cements

Types:

Resin modified Glass Ionomer
Compomers
Resin Cements

Delivery Systems:

Resin Light and Dual Cure
Indications: PLV
Resin Dual Cure
Indications: Metal-free restorations
Resin Self Cure
Indications: Metal restorations
Resin Glass Ionomer
Indications: Metal-free restorations

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Chemistry: Resin Modified Glass Ionomer

Powder: Fluoroaluminosilicate glass
Chemical and/or light activated initiators

Liquid: Polyacrylic Acid
Water Soluble Methacrylate Activators

Paste A: resembles powder

Paste B: resembles liquid

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Chemistry: Compomers

Powder: Fluoroaluminosilicate glass
Metallic oxides
Sodium Fluoride
Acidic Monomer
Initiator
Liquid: Dimethacrylate / Carboxylic Monomers
Acrylate Monomers
Water
Activator
Paste: Methacrylate Monomer
Acidic Monomer
Initiator

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Chemistry: Resin Cements

Powder: Polymethyl Methacrylate beads
Liquid 1: Methacrylate Monomers
Liquid 2: Catalysts

One Paste System:

Methacrylate Monomers
Initiators

Two paste Systems:

Base Paste: Methacrylate Monomers
Fillers
Initiators
Catalyst Paste: Methacrylate Monomers
Fillers
Activators (chemical cure)

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Systemic and Nutritional Dentistry – Biocompatible Restorative Material Selection

Resin Cements

Light Cured / Dual Cure

Calibra (Dentsply)
Nexus 2 (Kerr)
Variolink (Ivoclar)
Rely X Veneer Cement (3M)
Illusion (Bisco)
Lute It! (Dentron)

Indications: Porcelain Laminate Veneer

Metal-free periodontal splints
Metal-free orthodontic retainers
Metal-free restorations (less than 1.5mm in thickness)

Note: Includes initiators (for light curing) and activators (for chemical acid-base curing)

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Resin Cements

Dual Cure Only

Compolute (3M ESPE)
Duo-Link (Bisco)
Panavia F (Kuraray)
Rely X ARC (3M ESPE)
Cement It! (Dentron)

Indications: Metal free inlays

Metal free onlays

Metal free crowns

Metal free bridges

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Resin Cements

Self-Cure

Panavia 21 (Kuraray)
C & B Cement Luting Composite (Bisco)
Post Cement HL-X (Bisco)
C & B Metabond (Parkell)

Indications: Metal based inlays & onlays

Ceramometal crowns & bridges

Endodontic posts

Metal based resin bonded bridges

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Resin / Glass Ionomer Luting Cements

Products

Fuji Plus (GC)
Fuji CEM (GC)
Rely X Luting (3M)
PermaCem (DMG)
Principle (Dentsply)

Indications

Buildups and Cores

Class V Restorations and Primary teeth

Luting metal and ceramometal restorations

Do not cement metal-free restorations or endodontic posts!

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12. ROOT CANAL

Materials: Gutta Percha

Resins (new)

Sealers

Provisional Materials

Canal Medicaments

Canal Cleansers

Pulp Caps

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13. IMPLANTS

Pure Titanium

CP Grade I
CP Grade II
CP Grade III
CP Grade IV

note: trace amounts of-
Nitrogen, Carbon,
Hydrogen, Iron
and Oxygen

Titanium Alloys

Ti - 6 Al-4V Alloy
Ti - 6 Al-4V (ELI Alloy)
Ti -13 Nb-13 Zr (Phase Stabilizers)
Ti -15 Mo-2.8 Nb (Phase Stabilizers)

"Some controversy exists as to which titanium metal to use, because some researchers believe aluminum and vanadium can be toxic if released in sufficient quantities."

Esquivel-Upshaw "Dental Implants"
Phillips' Science of Dental Materials
11th Edition (Ed: Anusavice)

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Systemic and Nutritional Dentistry – Biocompatible Restorative Material Selection

IMPLANTS (cont)

Ceramic Implants (Non-Bioactive)

Aluminum Oxide (Al_2O_3) [Gold Standard]

Zirconia (ZrO_2)

Bioactive Ceramics

Hydroxyapatite (HA)

Tricalcium Phosphate (TCP)

“Bioglasses” ($\text{SiO}_2 \cdot \text{CaO} \cdot \text{Na}_2\text{O} \cdot \text{P}_2\text{O}_5 \cdot \text{MgO}$)

[note: Osteoinductive properties]

Indications: Implant coatings

Bone grafting

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IMPLANTS (others)

Surgical Austenitic Steel (Stainless Steel)

18% Chromium (corrosion resistance)

8% Nickel (stabilize austenitic steel)

“This is not used...because of the allergic potential of nickel...”

Cobalt – Chrome – Molybdenum Alloys

63% Cobalt / 30% Cr / 5% Mo

Vitalium (Cr – Co – Mo alloy)

Titanium (Ni – Cr – Mo – Be alloy)

NOTE: These generally showed:

1. no epithelial attachment
2. chronic inflammation
3. fibrous encapsulation
4. mobility

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14. DENTURES

Teeth

Porcelain (Projection metal pins)

Swissdent

Acrylic and Vinyl – acrylic resin

Bioblend

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Denture Acrylic Resins

Poly (methyl methacrylate) resin

Benzoyl peroxide (initiator)

Hydroquinine (inhibitor)

Glycol dimethacrylate (cross linking agent)

Cadmium (pink color)

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Denture Materials (cont)

Reline Materials

Rebase Materials

Denture Liners

Denture Adhesives

Maxillofacial Prosthetic Materials

Latexes

Vinyl Plastisols

Silicone Rubbers

Polyurethane Polymers

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15. ORTHODONTICS

Archwires and wires

Ni – Ti wires

Stainless Steel

Brackets

Stainless Steel

Ceramic

Adhesive Cements

Acrylics

Orthodontic Resins

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16. PEDODONTICS

Compomers – “Sceptable”

Product	Composition
Compoglass F (Ivoclar)	<p>Filler: Ba-Al-fluorosilicate glass Ytterbium trifluoride oxides, catalysts, stabilizers</p> <p>Resin matrix: urethane dimethacrylate DM tetrachylene glycol DM cycloaliphatic decarboxylic acid DM</p>
Dyract AP (Dentsply)	<p>Filler: Strontium – Al- fluoro-phosphato- silicate glass</p> <p>Resin matrix: UDMA TCB (reaction product of tetracarboxylic acid and HEMA)</p>

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Compomers “Flowable”

Product	Composition
Compoglass Flow (Ivoclar)	<p>Ba-Al-fluorosilicate glass Ytterbium Trifluoride Spheroidal Mixed oxides Stabilizers, Pigments Urethane DM Polyethylene glycol DM Cycloaliphatic dicarboxylic acid DM Fluoride</p>
Dyract Flow (Dentsply)	<p>Strontium - Al - F1 - Si Glass Titanium oxide Stabilizers, Pigments Macromonomers (M-IA – BSA) Reactive Diluent Polymerizable initiator Fluoride</p>

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Sealants

Product	Composition
Ultrasal XT Plus (Ultradent)	<p>Resin: BID – GMA / TEGDMA Fluoride releasing</p>
Clinpro Sealant (3M Espe)	<p>Opaque: Filled resin (26-60% depending upon product)</p>
Guardian (Kerr) Helioclear F / Helioclear Clear (Ivoclar)	<p>Clear: no fillers</p>
EcuSeal (DMG)	

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Temporary Crowns

Stainless Steel Crowns (Nickel)
Ion Crowns

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17. PREVENTIVE

Prophy Pastes

Fluoridated
Non-fluoridated
(preppies)

Fluorides

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18. SURGICAL

Bone Grafting Materials
Human Cadaver
Synthetic Bioactive Glasses
Guided Tissue Regeneration
Collagen Membranes
Suture Materials

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19. Whitening / Bleaching Agents

- Types: 1. Power
2. Assisted
3. Home Bleaching

<u>Product</u>	<u>Composition</u>
Opalescence Xtra (Ultradent)	35% Hydrogen Peroxide Carotene
Virtuoso Lightening Gel (Den-Mat)	32% Hydrogen Peroxide Potassium Nitrate Carbopol Potassium Hydroxide Sodium Fluoride EDTA
Illumine (Dentsply)	30% Hydrogen Peroxide Copolymer of Methylvinyl Ether and maleic anhydride

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Assisted Bleaching

<u>Product</u>	<u>Composition</u>
Opalescence Quick (Ultradent)	35% Carbamide Peroxide
White Speed (Discus)	18% Hydrogen Peroxide 22% Carbamide Peroxide (equivalent to 35% H ₂ O ₂)

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Home Bleaching

<u>Product</u>	<u>Composition</u>
Opalescence	10% Carbamide Peroxide (CAP)
Opalescence F	15 and 20% CAP 0.11% Fluoride ion
Opalescence PF (Ultradent)	10.15 and 20% CAP 0.11% Fluoride ion 3% Potassium Nitrate
Nite White Excel 2	CAP (10%)
Nite White Excel 2Z	CAP (16%) Potassium Nitrate Fluoride Hydrogen Peroxide (75-9.5%) Activators (Eugenol, Xylitol and Aloe Vera)
Nite White Excel 2NSF	CAP (22%)
Day White 2Z (Discus)	Neutral Sodium Fluoride

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20. Mouthguards and Splints

Various Resins
Ortho resin
Valplast

21. Anaesthetic Preservatives

Benzylkonium Chloride
Butyraldehydes
Formaldehydes
Metabisulfites
Methylparaben
Phenol
Propionates
Sorbates
Thimerosal

22. Electrochemical Reactions

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REFERENCES AND SUGGESTED READING

Clifford Materials Reactivity Testing Report
1-719-550-0008

Reality: The Information Source for Esthetic Dentistry
1-800-544-4999
info @ realityesthetics.com

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Saunders, St. Louis; 2003

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