

Comparisons of Direct Restorative Dental Materials

COMPARATIVE FACTORS	TYPES OF DIRECT RESTORATIVE DENTAL MATERIALS			
	AMALGAM	COMPOSITE RESIN (DIRECT AND INDIRECT RESTORATIONS)	GLASS IONOMER CEMENT	RESIN-IONOMER CEMENT
General Description	Self-hardening mixture in varying proportions of a liquid mercury and silver tin alloy powder.	Mixture of powdered glass and plastic resin, self-hardening or hardened by exposure to blue light energy.	Self-hardening mixture of glass and organic acid.	Mixture of glass and resin polymer and organic acid, self-hardening by exposure to blue light energy.
Principle Uses	Fillings; sometimes for replacing portions of broken teeth.	Fillings, inlays, veneers, partial and complete crowns; sometimes for replacing portions of broken teeth.	Small fillings; cementing metal & porcelain-metal crowns, inlays, temporary restorations.	Small fillings; cementing metal & porcelain-metal crowns, and inlays.
Resistance to Further Decay	High, self-sealing characteristic helps resist recurrent decay, but recurrent decay around amalgam is difficult to detect in its early stages.	Moderate; recurrent decay is easily detected in early stages.	Low-Moderate; some resistance to decay may be imparted through fluoride release.	Low-Moderate; some resistance to decay may be imparted through fluoride release.
Estimated Durability (permanent teeth)	Variable	Strong, durable	Non-stress bearing crown cement.	Non-stress bearing crown cement.
Relative Amount of Tooth Preserved	Fair; Requires removal of healthy tooth to be mechanically retained. Its adhesive bond of amalgam to the tooth.	Excellent; bonds adhesively to healthy enamel and dentin.	Excellent; bonds adhesively to healthy enamel and dentin.	Excellent; bonds adhesively to healthy enamel and dentin.
Resistance to Surface Wear	Low Similar to dental enamel, little metal.	May wear slightly better than dental enamel.	Poor in stress-bearing applications. Fair in non-stress bearing applications.	Poor in stress-bearing applications; Good in non-stress bearing applications.
Resistance to Fracture	Amalgams may fracture under stress, tooth around filling may fracture before the amalgam does.	Good resistance to fracture.	Brittle; low resistance to fracture but not recommended for stress-bearing applications.	Tougher than glass ionomer; recommended for stress-bearing restorations in adults.
Resistance to Leakage	Good, self-sealing by surface contraction; margins may chip over time.	Good if bonded to enamel; may show leakage over time when bonded to dentin; Does not contract.	Moderate; tends to crack over time.	Good; adhesively bonds to resin, enamel, dentinal post-insertion expansion may help seal the margins.
Resistance to Occlusal Stress	High but lack of adhesion may weaken the surrounding tooth.	Good to Excellent depending upon product used.	Poor; not recommended for stress-bearing restorations.	Moderate; not recommended to restore biting surfaces of adults; suitable for short-term primary tooth restorations.
Toxicity	Generally safe; occasional allergic reactions to metal components. However, allergic response certain mercury. Mercury in its elemental form is toxic and as such is listed on page 82.	Concern about trace chemical release are not supported by research studies. Safe; no known toxicity documented. Contains some compounds listed on page 82.	No known incompatibilities. Safe; no known toxicity documented.	No known incompatibilities. Safe; no known toxicity documented.
Allergic or Adverse Reactions	Fair; recommend that dentist evaluate patient to rule out metal allergies.	No documentation for allergic reactions was found.	No documentation for allergic reactions was found. Progressive roughening of the surface may predispose to plaque accumulation and periodontal disease if the material contacts the gingival tissue.	No known documented allergic reactions. Surface may roughen slightly over time, predisposing to plaque accumulation and periodontal disease if the material contacts the gingival tissue.
Acceptability to Post-Operative Sensitivity	Mixed; High thermal conductivity may promote temporary sensitivity to hot and cold. Contact with other metals may cause occasional and transient galvanic response.	Moderate; Material is sensitive to dentist's technique; Material abrades slightly when hardened, and a poor seal may lead to bacterial leakage, recurrent decay and tooth hypersensitivity.	Low; material seals well and does not irritate pulp.	Low; material seals well and does not irritate pulp.
Ethetics (Appearance)	Very poor. Not tooth colored, initially silver-gray, gets darker, becoming black as it corrodes. May stain teeth dark brown or black over time.	Excellent; often indistinguishable from natural teeth.	Good; tooth colored, varies in translucency.	Very good, more translucency than glass ionomer.
Frequency of Repair or Replacement	Low; replacement is usually due to fracture of the filling or the surrounding tooth.	Low-Moderate; durable material; hardware quality; some composite materials show more rapid wear than amalgams. Replacement is usually due to marginal leakage.	Moderate; slowly dissolves in fluids; easily dislodged.	Moderate; more resistant to dissolving than glass ionomer, but less than composite teeth.
Relative Costs to Patient	Low, relatively inexpensive, actual cost of fillings depends upon their size.	Moderate; higher than amalgams; fillings; actual cost of fillings depends upon their size; veneers & crown cost more.	Moderate; similar to composite teeth (not used for veneers and crowns).	Moderate; similar to composite resin (not used for veneers and crowns).
Number of Visits Required	Single visit (polishing may require a second visit)	Single visit for fillings; 2+ visits for inlays, veneers and crowns.	Single visit	Single visit

Comparisons of Indirect Restorative Dental Materials

COMPARATIVE FACTORS	TYPES OF INDIRECT RESTORATIVE DENTAL MATERIALS			
	PORCELAIN (DIECAST)	PORCELAIN (FUSED-TO-METAL)	GOLD ALLOYS (HOLE)	NICKEL OR COBALT CHROME (BASE-METAL) ALLOYS
General Description	Glass-like material formed into fillings and crowns using models of the prepared teeth.	Glass-like material that is "enamelled" onto metal shells. Used for crowns and fixed-bridges.	Mixture of gold, copper and other metals used mainly for crowns and fixed bridges.	Mixture of nickel, chromium
Principle Uses	Inlays, veneers, crowns and fixed-bridges.	Crowns and fixed-bridges.	Cast crowns and fixed bridges; some partial denture frameworks.	Crowns and fixed bridges; most partial denture frameworks.
Resistance to Further Decay	Good, if the restoration fits well.	Good, if the restoration fits well.	Good if the restoration fits well.	Good if the restoration fits well.
Estimated Durability (permanent teeth)	Moderate; brittle material that may fracture under high biting forces. Not recommended for posterior (molars) teeth.	Very good. Less susceptible to fracture due to the metal substructure.	Excellent. Does not fracture under stress; does not corrode in the mouth.	Excellent. Does not fracture under stress; does not corrode in the mouth.
Relative Amount of Tooth Preserved	Good - Moderate. Little removal of natural tooth is necessary for veneers; more for crowns since strength is related to its bulk.	Moderate-High. More tooth must be removed to permit the metal to accompany the porcelain.	Good. A strong material that requires removal of a thin outside layer of the tooth.	Good. A strong material that requires removal of a thin outside layer of the tooth.
Resistance to Surface Wear	Resistant to surface wear, but abrasive to opposing teeth.	Resistant to surface wear; permits either metal or porcelain on the biting surface of crowns and bridges.	Similar hardness to natural enamel; does not abrade opposing teeth.	Harder than rest of enamel but relatively abrasive to opposing natural teeth. Does not fracture in high.
Resistance to Fracture	Poor resistance to fracture.	Porcelain may fracture.	Does not fracture in bulk.	Does not fracture in bulk.
Resistance to Leakage	Very good. Can be fabricated for very accurate fit of the margins of the crowns.	Good - Very good depending upon design of the margins of the crowns.	Very good - Excellent. Can be formed with great precision and can be tightly adapted to the tooth.	Good-Very good - Better than gold; less adaptable, but can be forged with great precision.
Resistance to Occlusal Stress	Moderate; brittle material susceptible to fracture under biting forces.	Very good. Metal substructure gives high resistance to fracture.	Excellent.	Excellent.
Toxicity	Excellent. No known adverse effects.	Very Good in Excellent. Occasional allergy to metal alloys used.	Excellent; flare allergy to some alloys.	Good; nickel allergies are common among veneers, although rarely manifested in dental restorations.
Allergic or Adverse Reactions	None.	Rare. Occasional allergy to metal substructures.	Rare; occasional allergic reactions seen in susceptible individuals.	Occasional; infrequent reactions to nickel.
Acceptability to Post-Operative Sensitivity	Not material dependent, does not conduct heat and cold well.	Not material dependent, does not conduct heat and cold well.	Conducts heat and cold; may irritate sensitive teeth.	Conducts heat and cold; may irritate sensitive teeth.
Ethetics (Appearance)	Excellent.	Good to Excellent.	Poor - yellow metal.	Poor - dark silver metal.
Frequency of Repair or Replacement	Variable; depends upon biting forces; fracture of metal teeth are more likely than ceramic teeth; porcelain fractures may often be repaired with composite resin.	Infrequent; porcelain fracture can often be repaired with composite resin.	Infrequent; replacement is usually due to recurrent decay around margins.	Infrequent; replacement is usually due to recurrent decay around margins.
Relative Costs to Patient	High; requires at least two office visits and laboratory services.	High; requires at least two office visits and laboratory services.	High; requires at least two office visits and laboratory services.	High; requires at least two office visits and laboratory services.
Number of Visits Required	Two - minimum; matching aesthetics of teeth may require more visits.	Two - minimum; matching aesthetics of teeth may require more visits.	Two - minimum.	Two - minimum.