

Comparisons of Direct Restorative Dental Materials

| Comparative Factors | Amalgam | Composite Resin (Direct and Indirect Restorations) | Glass Ionomer Cement | Resin-Ionomer Cement |
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TYPES OF DIRECT RESTORATIVE DENTAL MATERIALS

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| General Description | Self-hardening mixture in varying percentages 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. | Self-hardening mixture of glass and organic acid. | Mixture of glass and resin polymer and organic acid; self hardening by exposure to blue light. |
| 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, liners, temporary restorations. | Small fillings; cementing metal & porcelain/metal crowns, and liners. |
| 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) | Durable | 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; No 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; brittle metal. | May wear slightly faster 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 | Amalgam 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 restorations. | Tougher than glass ionomer; recommended for stress bearing restorations in adults. |
| Resistance to Leakage | Good; self-sealing by surface corrosion; margins may chip over time. | Good if bonded to enamel; may show leakage over time when bonded to dentin; Does not corrode. | Moderate; tends to crack over time. | Good; Adhesively bonds to resin, enamel, dentin/post-insertion expansion may help seal the margins. |
| Resistance to Occlusal Stress | High; but lack of adhesion may weaken the remaining 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 teeth restorations. |
| Toxicity | Generally safe; occasional allergic reactions to metal components. However amalgams contain mercury. Mercury in its elemental form is toxic and as such is listed on prop 65. | Concerns about trace chemical release are not supported by research studies. Safe; no known toxicity documented. Contains some compounds listed on prop 65. | No known incompatibilities. Safe; no known toxicity documented. | No known incompatibilities. Safe; no known toxicity documented. |
| Allergic or Adverse Reactions | Rare; recommend that dentist evaluate patient to rule out metal allergies | No documentation for allergic reactions was found. | No known documentation for allergic reactions was found. Progressive roughening of the surface may predispose to plaque accumulation and periodontal disease. | 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. |
| Susceptibility to Post-Operative Sensitivity | Minimal; 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 shrinks 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. |
| Esthetics (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 tooth. | 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 hardens rapidly; some composite materials show more rapid wear than amalgam. Replacement is usually due to marginal leakage. | Moderate; Slowly dissolves in mouth; easily dislodged. | Moderate; more resistant to dissolving than glass ionomer, but less than composite resin. |
| Relative Costs to Patient | Low, relatively inexpensive; actual cost of fillings depends upon their size. | Moderate; higher than amalgam fillings; actual cost of fillings depends upon their size; veneers & crowns cost more. | Moderate; similar to composite resin (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 indirect inlays, veneers and crowns. | Single visit. | Single visit. |

Comparisons of Indirect Restorative Dental Materials

| Comparative Factors | Porcelain (Ceramic) | Porcelain (Fused-To-Metal) | Gold Alloys (Noble) | Nickel Or Cobalt-Chrome (Base-Metal) Alloys |
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TYPES OF INDIRECT RESTORATIVE DENTAL MATERIALS

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| General Description | Glass-like material formed into fillings and crowns using models of the prepared teeth. | Glass-like material that is “enameled” onto metal shells. Used for crowns and fixed-bridges. | Mixtures of gold, copper and other metals used mainly for crowns and fixed bridges. | Mixtures 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 (molar) 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 | Resistance 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 natural enamel but minimally abrasive to opposing natural teeth. Does not fracture in bulk. |
| 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 – Stiffer than gold; less adaptable, but can be formed 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 to Excellent. Occasional / rare allergy to metal alloys used. | Excellent; Rare allergy to some alloys. | Good; Nickel allergies are common among women, 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. |
| Susceptibility 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. |
| Esthetics (Appearance) | Excellent | Good to Excellent | Poor – yellow metal | Poor – dark silver metal |
| Frequency of Repair or Replacement | Varies; depends upon biting forces; fractures of molar teeth are more likely than anterior teeth; porcelain fracture 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; require at least two office visits and laboratory services. |
| Number of Visits Required | Two – minimum; matching esthetics of teeth may require more visits. | Two – minimum; matching esthetics of teeth may require more visits. | Two – minimum | Two – minimum |