Wong Family Dental

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The Dental Board of California - Dental Materials Fact Sheet

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As required by Chapter 801, Statutes of 1992, the Dental Board of California has prepared this fact sheet to summarize information on the most frequently used restorative dental materials. Information on this fact sheet is intended to encourage discussion between the patient and dentist regarding the selection of dental materials best suited for the patient's needs. It is not intended to be a complete guide to dental materials science.

The most frequently used materials in restorative dentistry are amalgam, composite resin, glass ionomer cement, resin-ionomer cement, porcelain (ceramic), porcelain (fused-to-metal), gold alloys (noble) and nickel or cobalt-chrome (base-metal) alloys. Each material has its own advantages and disadvantages, benefits and risks. These and other relevant factors are compared in the attached matrix titled "Comparisons of Restorative Dental Materials." A "Glossary of Terms" is also attached to assist the reader in understanding the terms used.

The statements made are supported by relevant, credible dental research published mainly between 1993-2001. In some cases, where contemporary research is sparse, we have indicated our best perceptions based upon information that predates 1993.

The reader should be aware that the outcome of dental treatment or durability of a restoration is not solely a function of the material from which the restoration was made. The durability of any restoration is influenced by the dentist's technique when placing the restoration, the ancillary materials used in the procedure, and the patient's cooperation during the procedure. Following restoration of the teeth, the longevity of the restoration will be strongly influenced by the patient's compliance with dental hygiene, home care, diet and chewing habits.

Both the public and the dental profession are concerned about the safety of dental treatment and any potential health risks that might be associated with the materials used to restore the teeth. All materials commonly used (and listed in this fact sheet) have been shown -- through laboratory and clinical research, as well as through extensive clinical use -- to be safe and effective for the general population. The presence of these materials in the teeth does not cause adverse health problems for the majority of the population. There exist a diversity of various scientific opinions regarding the safety of mercury dental amalgams. The research literature in peer-reviewed scientific journals suggests that otherwise healthy women, children and diabetics are not at increased risk for exposure to mercury from dental amalgams. Although there are various opinions with regard to mercury risk in pregnancy, diabetes, and children, these opinions are not scientifically conclusive and therefore the dentist may want to discuss these opinions with their patients. There is no research evidence that suggests pregnant women, diabetics and children are at increased health risk from dental amalgam fillings in their mouth. A recent study reported in the JADA factors in a reduced tolerance (1/50th of the WHO safe limit) for exposure in calculating the amount of mercury that might be taken in from dental fillings. This level falls below the established safe limits for exposure to a low concentration of mercury or any other released component from a dental restorative material. Thus, while these sub-populations may be perceived to be at increased health risk from exposure to dental restorative materials, the scientific evidence does not support that claim. However, there are individuals who may be susceptible to sensitivity, allergic or adverse reactions to selected materials. As with all dental materials, the risks and benefits should be discussed with the patient, especially with those in susceptible populations.

There are differences between dental materials and the individual elements or components that compose these materials. For example, dental amalgam filling material is composed mainly of mercury (43-54%) and varying percentages of silver, tin, and copper (46-57%). It should be noted that elemental mercury is listed on the Proposition 65 list of known toxins and carcinogens. Like all materials in our environment, each of these elements by themselves is toxic at some level of concentration if they are taken into the body. When they are mixed together, they react chemically to form a crystalline metal alloy. Small amounts of free mercury may be released from amalgam fillings over time and can be detected in bodily fluids and expired air. The important question is whether any free mercury is present in sufficient levels to pose a health risk. Toxicity of any substance is related to dose, and doses of mercury or any other element that may be released from dental amalgam fillings falls far below the established safe levels as stated in the 1999 US Health and Human Service Toxicological Profile for Mercury Update.

All dental restorative materials (as well as all materials that we come in contact with in our daily life) have the potential to elicit allergic reactions in hypersensitive individuals.[1] These must be assessed on a case-by-case basis, and susceptible individuals should avoid contact with allergenic materials. Documented reports of allergic reactions to dental amalgam exist (usually manifested by transient skin rashes in individuals who have come into contact with the material), but they are atypical. Documented reports of toxicity to dental amalgam exist, but they are rare. There have been anecdotal reports of toxicity to dental amalgam and as with all dental materials, risks and benefits of dental amalgam should be discussed with the patient, expecially with those in susceptible populations.

Composite resins are the preferred alternative to amalgam in many cases. They have a long history of biocompatibility and safety. Composite resins are composed of a variety of complex inorganic and organic compounds, any of which might provoke allergic response in susceptible individuals. Reports of such sensitivity are atypical. However, there are individuals who may be susceptible to sensitivity, allergic or adverse reactions to composite resin restorations. The risks and benefits of all dental materials should be discussed with the patient, especially with those in susceptible populations.

Other dental materials that have elicited significant concern among dentists are nickel-chromium-beryllium alloys used predominantly for crowns and bridges. Approximately 10% of the female population is alleged to be allergic to nickel.[2] The incidence of allergic response to dental restorations made from nickel alloys is surprisingly rare. However, when a patient has a positive history of confirmed nickel allergy, or when such hypersensitivity to dental restorations is suspected, alternative metal alloys may be used. Discussion with the patient of the risks and benefits of these materials in indicated.

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[1] Dental Amalgam: A scientific review and recommended public health service strategy for research, education and regulation. Dept. of Health and Human Services, Public Health Service, January 1993.

[2] Merck Index 1983, 10th Edition. M Narsha Windholz, ed.

Comparisons of Dental Restorative Materials

TYPES OF RESTORATIVE DENTAL MATERIALS								
	Made and Inserted by a Dentist				Made in a Dental Lab Using Models of the Prepared Teeth			
	AMALGAM	**COMPOSITE RESIN**	**GLASS IONOMER CEMENT**	**RESIN-IONOMER CEMENT**	**ALL PORCELAIN (CERAMIC)**	**PORCELAIN FUSED TO METAL**	**HIGH-GOLD ALLOYS**	**BASE METAL ALLOYS (NICKEL OR COBALT-CHROME)**
Description	A self-hardening mixture of liquid mercury + a silver, tin and copper alloy powder.	A mixture of powdered glass + plastic resin. 2 types: self-hardening, or hardening only by exposure to blue light.	A self-hardening mixture of glass + organic acid.	A mixture of glass + resin polymer (plastic) + organic acid; hardens by exposing it to blue light.	A glass-like material made like a clay pot -- by firing it in an oven in a dental lab -- using models of the prepared teeth.	Same as all porcelain (ceramic), except that it is "enameled" onto a metal shell for extra strength.	Mixtures of at least 60% gold, plus copper and other metals for strength. Cast in a dental lab from models of the prepared teeth.	Mixtures of mainly nickel and chromium, cast in a dental lab.
Main Uses	Fillings. Sometimes used for replacing portions of broken teeth.	Fillings, inlays, veneers, partial and complete crowns. Sometimes used for replacing portions of broken teeth.	Small fillings, cementing porcelain or metal crowns, liners under another material, and as temporary restorations.	Small fillings, cementing porcelain and metal crowns, and liners under another material.	Inlays, veneers, crowns and bridges.	Crowns and bridges.	Crowns and bridges. Also used as the metal in some partial dentures.	The metal in most partial dentures. Some crowns and bridges.
Resistance to Future Decay	High. Its self-sealing property helps resist recurrent decay; however, new decay around an amalgam is hard to detect in its early stages.	Moderate. Recurrent decay is easily detected in early stages.	Low to moderate. Some resistance to decay may be imparted through slow release of fluoride.	Low to moderate. Some resistance to decay may be imparted through slow release of fluoride.	Good, if the restoration fits well.	Good, if the restoration fits well.	Good, if the restoration fits well.	Good, if the restoration fits well.
Durability (in Permanent Teeth)	Durable.	Strong, durable.	N/A. (Only used as a non-stress bearing crown cement.)	N/A. (Only used as a non-stress bearing crown cement.)	Moderate. A brittle material that may fracture under high biting forces. Not recommended for molar teeth.	Very good. Less susceptible to fracture than all porcelain, due to the metal substructure underneath it.	Excellent. Does not fracture under stress and does not corrode in the mouth.	Excellent. Does not fracture under stress and does not corrode in the mouth.
Amount of Original Tooth Preserved	Fair. Since it does not bond to the tooth, it requires removal of some healthy tooth structure so as to be held in place.	Excellent. Bonds adhesively to healthy enamel and dentin.	Excellent. Bonds adhesively to healthy enamel and dentin.	Excellent. Bonds adhesively to healthy enamel and dentin.	Good, moderate. Not very much natural tooth is removed for veneers; more is removed for crowns since porcelain strength is related to its bulk.	Moderate to high. Additional tooth structure must be removed to make room for the metal shell underneath the porcelain.	Good. A strong material that only requires removal of a thin outside layer of the tooth.	Good. A strong material that only requires removal of a thin outside layer of the tooth.

Surface Wear	Low. Surface wear is similar to natural dental enamel. However, thin parts of metal are more brittle.	May wear down 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.	Resistant to surface wear, but is abrasive to the opposing teeth.	Resistant to surface wear. Permits either metal or porcelain on the biting surface of crowns and bridges.	A similar hardness to natural enamel. Does not abrade the opposing teeth.	Harder than natural enamel, but minimally abrasive to opposing natural teeth. Does not fracture in bulk.
Breakage	Amalgam may fracture under stress. Also, the tooth around the filling may fracture before the amalgam does.	Good resistance to fracture.	Brittle; low resistance to fracture. Not recommended for stress-bearing restorations.	Tougher than glass ionomer; recommended for stress-bearing restorations in adults.	Poor resistance to fracture.	Porcelain may fracture.	Does not fracture when in bulk.	Does not fracture in bulk.
Leakage	Good. Seals itself on a small scale by surface corrosion. Margins may chip over time.	Good if bonded to enamel. If bonded to dentin, it may show leakage over time. Does not corrode.	Moderate; tends to crack over time.	Good. Adhesively bonds to resin, enamel, + dentin. Early expansion may help seal the margins.	Very good. Can be fabricated for a very accurate fit.	Good to very good depending upon the design of the edges of the crowns.	Very good to excellent. Can be formed with great precision and can be tightly adapted to the tooth.	Good to very good. Stiffer than gold, less adaptable, but can be formed with great precision.
Resistance to Biting Forces	High. However, 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 for biting surfaces of adults; suitable for short-term uses in baby teeth.	Moderate. A brittle material susceptible to fracture under biting forces.	Very good. The metal underneath gives high resistance to fracture.	Excellent.	Excellent.
Toxicity	Generally safe. Occasional allergic reactions can occur to metal ingredients. Does contain mercury, which in its elemental form is toxic and Prop 65 listed.	Safe; no known toxicity documented. Contains some Prop 65 compounds, but concerns about trace chemical release are not supported by research.	Safe; no known toxicity documented. No known problems.	Safe; no known toxicity documented. No known problems.	Excellent. No known adverse effects.	Very good to excellent. Occasional or rare allergies to the metal ingredients.	Excellent; rare allergies to some alloys.	Good. Nickel allergies are common among women, but are rarely seen in dental work.
Allergic or Adverse Reactions	Rare. Recommend that dentist evaluate patient to rule out any 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 and periodontal disease.	No known documented allergic reactions. Surface may roughen slightly over time, predisposing to plaque and periodontal disease if the material contacts the gums.	None.	Rare. Occasional allergy to the metal underneath.	Rare. Occasional allergic reactions seen in susceptible individuals.	Occasional. Infrequent reactions to nickel can occur.

Post-Operative Sensitivity	Minimal. High thermal conductivity may cause a temporary hot and cold sensitivity. Also, contact with other metals may cause an occasional and transient small electric shock.	Moderate. Material is sensitive to dentist's technique. It also shrinks slightly when hardened, and a poor seal may lead to bacterial leakage, new decay + tooth hypersensitivity.	Low. It seals well and does not irritate pulp.	Low. It seals well and does not irritate pulp.	Not material dependent. Doesn't conduct heat and cold well (a good thing).	Not material dependent. Doesn't conduct heat and cold well (a good thing).	Conducts heat and cold, so it may irritate sensitive teeth.	Conducts heat and cold, so it may irritate sensitive teeth.
Appearance	Very poor. Not tooth colored: initially it is silver-gray, then gets darker, becoming black as it corrodes. May stain teeth dark brown or black over time.	Excellent. Often can't tell it from natural tooth.	Good. Tooth colored, varies in translucency.	Very good. More translucent than a glass ionomer.	Excellent.	Good to excellent.	Poor. A yellow metal.	Poor, a dark silver metal.
Frequency of Repair or Replacement	Low. Replacement is usually due to breakage of the filling or the surrounding tooth.	Low to moderate. A durable material which hardens rapidly. Some composites wear faster than amalgam does. Replacement is usually due to marginal leakage.	Moderate. Easily dislodged, and also slowly dissolves in the mouth.	Moderate. More resistant to dissolving than glass ionomer, but less so than a composite resin.	Varies, depending on 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 Cost	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 and crowns cost more.	Moderate. Similar to composite resins. (Not used for veneers and crowns.)	Moderate. Similar to composite resins. (Not used for veneers and crowns.)	High, requiring at least 2 office visits plus a dental laboratory.	High, requiring at least 2 office visits plus a dental laboratory.	High, requiring at least 2 office visits plus a dental laboratory.	High, requiring at least 2 office visits plus a dental laboratory.
# of Visits Required	1 visit. (Polishing may require a second visit.)	1 visit for fillings, 2+ visits for cast inlays, veneers and crowns.	1 visit.	1 visit.	2 visits minimum. Matching the color of nearby teeth may require more visits.	2 visits minimum. Matching the color of nearby teeth may require more visits.	2 minimum.	2 minimum.

Glossary of Terms

# of Visits Required -- On average, how many times a patient would have to go to their dentist's office in order to get a restoration made from this material.

Abrasive -- A material which is so hard that over time it wears away the surfaces of natural teeth which bite against it.

Allergic or Adverse Reactions -- Body reaction to the material, overall or in just a small area.

Amount of Tooth Preserved -- A general measure of how much of the original tooth needs to be removed in order to put in the material.

Appearance -- Visually, how much does this material resemble natural tooth structure?

Biocompatibility -- The effect, if any, of the material on the general overall health of the patient.

Dental Amalgam -- A filling material which is composed mainly of mercury (43 - 54%) and varying percentages of silver, tin, and copper (46 - 57%).

Description -- A brief statement of the composition and behavior of the denture material.

Durability -- How strong this material acts in the mouth environment.

Frequency of Repair or Replacement -- A very general indication of how often this material will have to be replaced. (This will also depend upon many other factors, such as the biting habits of the patient, their diet, the strength of their bite, oral hygiene, etc.)

Leakage -- The ability of the material to "self-seal" small holes at its edges, thereby helping to prevent sensitivity and new decay.

Main Uses -- How this material is used in dentistry.

Post-operative Sensitivity -- After the dental work is done, the tooth is sensitive to heat, cold, sweets, and/or pressure. This is usually temporary, and gets progressively better as time goes by. However, some amount of sensitivity may be permanent.

Relative Cost -- How much would this material cost relative to your other choices?

Resistance to Biting Forces -- The ability of the material to survive biting forces over time.

Resistance to Future Decay -- The general ability of the material to prevent decay around it.

Surface Wear / Breakage -- How well does the material hold up over time under the forces of biting, grinding, clenching, etc.

Toxicity -- Is there any indication this material can interfere with normal bodily processes beyond the mouth?