

COMPONENTS OF DENTAL MATERIALS

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Need for components of dental materials to be listed

There is an essential need for a consumer-based listing for components of dental restorations including fillings, crowns, bridges, and other devices and implants. Less than thirty years ago, most food packaging did not include a list of ingredients and nutritional facts. However, consumers and other groups demanded this information be disclosed, and in 1990, food labeling became a requirement by the United States Food and Drug Administration (FDA).¹ Yet, even before this legislation was passed, Ulf Bengtsson, a research engineer at Linköping University in Sweden, had been working to encourage government authorities to accomplish this type of open disclosure for dental products. Unfortunately, to date, no such packaging list of dental material components has been created for patients.

However, the need for manufacturers to list the components of dental materials was validated by a 2013 policy paper from the Council of European Dentists. Two statements included in this paper can be applied to listing the components of dental products:

- The first one states, “The profession urges manufacturers to fully declare the chemical composition of the alternative materials.”²
- The second one establishes, “In the best interest of the patient, dental professionals should consider not choosing to use a material where the manufacturer has not made a full qualitative declaration of its chemical composition.”³

Most people are not aware that for many decades, arsenic and other poisons were commonly used for dental treatment, and most people are not aware that toxic components are still being used in dentistry today. For example, a 2014 Zogby poll established that 57% of Americans did not know that mercury is the main ingredient in amalgam fillings and that 63% thought the common practice of referring to mercury amalgams as “silver fillings” was misleading.⁴

What are some of the components of dental materials?

Dental amalgams (silver) fillings, contain about 50% mercury, which is a known neurotoxin. This mercury is mixed with copper, silver, and tin. These fillings can also contain zinc⁵ and other metals,⁶ with at least one study finding the presence of lead and cadmium.⁷

Other filling materials also contain a number of components of which the average person is probably unaware. Composite fillings can contain bisphenol-A and fluoride, among other controversial components. Dental gold alloys can also contain copper, gallium, indium, iridium, palladium, nickel, silver, tin, titanium, and zinc,⁸ as well as beryllium.⁹

Dental bridges, crowns, partial dentures, and implants can contain aluminum, chromium, cobalt, copper, gallium, gold, indium, iridium, iron, manganese, nickel, palladium, platinum, silver, titanium, vanadium and more.^{10 11 12} Items made of cobalt-chromium-molybdenum steel contain

those elements in addition to aluminum, nickel, titanium, and others.¹³ Research has found that some of these dental materials can contain lead.¹⁴

Safety Data Sheets: a worker-based listing of components of dental materials

The United States Department of Labor's Occupational Safety and Health Administration (OSHA) requires manufacturers to produce safety data sheets (SDS, formerly known as material safety data sheets, or MSDS). The purpose of safety data sheets is to protect workers by supplying them with the most crucial facts about the hazardous materials at their jobsite, such as the physical properties of the material, proper storage and handling techniques, known health risks, and essential emergency procedures.

For example, manufacturers of amalgam fillings must create these information sheets for workers, and excerpts from just a few of the SDSs for dental amalgam include compelling evidence about the known dangers of using mercury in fillings:

- [SDI; Permite; Lojic +; GS-80, GS-80 Spherical; F400; Ultracaps +; Ultracaps S; SDI Admix; SDI Spherical and New Ultrafine.- Capsules](#); Australia, Brazil, Ireland, and the USA; 2015:¹⁵
 - Hazard Identification/California Prop 65 Warning: "This product contains mercury, a chemical known to the State of California to cause birth defects or other reproductive harm."
 - First Aid Measures: "May cause respiratory disorders including inflammation and fluid retention. Inhalation of mercury vapours at high concentration can cause dyspnea, coughing, fever, severe nausea, vomiting, excess salivation, kidney damage with renal shutdown."
 - Toxicological Information/Chronic Health Effects: "Inhalation of mercury vapours, dusts or organic vapours, or skin absorption or mercury over long periods can cause mercurialism. Symptoms include tremors, inflammation of mouth and gums, excessive salivation, stomatitis, blue lines on gums, pain and numbness in extremities, weight loss, mental depression, and nervousness. Exposure may aggravate kidney disorders, chronic respiratory disease and nervous system disorders. May cause damage to blood, kidneys, liver, brain, peripheral nervous system, central nervous system."
- [Kerr Corporation; Tytin FC™](#); USA; 2014:¹⁶
 - First Aid Measures/Inhalation: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations, salivation, metallic taste, eye irritation, respiratory tract irritation, coughing, pulmonary edema, wheezing and breathing difficulties, headache, fever, nausea or vomiting, diarrhea, abdominal cramps and pain, muscle weakness / pain, mental confusion or disorientation."
 - First Aid Measures/Skin Contact: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations."
 - First Aid Measures/Ingestion: "Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations."
- [Henry Schein; SDS acc. to OSHA HCS; Stratosphere, Ionosphere, Troposphere](#); USA; 2014:¹⁷

- Hazard Identification/Classification: “Very toxic, Very toxic by inhalation, Toxic, May cause harm to the unborn child, Toxic: danger of serious damage to health by prolonged exposure through inhalation.”
- Disposal Consideration: “Must not be disposed of together with household garbage. Do not allow product to reach sewage system.”
- Toxicological Information: “Avoid exposure of mercury to pregnant person.”

While this information would be very helpful to consumers, it is very rare that dental patients are presented with these safety data sheets. Additionally, the sheets only address the components of the particular dental restorations and not how these components might react with other materials in the mouth of the patient.

Mixing metals: crucial in understanding the components of dental materials

A mouth with any amount of metallic dental restorations has all the metals needed to produce chemical reactions in a phenomenon known as oral galvanism, which simply means electric currents produced by chemical action in the mouth. Researchers have offered a succinct explanation of the process: “In dentistry application, galvanic corrosion occurs when two or more dental prosthetic devices with dissimilar alloys come into contact while subjected to oral liquids like saliva; the difference between the corrosion potentials results in a flow of electric current between them.”¹⁸

Dental textbooks have included reference to oral galvanism for decades.¹⁹ Therefore, most dental authorities acknowledge oral galvanism, and Health Canada has even stated that “new amalgam fillings should not be placed in contact with existing metal devices in the mouth, such as braces.”²⁰ However, when it comes to fully taking heed of the consequences of oral galvanism, the knowledge of its existence does not appear to have significantly altered most dental practices.

Conclusion about components of dental materials

The number of dental alloys used since the 1980’s has noticeably increased,²¹ and more and more patients are being exposed to different materials, often with no practical knowledge about the potential hazards of the components. Meanwhile, research continues to present evidence of human health risks caused by mercury fillings, as well as other materials in the mouth.

The IAOMT works to educate dental and medical professionals and patients about biocompatibility and components of dental materials. Biocompatibility involves the use of dental materials that are best suited for the patients based on safety and their personal healthcare needs. Also, when dental mercury fillings are removed, the IAOMT encourages professionals and patients to ensure that measures are taken to mitigate mercury exposure by applying the IAOMT’s [Safe Mercury Amalgam Removal Technique \(SMART\)](#). Furthermore, the IAOMT researches [alternatives to amalgam fillings](#) and suggests that patients take an active role in making sure that they understand the components of dental materials being used in their mouths.

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