

# Example of chemistry behind dental fillings research paper



**ASSIGN  
BUSTER**

A dental cavity in a tooth is the result of the decay process that happens over time when bacteria in the mouth produce acids. In a time, acids can dissolve enamel and cause a hole, which is known as a cavity. Unlike some other injuries, a cavity will not heal by itself and needs to be filled. Several different materials are available, and each material has advantages and disadvantages.

Dental fillings can be categorized as direct or indirect restorations. Direct restorations are fillings that get inserted into a cavity in a single visit. These substances include consisting of amalgams, glass and resin ionomers and composite resin fillings. Indirect restorations require more than one visit. These fillings are done in inlays, onlays, veneers, crowns and bridges.

For many years the only available choices for dental filling were gold alloy or an amalgam of mercury, silver and copper metals. In recent years, other materials have been developed for restoring teeth. These are tooth colored and include composite resin, glass ionomer and porcelain materials.

## **Amalgam**

The word amalgam in dental fillings refers to a mixture of two or more metals with mercury as one component. Dental amalgam is a mix of ~ 50% mercury with other metals, including silver, copper and tin. Dental amalgams are also called silver fillings because of their silver color when they are first placed. Amalgam is generally used in the back teeth and has been in use for two centuries. Dental amalgam is the most extensively researched and tested material. The advantages of amalgam include strength, durability, low cost and minimal shrinkage. There are certain disadvantages to amalgam fillings. While no conclusive evidence of harm from dental amalgam exists,

there are concerns about the very low levels of mercury vapor released from amalgam. In addition, amalgam does darken over time as it corrodes, and many people find it less attractive than tooth colored materials.

## **Composite resins**

Composite is a mixture of acrylic resin and powdered glass particles that mimic a tooth-color. The material is hardened by itself or may be hardened on exposure to light. Composite is used for many types of fillings and to replace a portion of a broken or chipped tooth. The advantages of composite include that color and shade can be matched to the existing tooth and is a relatively strong material. It affords long durability in small as well as mid-size restorations. Disadvantages are that the filling can break and wear out more, unlike the metal fillings. Also, composite are more expensive than amalgam and may require more than one visit.

## **Glass Ionomer**

Glass ionomers are also tooth-colored made of acrylic acids mixed with fine glass powders. The mix is used to fill cavities on surfaces of teeth. The fillings tend to be small and in areas of low chewing pressure. The fillings do look natural and require only one single visit. But the fillings offer little resistance for fracture and hence their use is limited.

## **Resin Ionomer**

Resin ionomers are also made using acrylic acids and acrylic resin with glass filler. They are hardened with shining to blue light. These ionomers are most generally used as fillings on non-chewing surfaces and for baby teeth. Resin ionomers are tooth-colored and more translucent than glass ionomer.

## **Porcelain (ceramic)**

All-porcelain materials include ceramic, porcelain, or glass. Porcelain infusion with metal is also in practical use.

## **Gold Alloys**

Gold alloys contain gold, copper and tin metals that result in a strong, effective filling. They have excellent durability, do not crack under stress and show good resistance to corrosion. Gold is normally the highest cost material.

## **The chemistry of modern dental fillings**

Composite resins consist of bulky bifunctional monomers together with powdered inorganic fillers, and they set by polymerization. The filling material is placed on the tooth in the form of a paste and a beam of ultraviolet (uv) light is focused on it. The uv light initiates chemical reactions to form a number of cross links between the polymers. The polymer containing the glass becomes a solid three dimensional matrix cross-linked network which fills the hole in the tooth. Glass-ionomers consists of water soluble polymeric acids such as polyacrylic acid and basic glass powders. They are solidified by a neutralization reaction, but leave a good amount of the unreacted glass to act as reinforcing filler.

An example of resin-based dental composite contains methacrylate monomer and silica powder as a filler material. Methacrylate is a derivative of methacrylic acid.

**References:**

Dental Filling Facts, American Dental Association, [www.ada.org](http://www.ada.org), 2008

National Institute of Dental and Craniofacial Research, Web site: <http://www.nidcr.nih.gov/>;

<http://www.nidcr.nih.gov/>;

<http://www.nidcr.nih.gov/Research/ResearchResults/InterviewsOHR/TIS082006b.htm>

Whitters, C. J., et al. "Dental Materials: 1997 Literature Review." *J Dent* 27 6

(1999): 401-35. Print.

Zimmerli, B., et al. "Composite Materials: Composition, Properties and

Clinical Applications. A Literature Review." *Schweiz Monatsschr Zahnmed*

120 11 (2010): 972-86.