

# About bonding and beyond

The term *bonding* is used to describe the process of welding an artificial restorative material to natural tooth anatomy using a mixture of chemicals. Although often thought to be a glue, bonding is actually a complex process where microscopic plastic pins are formed to mechanically hold an artificial material onto a tooth.

Essentially, a concentrated form of the acid found in soda pop—phosphoric acid—etches, cleans, and pits the surface of the tooth to be bonded, similar to how glass is etched to make artistic window designs. Then an alcohol or ether-based wetting agent is applied to the dentin to fool the resin into thinking that the tooth is an artificial material rather than a water-filled natural substance because plastic does not stick to water. A thin coat of liquid, unset plastic is applied to the treated bonding surface and then set up with a catalyst, which may be light or a chemical. The catalyst starts a chain reaction in the liquid resin that makes it turn hard by covalent chemical bonds, which is the basis of the term “bonding.”

Bonding to enamel, or the outer surface of the tooth above the gum, is extremely durable and predictable; bonding to the softer inner layer of the tooth, the dentin, requires careful technique and is significantly weaker than resin bonds to enamel.

Most of the time, the term “bonding” is used in reference to tooth-colored direct resin restorations, or composites. Thick composite resin paste, fundamentally similar to the previously described liquid bonding resin, can be stacked, colored, and



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molded to resemble the form, color, and function of natural teeth. Many dentists use composite resin to restore cavities instead of “silver fillings” because they look better. Composite can also be used to build veneers, depending on the skill of the clinician. Although bonded fillings are extremely versatile and may be less costly than porcelain for esthetic restorations, there are limits.

Resin fillings typically have a shorter lifespan than restorations of other materials such as porcelain or gold. Compared to layered, stacked, and fired modern porcelain for veneers, resin tends to fall short in long-term esthetic value. For small to moderate cavities, composite resin restorations may be the best restorative material and serve well for many years. When the filling is large, the longevity of service of a directly placed composite restoration is uncertain. Since bonding is better to enamel than to dentin, the more enamel that can surround the filling, the better the life expectancy of a composite restoration.

One of the main reasons for failure of composites is that they are often used to replace deep older fillings that extend below the gum line, where there is no enamel to which to bond. Typically, recurrent decay eventually develops at the bottom of these restorations. Bonded fillings and directly placed resin veneers on front

teeth may serve well for approximately seven years, on average. Failure of front tooth bonding typically presents as discoloring of the edges or of the filling itself or as wear and fracture. Since resin is softer than enamel and porcelain, it wears at a greater rate. Therefore, when stability of the bite depends upon the restoration, composite resin should be viewed as a temporary type of restoration only.

Directly placed composite restorations are technically challenging. Since bonding requires a relentlessly dry environment, if the tooth to be bonded cannot be kept dry, the bonding will fail in short order. Bleeding around a composite restoration during placement compromises esthetics and bond strength. Highly esthetic composite restorations require significant chair time and artistic skill.

Lastly, directly placed composites are difficult to contour and shape to reproduce the form and function of natural teeth. Despite the challenges and technical difficulty, in the right patient and under the right conditions with an understanding of the limitations, bonded resin restorations can be economical and predictable esthetic restorations.

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