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Reducing or eliminating failure of large Class II composites

Q: It is well recognized among practicing clinicians that large Class II resin-based composites do not serve as long as amalgam in moderate-to-large tooth preparations for posterior teeth. I have certainly seen that characteristic in my practice. Is there a way to make the currently excellent composite resin materials serve longer in large tooth preparations?

A: This observation has always frustrated me also. Since most patients prefer tooth-colored restorations, practicing dentists would prefer to place tooth-colored direct restorations instead of metal ones if they lasted as long as the metal. However, the fact is that dentistry currently has the ability to place long-lasting, direct tooth-colored restorations in small tooth preparations (figure 1), and long-lasting crown or onlay restorations in teeth with significant destruction (figures 2-4).

However, relatively inexpensive, long-lasting, direct tooth-colored restorations for moderate-to-large posterior tooth preparations are still not often seen. Soon after placement, marginal enamel or restorative material chips away, caries starts again, cusps break off, or the resin actually comes loose from the tooth in the proximal box forms (figure 5).

Figure 1: Small Class II resin-based composite restorations have been shown to serve many years longer than larger direct resin restorations. Class II tooth preparations should be kept as small as possible, thus retaining the tooth-wear facets on the tooth structure and not on the resin, and providing increased longevity.

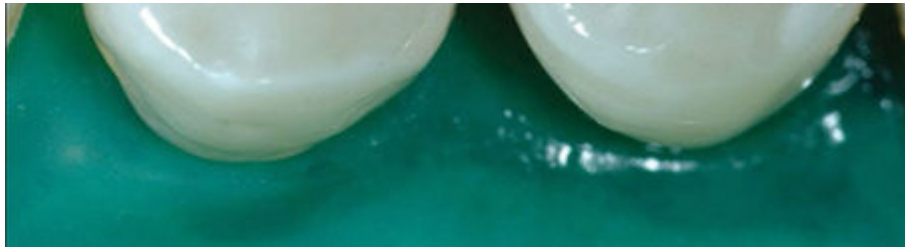


Figure 2: Laboratory fabrication of crowns for grossly destroyed and built-up teeth.

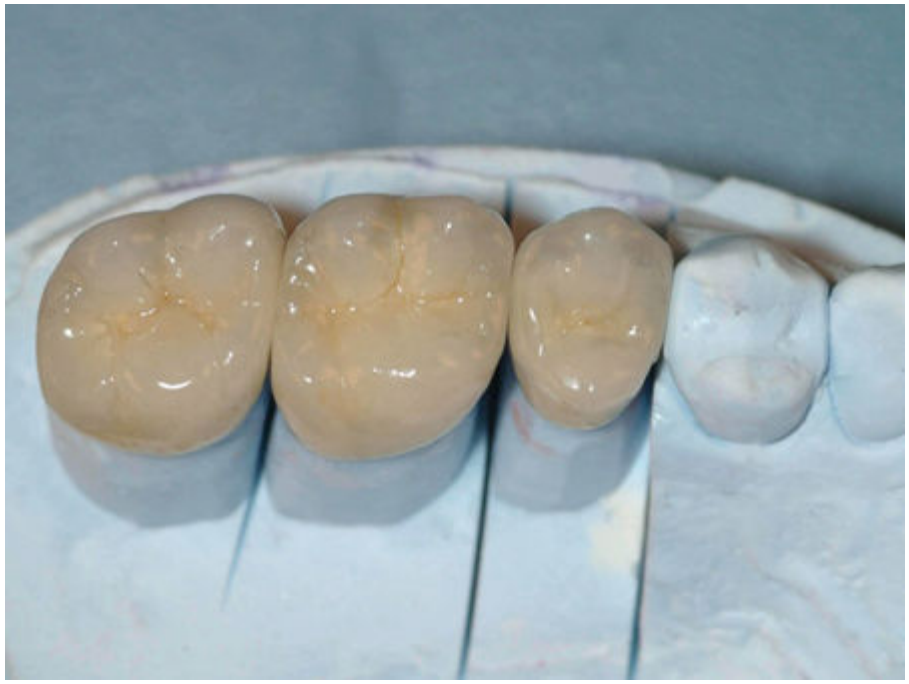
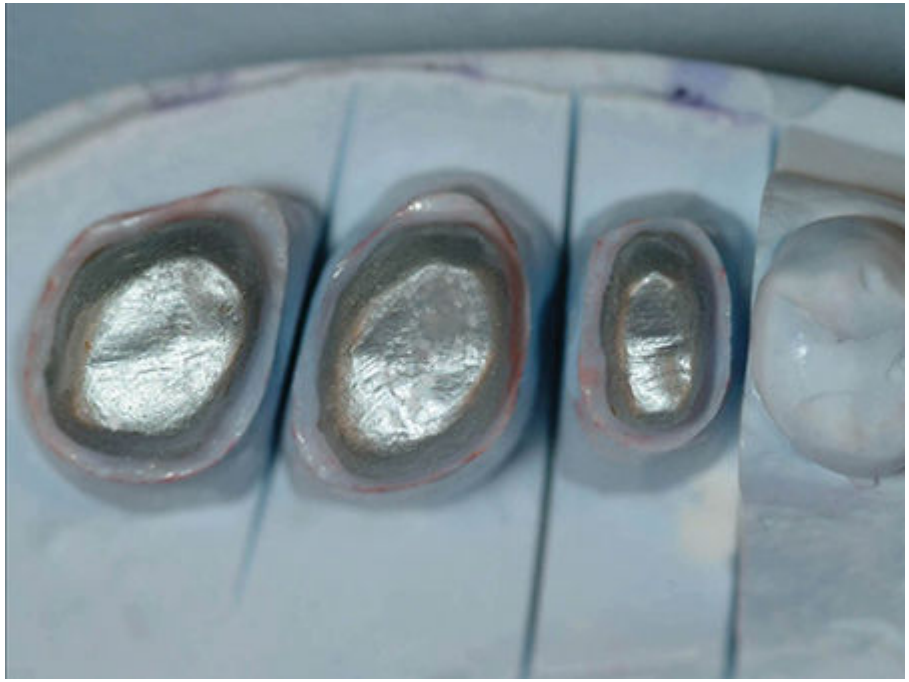


Figure 3: The dies for the crown fabrication appear to be normal preps, when in fact the teeth have a significant amount of build-up material in them.



Some dentists say that indirect tooth-colored partial crowns, inlays, and onlay indirect restorations should be placed in moderate-to-large posterior tooth preparations since they have been proven to serve well. But the cost of indirect restorations is about five times higher than the fees for directly placed restorations, making them undesirable to most average-income patients for a "filling."

What can be done to increase the longevity of the larger, directly placed resin-based composite restorations? I will provide suggestions based on the research literature, research on the topic by Clinicians Report (CR) Foundation scientists, and my personal

observations obtained over many years of prosthodontic practice.

Figure 4: The crowns in the mouth will serve for many years.

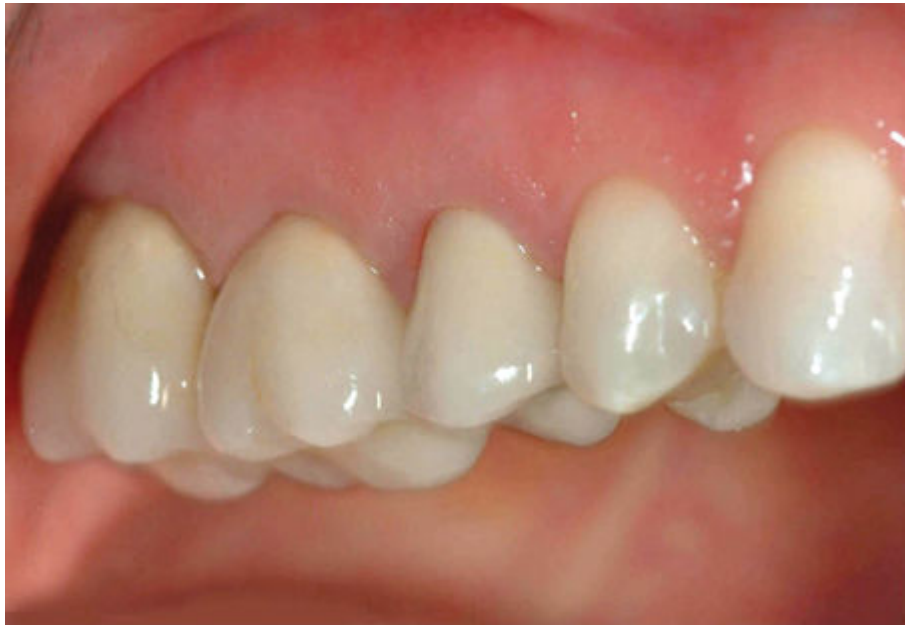
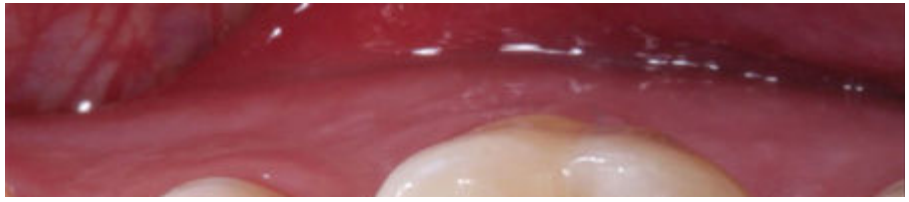


Figure 5: A large Class II restoration such as this one has limited longevity potential according to international research, with many studies showing only about six or seven years of average longevity.



Numerous factors relate to the premature failure of large composite restorations. Among them are the following:

Curing lights and resin-curing techniques-This factor is probably the most important one relative to premature restoration failure.

• Resin curing lights should have an output of about 1,000 mW/cm^2. Many do not have this much output.

• Some dentists have purchased low-cost, foreign-made lights at ridiculously low prices. In CR Foundation research, some of these lights have been found to have both minimal light output and lack of the recommended broad-spectrum wavelength of 400 to 500 nm.

• Some curing light brands have light guides that bond resin residue on their tips. If you have such a light, remove the debris with composite discs and polish the tip. Use a sheath of Saran Wrap to avoid future contamination and reduction of light output.

• Lights with narrow-diameter light guides (about 7 mm in diameter) require circular movement of the guide during curing and longer curing time to ensure optimum resin conversion. 10- or 11-mm-diameter light guides are optimum.

• Move the light tip as close to the resin as possible when curing because the power of the light is grossly diminished as it is moved farther from the resin surface.

• For optimum cure, the light coming from the device should be in an angulation perpendicular to the resin surface. This is one of the most neglected points, since most of the light guides do not allow this angulation in many clinical locations. Most of the newer lights are being made with a light guide of near 90 degrees from the light device (figure 6). This angle is far better than those with less angulation because it allows curing the resin with the light hitting the resin perpendicular to the resin surface.

• The bulk fill concept can work well if done properly. Most of the resins cure deeply enough when the previous factors are done properly. However, research is showing pulling away of resin from the apical areas of deep proximal boxes with some of the bulk-fill composite brands because the resin shrinks during curing. These obvious voids can promote new caries. I suggest when using either conventional incremental curing or bulk filling that a thin layer of resin be cured in the deepest areas of the tooth preparation, especially box forms, before larger amounts of resin are placed. Some brands of resin for Class II placement are available that are dual cure, and they can reduce or eliminate this problem. An example brand is HyperFil from Parkell.

Tooth preparations

Class II tooth preparations for resin-based composite have evolved through numerous forms since resin in Class IIs was introduced in 1968. Currently, most dentists are using conventional G.V. Black tooth preparations for resin restorations (figure 7). I suggest from research dating back to the 1970s that, when possible, small, round-ended burs, such as 329, 330, or 245, be used to avoid making large preps and to reduce facets on the resin.

Figure 6: It is obvious that a 90-degree angle light guide allows optimum direction of light energy to cure the resin in some difficult-access clinical situations.

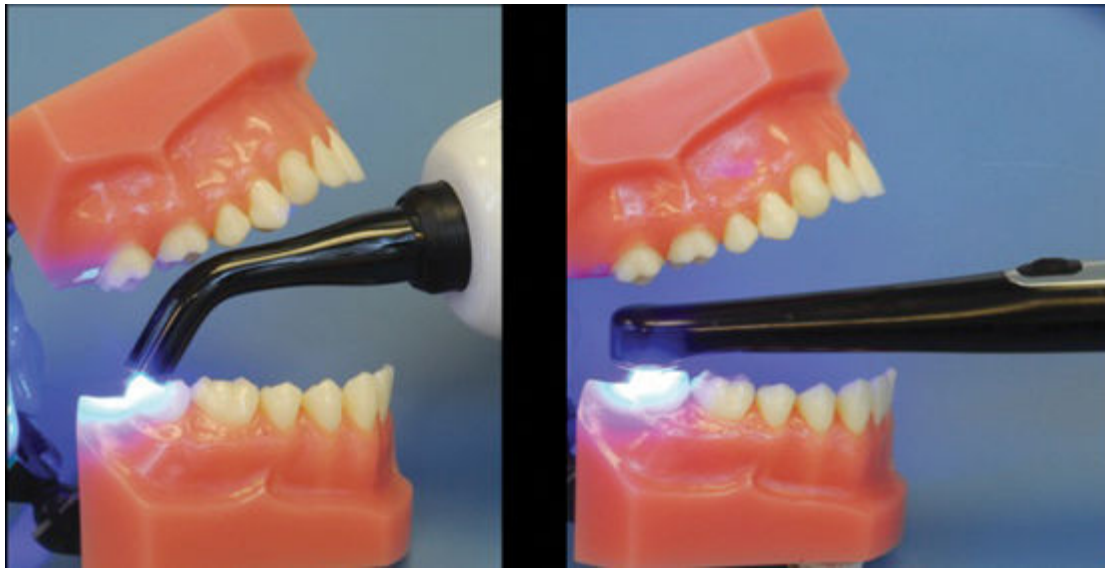
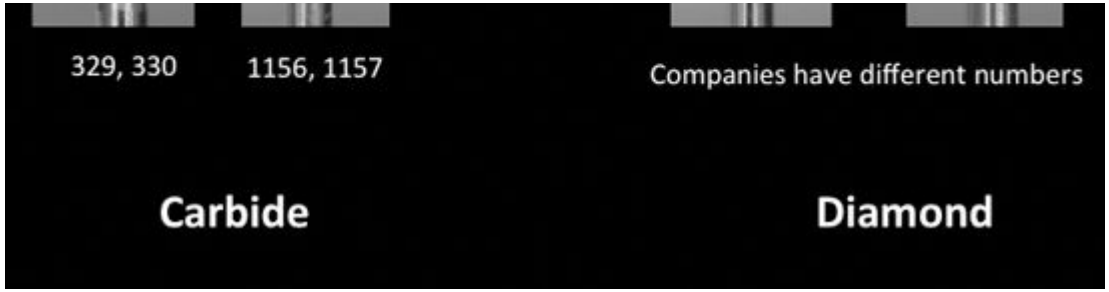


Figure 7: Whenever possible, small nontraumatic burs such as those shown should be used to reduce unneeded tooth structure removal.



When large preps are necessary, longer, round-ended burs, such as 1156 or 1157, should be considered. Burs such as the still commonly used 556 and 557 should be eliminated due to the well-researched vibration and sharp angles these burs with cross-cut design produce.

I am amazed to see many clinicians make direct or indirect intracoronal tooth preparations so wide that the facial and lingual occlusal margins approach or are actually in the cusp tips. Such restorations are doomed to premature failure. When intracoronal preps are larger than half of the cusp-tip-to-cusp-tip distance, coverage of the affected cusp with one to 1 to 1½ mm of restorative material should be accomplished. If visible cracks are present in the preps, especially horizontal cracks, that part of the tooth should be removed, or it will soon break away.

Over-finishing of restorative material

Some dentists overfill direct restorations and have difficulty finding the tooth preparation margins when finishing. The result is broken enamel when finishing and the appearance of the "white line" on the margins familiar to all restorative dentists. Continued breakdown and eventual dental caries soon occur.

To avoid such problems, I suggest making distinct margins on the tooth preparation, placing resin just slightly over the margin, and using sharp carbides or diamonds at low speed, under magnification, without water spray, to allow nontraumatic uncovering of the tooth prep margin and thereby avoiding enamel and restorative material destruction.

Conclusions

There is no question that many moderate-to-large resin-based composites fail prematurely. There are methods to reduce this problem, including properly using a state-of-the-art light, making correct tooth preparations, and finishing correctly. Large Class II resin-based composite restorations should serve longer using the concepts discussed in this article.

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