

# Adhesive Dentistry: Changing Restorative Treatment for the Better

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**A**malgam fillings and full-coverage gold crowns have long been the “gold standard” for direct and indirect restorations of cariously involved and/or broken teeth. While these restorations have a proven track record for functional success, they are not ideal with respect to esthetic outcomes or the preservation of residual tooth structure for subsequent solutions upon failure. The development of modern, adhesively retained restorations has enabled clinicians to provide patients a long-lasting solution that is not only a more conservative option for addressing diseased and/or structurally damaged teeth, but a more esthetic one.

This article will review recent developments in adhesive dentistry, as well as the often-overlooked excellent track record already established by direct resin and indirect all-ceramic restorations.

## Emergence of Universal Adhesives

Fourth generation dentin bonding agents (DBAs) have long been considered the benchmark for adhesives in dentistry. This is due to their excellent in vitro and well-documented in vivo performance.<sup>1</sup> While 4th generation DBAs do have a proven clinical track record, much of it consists of class V restoration studies.<sup>1</sup> Class V studies do not necessarily reflect the expected outcomes of other more common clinical scenarios such as class II, III, and IV direct restorations, or indirect adhesive restorations, where the types of dentin involved in bonding are different than those in class V restorations, and the ratio of enamel to dentin surfaces is different.

For example, it is clear from clinical data that the resin restorative material used is not a significant variable in the success of posterior composite restorations.<sup>2</sup> Even among 4th generation DBAs, in vitro and in vivo performance is variable.<sup>1</sup> While it is understandable why class V restoration studies were chosen to determine “best performance” capabilities of DBAs, it is questionable what relevance they have with respect to the longevity and clinical performance of modern adhesive restorations, which is undoubtedly the most pressing concern for clinicians.

In any case, with the emergence of “universal” adhesives, 4th generation DBAs finally appear to be relinquishing their perch on top. Not all manufacturers’ chemistries are the same, and the adhesives in the “universal” category are somewhat heterogeneous. However, in general, universal adhesives are a single-step adhesive that can be used with a total-etch, selective enamel-etch, or self-etch approach. These adhesives should not be confused with 7th generation, one-step self-etch adhesives.

Not everyone in the dental profession agrees with or believes the notion that 4th generation bonding agents are no longer the standard for adhesives. Yet an objective review of evidence and available literature reveals this to be the case. Requiring fewer clinical steps, universal adhesives are much less technique sensitive than 4th generation DBAs. Again, while not all universal adhesives share the same chemistry, several have been shown to be unaffected by varying degrees of dentinal wetting<sup>3,4</sup> and compatible with all approaches for bonding, regardless of how, or if, phosphoric acid is used,<sup>5</sup> although enamel bond strengths are still best when the enamel is treated with phosphoric acid. Even when comparing class V restorations, recent data from Lawson et al showed a universal adhesive outperformed a 4th generation adhesive clinically.<sup>6</sup>

## Sensitivity and Bond Maintenance

An often-reported issue with adhesive dentistry is that of postoperative sensitivity. Although carefully following manufacturers’ recommendations for product usage should limit postoperative sensitivity, practitioners have reported higher amounts of sensitivity with total-etch protocols. The movement toward self-etch bonding agents and protocols largely eliminated reports of postoperative sensitivity issues but had the downside of not etching the enamel, which is necessary for a good enamel bond. Ironically, the perceived benefit practitioners have of reduced postoperative sensitivity with self-etch DBAs is not supported by evidence-based literature, which shows no difference in patient-reported postoperative sensitivity between total-etch and self-etch approaches.<sup>7</sup> Be that as it may, a possible advantage to the use of universal bonding agents is the ability to selectively etch the enamel while using only the self-etching properties of the adhesive on the dentin. In theory, this would give practitioners the “best of both worlds,” so to speak.

Another approach to reducing postoperative sensitivity is to use glutaraldehyde prior to the placement of the dentin bonding agent. This has been shown to significantly reduce the incidence of postoperative sensitivity while not negatively affecting bond strength.<sup>8</sup> Also, the use of glutaraldehyde has been shown to inhibit the activity

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of matrix metalloproteinases (MMPs), which are thought to be at least partially responsible for dentin bond degradation over time.<sup>8</sup> Hence, the application of 5% glutaraldehyde for 60 seconds before applying a DBA might help to maintain a more durable adhesive bond to dentin over time, although the duration of this effect is unknown.<sup>8</sup>

Chlorhexidine is another medicament used to disinfect restorative preparations in an attempt to reduce postoperative sensitivity by eliminating pulpal irritation resulting from the presence of bacteria.<sup>9</sup> Chlorhexidine is also effective in reducing MMP activity, thereby promoting more durable dentin bonds,<sup>10</sup> although its duration of effect is likely limited.<sup>8</sup> It is important to note, however, that no clinical data exists to show that preparation disinfection or inhibition of MMP activity to promote dentin bond stability has any clinical significance with respect to restoration longevity or avoidance of complications over time. This is true for both chlorhexidine and glutaraldehyde.

### Use of Liners

A long-time common practice among dentists has been the placement of a liner material underneath direct and indirect restorations, either to insulate the pulp from close proximity to the restoration or provide a more uniform surface for the subsequent restorative material. With modern restorative materials, however, the use of a liner material is not supported by the available literature. In fact, the presence of a liner has been shown to negatively affect adhesive restoration survival rates, regardless of whether it is under a direct composite restoration<sup>2</sup> or indirect all-ceramic restoration.<sup>11</sup> The only exception is in the case of a direct pulp cap, in which the use of mineral trioxide aggregate has been shown to be effective in avoiding negative pulpal responses from restored teeth with a pulp exposure during treatment.<sup>12</sup>

### The Establishment of Adhesive Dentistry

An abundance of clinical data is available proving the efficacy and longevity of adhesive dentistry. For small to moderate direct restorations, resin composite has already been shown to equal or outperform dental amalgam in several reviews and meta-analyses,<sup>13,14</sup> despite a continued “professional opinion” to the contrary. Given advances in resin technology and the ability to diagnose carious lesions at an earlier stage than in the past, the size of restorations for new carious lesions should continue to get smaller, promoting better outcomes for patients.

Indirect all-ceramic restorations also have a proven track record for success, with excellent results for partial-coverage restorations<sup>15</sup> and ever-improving results for full-coverage restorations.<sup>16</sup> Especially with respect to partial-coverage all-ceramic restorations, these solutions can be much more conservative than their “traditional” counterparts that require conventional retention and resistance form.<sup>17,18</sup> Additionally, although practitioners tend to dislike bonding full-coverage restorations, ironically the recent trend toward using monolithic “esthetic” zirconia necessitates the bonding of these restorations for long-term success.<sup>19</sup>

### Conclusion

Mechanically retained restorations are, for the most part, a thing of

the past, as adhesively retained restorations are now proven, predictable solutions for patients, offering better esthetics and more conservative outcomes than the previous “gold standards.” The optimum restorative options for patients today, and the ones that appear to be most popular among practitioners, are all facilitated by adhesive dentistry and will undoubtedly continue to be so for the foreseeable future.

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