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**Trevor Burke**

## Enhancing adhesive restoration effectiveness

In the current era, with anxieties over aerosol generating procedures (AGPs), it has been suggested<sup>1</sup> that the use of adhesive (and, by inference, minimally invasive) procedures could facilitate a majority of dental treatments, with crown preparations, removal (rather than repair) of large restorations, and the opening of access cavities being notable exceptions. It therefore follows that the processes by which the performance of adhesive restorations can be maximized should be examined.

A general, if obvious, thought is: materials used in the mouth should have a robust evidence base, which rules out those which do not – generally the own label, 'me too' products, to which some practitioners may be attracted because of their (often lower) price. The provenance of these materials is usually not known and their batch to batch variation can be high,<sup>2</sup> possibly indicating that they are manufactured by one company one year and another the following year. That these own label materials should be treated with some suspicion has been mentioned in this column over the years, and is backed up by research.<sup>3,4</sup> Moreover, patients care about the quality of the materials that we use in their teeth!<sup>5</sup> The cost of one prematurely failed restoration is arguably more than the saving accrued by using a cheap, untested alternative material.

Adhesive restorative materials fall into two broad categories, Glass Ionomer Cements (GICs) and resin-based materials. Glass ionomers are popular in areas where aesthetics is not an overriding concern, although the appearance of restorations in one Resin-Modified GIC (RMGIC) (Ionolux<sup>®</sup>, VOCO) was considered excellent by a group of practice-based researchers.<sup>6</sup> In a survey of 1,000 Class V GIC restorations placed in UK dental practices, the RMGICs outperformed other materials in terms of restoration survival and were 10 percentage points superior to resin composite at five years.<sup>7</sup> For cavities in loadbearing situations in posterior teeth, GICs have not been advocated, given the high success rates achievable by resin composite materials.<sup>8</sup> However, the manufacturers of Equia Forte<sup>®</sup> (GC) claim large increases in the physical properties of the material compared with its predecessor, albeit with those still to be tested independently. It is, however, worth noting a very recent publication by Miletic and colleagues<sup>9</sup> in which they, and colleagues from three other dental schools, reviewed a large number (n = 360) of Equia Forte<sup>®</sup> and resin composite (Tetric Evo-Ceram<sup>®</sup>, Ivoclar Vivadent) 'moderate to large' Class II restorations after two years. There were no significant differences between the two groups (93.6% for Equia Forte<sup>®</sup> and 94.5% for Evo Ceram<sup>®</sup>) and, although two years is not long in terms of the lifespan of a restoration, the numbers in this study were high, and it could be considered that these results hold promise for a material which will be simple to place in a minimal cavity design without any ACP. Figure 1 presents a non-retentive restoration, originally placed as an interim restoration prior to the placement of a ceramic inlay replacing a fractured premolar palatal cusp, but which has survived for over 2 years.

It should be added that the application of 20% polyacrylic acid to the

tooth surface prior to placement of the GIC may improve adhesion, although the results of research on this are by no means equivocal.<sup>10</sup> Research has also indicated that air abrasion with bioactive glass Bioglass 45S5 (now commercially available as NovaMin®, GSK), in combination with polyacrylic acid, may enhance bonding durability of RMGIC in the laboratory,<sup>11</sup> but this remains to be tested clinically. As mentioned previously,<sup>1</sup> for Class V restorations in either GIC or resin composite, roughening the surface and getting rid of a shiny, sclerotic layer with a bur or intra-oral sandblaster, improves the retention of the restorations.

A frequently asked question (FAQ) is 'What happens if I etch the tooth with phosphoric acid before applying the GIC?' Let's look at how GICs adhere to tooth: it is primarily a chemical reaction between the polyacrylic acid in the material and the hydroxyapatite, although there may be some micromechanical adhesion: therefore, as etching dissolves part of the enamel and/or dentine, thereby reducing the amount of calcium available for bonding, etching with phosphoric acid will have an adverse effect upon bond strength.

Regarding resin-based dentistry, the use of an adhesive promotes minimal intervention and, as mentioned previously, thereby facilitates minimal cavity preparation, which hopefully can be carried out without an AGP.<sup>1</sup> The Universal bonding agents are no longer 'new', but have heralded a new norm in the era of adhesion. While older bonding agents were type/etch specific (ie the self-etch materials would only work properly if the dentine was not etched and the total etch materials only worked when the whole tooth was etched with phosphoric acid), the Universals are designed to work under whichever etching mode the clinician decides is appropriate. Therefore, they can be used successfully in self-etch mode, obviating the need for washing etchant

off the tooth, and drying. Five years ago, in a systematic review and meta-analysis, da Rosa and co-workers concluded that 'selective enamel etching could be considered the best strategy for optimizing bonding.'<sup>12</sup> More recently, Zanatta *et al*,<sup>13</sup> in a randomized double-blind clinical trial of Class V restorations in 152 teeth, found no difference in behaviour of Scotchbond™ Universal (3M) and two conventional etch-and-rinse/self-etching systems at two years. These workers attributed the success of universal adhesives to the presence of the phosphate monomer 10-methacroyloyloxydecyl dihydrogen phosphate (known to you and me as 10-MDP!). The reason? It provides chemical adhesion as well as the hybrid layer method of micromechanical adhesion, a 'belt and braces' approach. In an updated systematic review last year, Cuevas-Suarez, da Rosa *et al*<sup>14</sup> found nothing in more recent research reasoning to change their view from their earlier conclusion, concluding that 'mild universal adhesives seem stable materials in both etch-and-rinse and self-etch strategies'. However, for all resin-based adhesives, it is important not to overdry the dentine, as doing that will cause the collagen in the exposed dentine surface to collapse, not permitting the resin to infiltrate it and produce a hybrid layer.

Another FAQ is 'Does rubbing the adhesive into the dentine enhance adhesion?' Yes! Research confirms that this is a good technique,<sup>15</sup> with this technique also appropriate for universal adhesives.<sup>16</sup> And, for all restorations, in the current situation, placement of rubber dam for cavity preparation and restoration placement is suggested as good clinical practice. Readers will all be aware that bonding does not work on a contaminated surface!

Lastly, while the last issue was devoted to providing ideas for getting UK dentists back treating patients in the 'new norm', this issue also provides information relevant to the COVID-19 era, along with excellent information on the cracked tooth syndrome and the maxillary sinus, which will become even more useful when dentistry returns to some semblance of normality. All such articles in *Dental*



**Figure 1.** An adhesive cusp replacement restoration in Equia Forte® (GC) in an upper premolar at 2.5 years. (Courtesy of Nerina Hendrickse).

*Update* are peer reviewed, other than those badged as Guest Editorials, or my Comment (although I always try to back-up statements that I make with references). I am aware of some disquiet, both in emails to me and on social media, in relation to one such Guest Editorial in the last issue. It was obvious that those corresponding with me did not understand that this was not a peer reviewed paper, but an author expressing a well-considered opinion, with references to back-up his opinions. I did offer the email correspondents the opportunity to write a 'letter to the editor' to relate their disquiet to the wider readership and to stimulate scientific debate (which is healthy) but, to date, I have not received anything from them. All of this has led me to consider ways of making Guest Editorials more obvious, by 'badging' them as non peer-reviewed, or by using a different font or different format, so that readers are in no doubt regarding articles which are not peer reviewed, which is not the norm in *Dental Update*.

PS While we continue to publish articles of relevance to general dentistry, we will also publish articles of particular interest to the current pandemic (we have been swamped with submissions on that). I therefore advise readers that, while the current issue contains a technical review of masks, the next issue of *Dental Update* will contain a paper on the scientific basis for their use. Also, particular thanks to

Louis MacKenzie and his co-authors for producing their first rubber dam article in record breaking time, with the second one following shortly.

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