The last half of the 20th century has introduced adhesive surface preparation of the enamel and dentine (ie acid etching, self etching) and composite resin technology, which allow minimal invasive procedures without a standard geometric preparation form (Osborne 1998). Currently, the concept ‘prevention of extension’ seeks to minimise the biologic cost of the natural tooth as a whole (Mount and Ngo 2000) by adopting a philosophy that combines prevention, remineralisation, and minimal intervention for the replacement of natural tooth structure and/or restorations. This new philosophy has three objectives from the early onset of the disease or trauma: to preserve the maximum integrity of the natural dentition, to conserve tooth structure during preparation of restoration and to increase the longevity of the restoration between replacements. The class IV composite restoration can provide these three modern dental strategies for the fractured anterior tooth: preservation, conservation, and longevity. The purpose of this article is to describe a conservative technique for restoring the fractured incisor using a minimal class IV preparation design with a new formulation single component self-etch adhesive system (G-Bond, GC) and a small particle composite resin (Gradia Direct, GC).

Self-etch technique

Over the past several years, efforts have been made to eliminate the need for acid etching the cavity preparation prior to the application of the dentine bonding agent. Two types (or categories) of bonding agents are used with the self-etching strategy – one with two components (ie a combined etching/priming solution and a bonding agent) and one with a single-component etching, priming and bonding material.

The self-etching primer strategy leaves the smear layer in place. These dentine bonding systems are based on the infiltration and modification of the smear layer by an acidic monomer. The objective is to reinforce the bonding of the smear layer to the underlying dentine. These slightly acidic, hydrophilic primers penetrate the smear layer and achieve micromechanical and chemical bonding of the smear layer to the underlying dentine. This technique allows the simultaneous infiltration of the collagen fibres and decalcification of the inorganic component to the same depth in dentine, thus minimising the risk of not reinforcing part of the demineralised dentine. Additionally, this prevents the collapse of the collagen fibrils after conditioning and drying. The resin may slightly (0.10m to 0.50m) infiltrate the smear layer and the dentine and copolymerise (Eick et al 1993).

Empirical data

Self-etch materials have been evaluated in numerous studies (Perdigão and Geraldeli 2003, Hannig et al 1999, Belli et al 2001, Kanemura et al 1999, and Perdigão et al 1997). Some of these studies indicate that enamel bonding with self-etch adhesives is as effective as enamel bonding after conventional phosphoric acid etching (Hannig et al 1999, Belli et al 2001). Evidence of enamel leakage has been reported clinically in class II and class V composite restorations and in vitro class I and class V restorations, when a self-etch adhesive was used as a dentine-enamel adhesive (Perdigão et al 1999, Belli et al 2001). A study by Perdigão reported that commercial self-etch adhesives performed better on prepared enamel than on unprepared enamel. This study suggests that for all-in-one self-etch adhesives, instrumentation of unprepared enamel may be critical for their ability to bond to enamel (Perdigão and Geraldeli 2003). The authors suggest that it may be prudent to acid etch any peripheral enamel margins to minimise the potential of microleakage and enhance bond strength to enamel; however it is important not to etch the dentine.

Selecting an adhesive strategy

The clinical advantages of a self-etch to a conventional adhesive technique include the former’s simplicity and reduced post-operative sensitivity. Self-etch systems do not require acid etching or the washing off of acid. The self-etch adhesives are less technique sensitive than the acid- etch adhesives in four categories.

First, since water is a fundamental ingredient of these self-etch systems allowing ionisation of the acidic monomers for demineralisation of hard dental tissues, the technique sensitivity associated with substrate hydration is eliminated (Pashley and Tay 2001). Second, in comparison to acid-etch...
adhesives, these adhesives do not allow a discrepancy between the depth of demineralisation and depth of resin infiltration because both process occur simultaneously (Perdigão and Geraldeli 2003). Third, since the smear plugs are not removed before the application of the adhesive the potential for post-operative sensitivity is less than with total-etch adhesives (Perdigão and Geraldeli 2003). Finally, moist bonding is not required for self-etch adhesives as it is for some total-etch adhesive systems. (Perdigão and Geraldeli 2003).

The goals for future adhesive systems are simplicity of application with quality of adhesion. As clinicians desire restorative materials that are ‘user friendly’, these simplified self-etch dentine adhesives offer another avenue. This clinical efficacy and simplicity of application, however, must not be confused with the demands required of the operator’s attention to meticulous detail when considering diagnosis, treatment planning, and the balance of the associated aspects of restorative care.

Restorative procedure
A 53-year-old female patient presented with an oblique, vertical fracture on the maxillary right lateral incisor. A pre-visualised composite mockup was performed with the proper selection of the composite restorative materials, and their

Figure 1: Pre-operative facial view of a vertical fracture in the maxillary right lateral incisor.
Figure 2: A single component self-etch adhesive was applied to the entire cavity surface and allowed to dwell for 10 seconds.
Figure 3: The self-etchant adhesive was air dried under maximum air pressure for five seconds in the presence of vacuum suction.
Figure 4: The self-etchant adhesive was light-cured for 10 seconds with a halogen light curing unit (Coe Lunar TA, GC, +44(0)1908 218999)
Figure 5: To disguise the silhouette of the cavity form, an artificial dentin core was developed with an opacious AO2-shaded hybrid composite resin
Figure 6: A clear translucent–shaded hybrid composite resin was applied, sculpted, and smoothed to the lingual aspect with a curved instrument and light-cured for 40 seconds
orientation was charted so the definitive restoration could be visualised prior to completion. A 0.5mm bevel was placed in enamel around the entire margin. The enamel margin was etched for 15 seconds with 37.5% phosphoric acid, rinsed for five seconds, and gently air dried for five seconds. The etch should extend several millimetres beyond the bevels. A single component self-etch adhesive (G-Bond, GC, +44(0)1908 218999) was applied to the entire cavity preparation according to the manufacturer’s recommendation and light cured. The tooth was restored using an incremental layering technique with a small particle composite resin (Gradia Direct, GC, +44(0)1908 218999). This procedure demonstrates that by using a conservative adhesive preparation design in combination with proper adhesive techniques and a methodological protocol of incremental application of composite resins the clinician can transform the class IV fracture into a final restoration with an aesthetic natural appearance (see Figures 1-10).

Conclusion
Knowledge and a desire to create are limited by the products clinicians have available to them for restorative procedures. Advancements in restorative materials and adhesive technology have enabled the development of direct bonding techniques that allow the provision of conservative treatment while allowing clinicians to combine form, function and aesthetics for predictable restorative success.

References


Figure 7: The first ‘artificial enamel’ layer, an A1 shaded hybrid composite resin was applied to the facial aspect and contoured with a long-bladed composite instrument.

Figure 8: The final ‘artificial enamel’ layer, a clear translucent shaded hybrid was applied, adapted, and smoothed into an ideal anatomical contour with a sable brush.

Figure 9: The facial contouring was performed with a 30-fluted needle-shaped finishing bur.

Figure 10: The post-operative result achieved with the use of this direct composite resin reflects the harmonious integration of natural tooth structure with restorative material and colour.