Since its introduction in 1999, a component of the Invisalign system (Align Technology, Inc., San Jose, California) of removable, transparent aligners has been the use of resin attachments bonded to the teeth to aid in retention of the aligners and facilitation of individual tooth movements. As the Invisalign system advanced from treating simple to more advanced orthodontic cases, the shapes of the attachments, as well as the quality of resin material, have taken on added significance.

In 2005, the newly formed Invisalign Clinical Advisory Board (including one of the authors) was credited with improving the attachment protocols based on clinical experience. In 2007, John Morton's arrival at Align Technology introduced a new era of research and development with the adoption of power ridges for torquing incisors and optimized attachments for improved rotation and extrusive movements of teeth. Developed from computer models and bench testing, the shapes and positions of these new attachments on the teeth are determined by the software based on the specific shape of each crown, long axis of each tooth and required movement. In addition, certain restorative resins which are high in bond strength, surface hardness and wear resistance have been recommended for use based on in-vitro research at Align Technology.

Given the importance of the resin attachments to treatment success, the system of bonding the attachments to the teeth takes on added significance. The technique should be efficient and dependable with minimal failure and be comfortable and aesthetic to the patient. Align Technology provides attachment templates, which are trays with greater flexibility than aligners and include the attachment bubbles for the indirect bonding of the attachments. Each optimized attachment has an active working surface, therefore, the shapes of the bubbles in the templates are slightly different than those in the aligners.

The primary pitfalls clinicians encounter when placing the attachments are voids in the attachments which can lead to retained plaque or failure of the attachment, and excessive flash/residual resin material on the tooth which requires added time to remove and, when using fluted burs to reduce flash between the gingival margin of the attachment and the gingiva, can create patient sensitivity.

Our long-time clinical assistant and one of the authors developed a dependable technique which solves these problems. This technique has been closely monitored by the doctors and successfully used in our office for more than a year by all of the assistants in our practice. The advantages of this technique are as follows:

- Minimal flash
- Where flash is present, it can be easily and comfortably removed with a scaler, reducing the use of high-speed fluted burs
- Eliminates voids, so there are few attachment failures
- Increased efficiency with little flash to remove and rarely requires an attachment be replaced

The Holloman Attachment Bonding Technique

Step 1: Trim and remove excess template areas which do not include attachments, or section the template if there are multiple attachments in different quadrants.
the arches has four attachments only on the upper incisors, remove the bicuspids and molars from the template with scissors. If attachments are on the bicuspids, canines and incisors, the molars may be removed from the template and the template may be sectioned at the midline and each quadrant bonded separately (Fig. 1).

Step 2: Place Tetric Ceram shade T (for translucent) (Ivoclar Vivident, Amherst, New York) resin into template bubbles, pressing firmly so as to compress material and prevent voids within the attachment which could lead to breakage (Fig. 2). Compact the resin into the attachment bubbles so the exposed surface is level with the edges of the template. Use a brush with primer to smooth attachments. View template from facial to be sure there are no voids.

Step 3: Place attachment template (with resin in bubbles) in drawer or light-tight box. The resin will remain stable for several hours to several days for use later.

Step 4: After drying and etching teeth, spread bonding agent/primer on tooth (Fig. 3). The authors suggest to etch only attachment area and slightly beyond, not the entire tooth surface.

Step 5: Place template – which includes the uncured resin – onto the teeth without curing and remove uncured immediately (Fig. 4). This creates a custom base as the tooth side of the resin fill is pressed onto the tooth and takes on the contour of the tooth surface. There should be some flash around the entire perimeter of each attachment. If there are any areas where there is no flash after removing the template, add some resin as this is an area where there will likely be a void after bonding.

Step 6: Use a scaler or other instrument to remove all flash from within the template where the excess resin has spread after placing the template on the teeth. Then, smooth edges with a dry micro-brush at attachment edges (Fig. 5).

Step 7: Place template onto teeth and cure through the template material (Fig. 6). Cure again after removing the template, as the template material can reduce the effectiveness of the curing light by 40 percent.

Step 8: Remove flash, if present, with scaler and check with floss for residual flash interproximally (Fig. 7). Just as bracket bonding procedures can influence the results of fixed appliance treatment, effective attachment placement will have significant consequences for treatment with transparent aligners. This new system for placing attachments should provide more predictability, efficiency and comfort in the treatment of patients with the Invisalign appliance.