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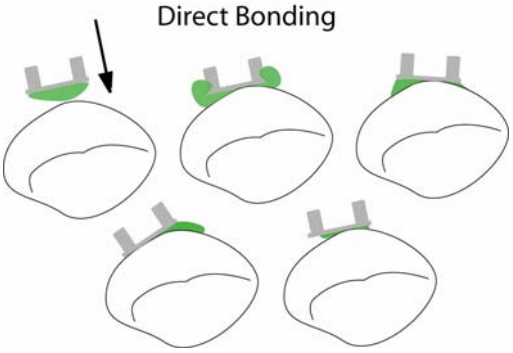
Part 1: Comparison of the Quest Indirect Bonding System & current alternative methods

The inherent benefit of an indirect method is virtually undisputed. With the better vision and access afforded by working on a model rather than inside the mouth, brackets can be positioned with far greater accuracy and precision. And it is also undisputed that good positioning of brackets is one the most important aspects of contemporary orthodontics.

Many methods of indirect bonding have been proposed and utilized for many, many years but to date relatively few orthodontists routinely use an indirect method. We admit almost unanimously as a profession that bracket positioning is perhaps the single most important aspect

of orthodontics. So it is interesting that we ignore the most obvious means to this end. It is our opinion that there are two primary reasons indirect bonding has not become widely adopted:



First, the technical challenges presented by the "other" methods and secondly, the belief that the increased precision "doesn't really help". So the rationale is, why expend the added effort to do indirect bonding when the benefits are marginal? In regard to the former, it's not that these other methods don't work or don't work well; rather, it's just too difficult and frustrating to make them work. To overcome the technical challenges some doctors have incorporated labs and hired technicians in their office to do the indirect set-ups. While I applaud the effort put forth to achieve a higher level of care, for the young orthodontist starting out in private practice, this scenario is simply not realistic. The development of the Quest method was motivated by the need for an indirect method that was simple and effective in the hands of any doctor in any size practice. And, during the process of its development, it was discovered that not only does the Quest method have advantages over other indirect methods but it also has profound advantages over traditional direct bonding even beyond the ability to better position brackets.

The Quest Indirect System possesses the following unique features that make it more simple and effective than any other existing method.

1. Tray fabrication requires minimal instruction, is virtually error proof, and can be delegated to an assistant after very little training.

2. The tray combines two key features: translucency to allow the use of a viscous, light-cured composite adhesive, and the capacity to fully and intimately encapsulate the brackets on the model.

3. Although the brackets are intimately encased by the matrix material, the tray is easily removed with minimal force so there is virtually no risk of pulling off a bracket with the tray during intra-oral procedures.

4. Because of the combined features of "complete encapsulation" and the ability to use a light-cured, we have:
    a. A "built-in" mechanism for managing excess adhesive – it is dispersed into the interface between the tray and the tooth and thereby forms a protective, invisible veneer.
    b. A mechanism for building pressure upon seating of the tray that forces adhesive into the mesh of the bracket.
    c. The ability to automatically create a "custom base" during the bonding procedure rather than in the lab.
    d. Virtually unlimited working time and control at the time of intra-oral bonding. This allows for the localized application of pressure just prior to curing to ensure full seating of the brackets against the teeth.

5. The Quest system, unlike most other indirect methods, does not require, nor does it advocate, the creation of a custom base. This eliminates a lot of potential for technical error.

6. The Quest System advocates the complete and aggressive cleaning of the bracket bases by micro etching with aluminum oxide (a procedure that also can be delegated to an assistant). Ideal preparation of the bracket bases is virtually assured since they are protected from contamination by "handling" once they're in the tray. Methods that employ lab fabricated custom bases must be etched with great care to ensure their integrity (only a well trained technician could be trusted to execute this consistently). On the other hand, the Quest method does not require any such delicacy.

Quest Indirect Bonding Compared to Direct Bonding

Compared to direct bonding, the Quest method presents the opportunity to achieve a "more consistently maximized" or a "more predictably durable" bond. There *often* exists an inverse relationship between accuracy of bracket position and bond integrity; more effort put into positioning reduces the chance of maximum bond integrity. There are several explanations for this.

a. First, brackets are often bonded to enamel with surface contours that poorly fit the contour of the bracket base. This causes "rocking" of the bracket that causes a discontinuity of the adhesive between the base and the enamel surface. In other words, the base bonds only to the part of the enamel where it is closely adapted. As such, less bond strength is realized because less surface area of the base is effectively utilized.

b. Second, the more that a bracket is moved on the surface of the enamel, back and forth, and up and down, trying to get the "just-right" position, the more adhesive is dispelled (lost), which causes a loss of the "seal" between the bracket base and the enamel. The consequence is reduced density and continuity of the adhesive between the bracket base and the enamel.

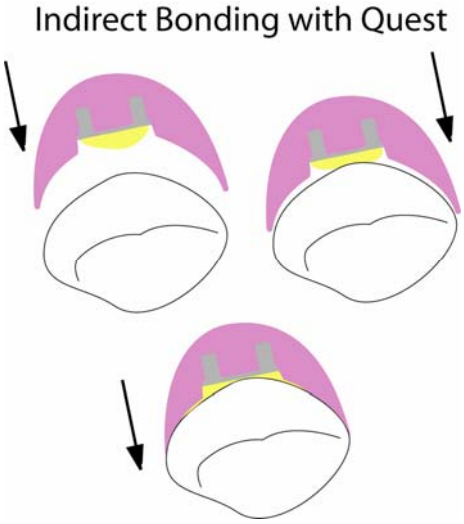
c. Direct positioning methods often require that enamel surfaces remain isolated and dry for extended periods of time while the other brackets are positioned. As time passes, the patients moist breath can cause condensation of water vapor on the bonding surfaces and there is greater chance, just by virtue of the increased time, for contamination due to manipulation of instruments, splashing of saliva, and spontaneous patient movements in general etc.

d. Attempts made to position brackets on posterior teeth require more dexterity and are inherently more stressful. This leads to a reduced chance of maintaining a perfectly dry field.

e. When direct bonding molars (especially second or third molars) it is more difficult to achieve and maintain isolation while placing and positioning a bracket due to the tendency for the cheek to lie against these teeth. We are often forced to hold the cheek away with one hand while drying, etching, priming and then placing and positioning with the other hand. This can be very difficult if not impossible in some cases.

2. The Quest Indirect Bonding System provides the opportunity to always maintain complete continuity of the adhesive interface (see illustration below). Using the Quest method you are literally creating a custom base during the intra-oral bonding procedure and you are afforded the opportunity to use an excess amount of adhesive without the worry of creating a mess and clogging tie wings. In addition to alleviating the worries about the excess adhesive, the excess actually performs several important functions:

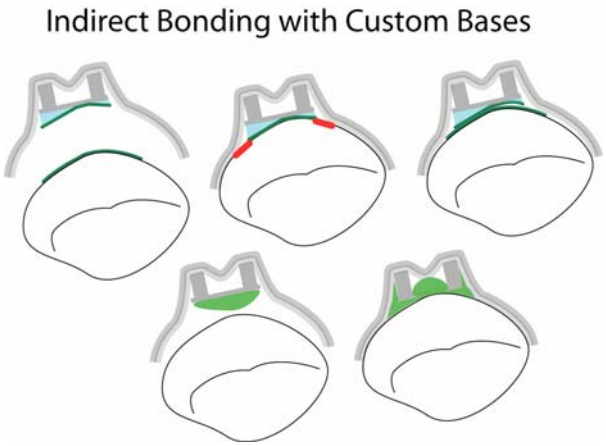
   a. It ensures that every bit of surface area covered by the bracket base is effectively utilized to its maximum capacity. Because the brackets are completely encapsulated by the PVS matrix, the excess adhesive is forced into the mesh and micro-mechanical retentive features of the base as the tray is seated. The excess can't get under the tie-wings (because they are blocked-out by the PVS), rather, it is forced into the thin interface between the PVS the tooth. It thereby creates a thin veneer of composite material around the bracket base that bonds to the etched enamel. This invisible composite veneer protects the enamel from decalcification during treatment and virtually eliminates decalcification around bracket bases. Of course decalcification could still occur elsewhere, but this veneer protects the most compromised and most vulnerable area – the area that has been etched near the edge of the bracket.



3. Isolation is much easier and more effective for an indirect bonding procedure than for a direct bonding procedure. With an indirect method, the doctor needs only a moment of isolation to allow seating of the tray. With this reduced need for time reduces the opportunity for contamination. Furthermore, when bonding second and third molars, it is easy to place a dry angle between the cheek and the enamel to maintain a saliva free enamel surface. Etching, and rinsing can be done with the dry angle literally against (in contact with) the tooth if necessary. The dry angle can be replaced with a fresh dry one for priming and seating of the tray. However, we find that in the vast majority of cases, a dry angle can be used to retract the cheek enough to access the enamel without the dry angle contacting the enamel. If you tried to direct bond using this trick you'd discover that not enough space exists to place the bracket without the dry angle interfering. But an indirect bonding tray can easily be slid between the dry angle and the enamel even when the dry angle lies against the enamel!

4. Most indirect bonding methods employ the use of custom bases. Why? Because none of the alternative methods combine the tray properties found in the Quest system, and therefore, these methods are prone to particular problems related to the type of tray being used.

    a. Perhaps the most common method used is a "double-thermoplastic" tray. The inner tray is formed of a thin mouth guard material to provide good adaptation and low tear resistance. The outer tray is formed of a thicker and more rigid material to give stability. While this type of tray is translucent and therefore lends itself to use of a light-cured adhesive, in reality, its advocates recommend using chemical cured adhesive along with a custom base. Why? Because the inner tray does not adapt intimately enough to prevent the expulsion of a viscous light-cured adhesive under the tie-wings – in other words, it can't prevent making a mess. Therefore, its advocates must use a custom base that must intimately match the contours of the enamel to facilitate the two liquid components of the chemically cured adhesive coming into intimate, broad contact and mixing together – otherwise no bond would be created. Because a chemically cured adhesive must have a low, fluid viscosity to facilitate mixing of the two components, it resides on the teeth and the bases in a very thin layer. While this prevents forming large masses of adhesive under tie-wings and creating a mess, it is inherently more error prone – it requires consistent highly accurate impressions, models, custom bases, and bonding trays. Distortion of a small magnitude could easily prevent the two liquid components from making broad, intimate contact that is required to get a good solid bond. Furthermore, the chemical cured adhesive begins to cure as soon as the tray is seated, therefore, working time is very limited and pressure must be applied throughout the arch immediately to ensure bond success.



Comparison of results using various bonding techniques

Feature	Direct Bonding	Custom Base Indirect Bonding	Quest Indirect Bonding
Bond Success	More unpredictable the further posterior you go	Unpredictable	Highly Predictable
Bonding Integrity	Inverse relation with positioning	Unpredictable	Consistent Maximum bond strength
Laboriousness and technical sensitivity	More problematic the further posterior you go	High: must delegate to skilled technician	Low: delegate to chair-side assistant
Adhesive Management	More problematic the further posterior you go	Creates technical challenges	Automatic
Isolation and access	Very difficult the further posterior you go	Simple, effective	Simple, effective
Accuracy of bracket positioning	Poor: cannot use gauges to coordinate	Excellent	Excellent
Condition of bases	Unknown: therefore, unpredictable.	Excellent…if micro-etched just right (not too much)	Excellent