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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.

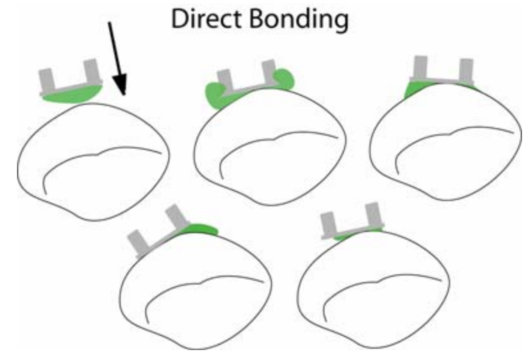
3. Although the brackets are intimately encased by the matrix material, the tray is easily removed with minimal force so there is virtually no risk of pulling off a bracket with the tray during intra-oral procedures.

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.

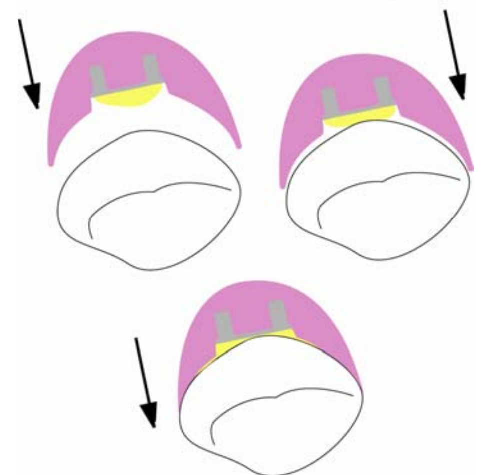
a. First, brackets are often bonded to enamel with surface contours that poorly fit the contour of the bracket base. This causes "rocking" of the bracket that causes a discontinuity of the adhesive between the base and the enamel surface. In other words, the base bonds only to the part of the enamel 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.



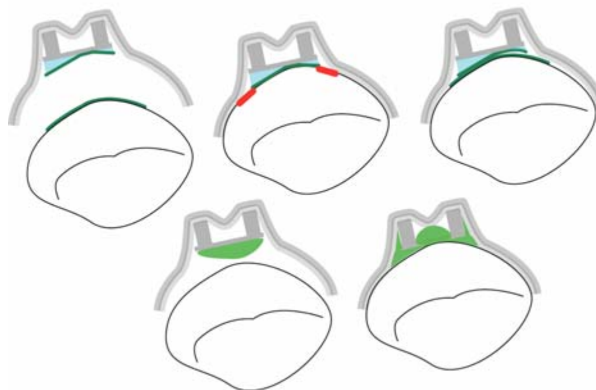
2. The Quest Indirect Bonding System provides the opportunity to always maintain complete continuity of the adhesive interface (see illustration below). Using the Quest method you are literally creating a custom base during the intra-oral bonding procedure and you are afforded the opportunity to use 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.

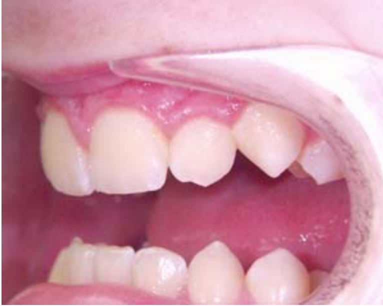


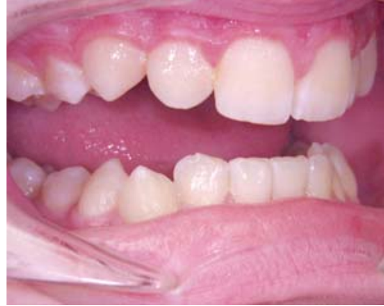
Comparison of results using various bonding techniques

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

Part 2: The Quest Indirect Bonding System Laboratory Protocol

1) Prior to making impressions it is vital to establish the most ideal anatomy possible. Enamel edges are shaped to create ideal form (flat edges that reflect proper root position) using a fine diamond or carbide finishing bur in a high-speed hand-piece. Note the pointy upper lateral incisor and pointy lower later incisors in the photos below. These should be flattened with reference to root position as viewed on a panoramic radiograph. Excessively pointy cuspids, premolars and molars should be rounded as well to create a coordinated degree of roundness to the cusps.





2) Good quality alginate impressions are made.

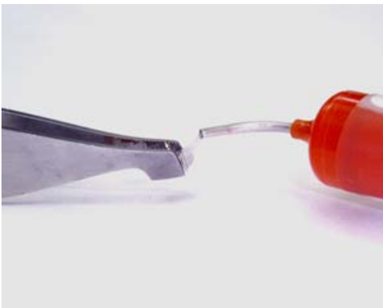
3) Pour the impressions immediately after taking them to ensure dimensional accuracy. A type IV dental stone is recommended. A stronger material than orthodontic plaster is recommended to lessen the risk of breaking the model.

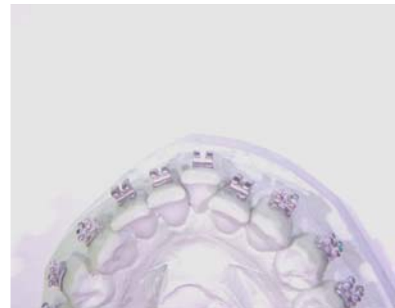
4) Trim the models of excess stone to allow full access to buccal and lingual tooth surfaces. It is best to eliminate narrow crevices that often form on the lingual posterior of the lower models and the upper buccal/distal to the second molars.

5) Allow the models to dry completely in preparation for applying the surface barrier coating. (This is only necessary if bracket positioning will not be done immediately.) Faster and more complete drying can be achieved by placing the models in an oven at approximately 120 degrees for several hours.

6) If brackets are to be positioned at a later time, apply a coating to the model to prevent excessively strong adhesion of brackets to the model. For this purpose, we recommend the use of a "separating medium" or a "tin foil substitute" ("Foil Coat" can be purchased from Ortho Quest). It is applied liberally to facial and occlusal tooth surfaces and allowed to dry thoroughly. Note that the model must be completely dry prior to applying the Foil Coat or its barrier properties will be compromised. We have recently experimented with Vaseline as a separating medium and this has shown promising results. It must be emphasized that only a very, very light coating of Vaseline should be applied to the model. Just "wet" your finger with the thinnest amount of Vaseline and rub it on the teeth. Avoid allowing for accumulation in interproximal areas and crevices. This seems to do an adequate job of preventing excessive adhesion of the brackets to the model. All excess Vaseline should be removed from the model, especially interproximal areas and crevices using a fine bristled brush. Remember that any undue contamination of a bonding surface with Vaseline will prevent bonding intra-orally!

7) Brackets are then loosely adhered to the model using the Quest light cured orthodontic adhesive.





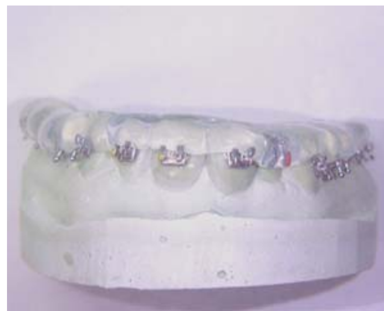
8) Position brackets.

9) Remove excess adhesive from around bracket bases.

10) Lightly cure the adhesive. Only a **very brief** exposure to the curing light is needed! We recommend the inexpensive Pen Light available from OrthoQuest, which is ideal for producing a "tack" bond for this type of application. Care should exercised not to cure excessively, especially with ceramic brackets. Excessive curing of the adhesive at this stage will lead to very strong adhesion of the brackets to the model (even if Foil Coat or Vaseline was applied to the model). This will present a problem later with removal of the tray from the model and will likely damage your model and/or your tray. Therefore, cure from the occlusal side, and if using a traditional curing light, *keep it in motion,* and simply move across the arch at a moderate pace. The degree of cure will vary depending on intensity of the unit. **A thorough cure of the adhesive is not your objective** - you need only to lightly "tack" the brackets in place with enough strength to fabricate your tray.

> Caution: Be especially careful when using ceramic brackets not to "over-cure" - a brief exposure to a light cure unit will bond them to the model with great strength! Subsequent removal of the brackets will likely damage your model and may even break the ceramic bracket! Ceramic brackets cure much faster because their translucency allows for penetration of much more light. Therefore, when curing ceramic brackets on a model use a low powered curing light and do not expose a bracket for more than a fraction of a second!

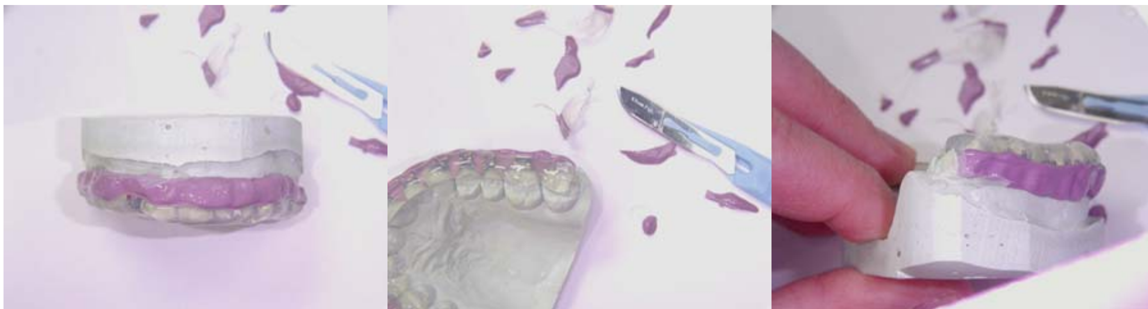
11) Apply translucent Quest matrix material to the occlusal side of the model teeth and brackets. While dispensing the clear material, keep the dispensing tip in motion and slowly move across the entire arch in one stroke. One pass over the occlusal should be sufficient. The translucency of this material allows for adequate transmission of visible light for curing the adhesive during intra-oral bonding.



12) **Special note:** Some brands of ceramic brackets have micro-surface-irregularities that will cause the matrix material to stick tenaciously to the ceramic brackets. This creates a serious "clean-up" problem upon removal of the trays intra-orally. To prevent this, coat the ceramic brackets **very liberally** with Foil Coat (the same product you placed on the model) prior to dispensing the matrix material but after the brackets have been secured ("tacked") to the model. The Foil Coat simply serves as a barrier to prevent excessive engagement of micro-retentive features. **We recommend that you test your brand of bracket to determine whether this step is necessary.**

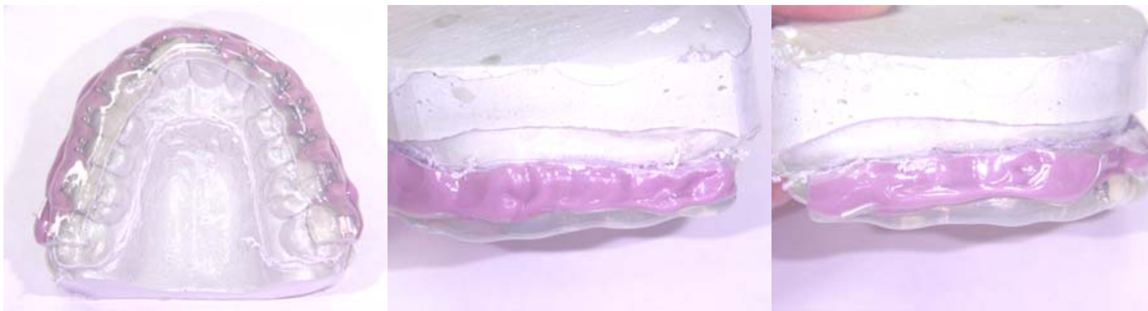
13) Approaching from the gingival side, inject the more fluid purple matrix material *against* the clear material. Using an opaque material for this step allows you to actually see the penetration of the material into small crevices (such as inter-proximal areas) and thereby permits visual verification that complete encapsulation of the brackets has been achieved. By completely encapsulating the brackets and teeth, you create a means for managing the excess of adhesive used for the intra-oral bonding. When seated with light pressure inside the mouth, excess adhesive will be forced into a broad thin layer between the matrix material and the teeth, preventing bulky accumulations, and coating etched enamel with an invisible protective veneer of composite.

14) Trim away excess matrix material with a scalpel or Exacto knife and sculpt as needed. Removing excess from the second molar (or third molar) area is important to achieve the least possible tray thickness. Avoid exposing the brackets. It is best to maintain a thickness of matrix material around every bracket.



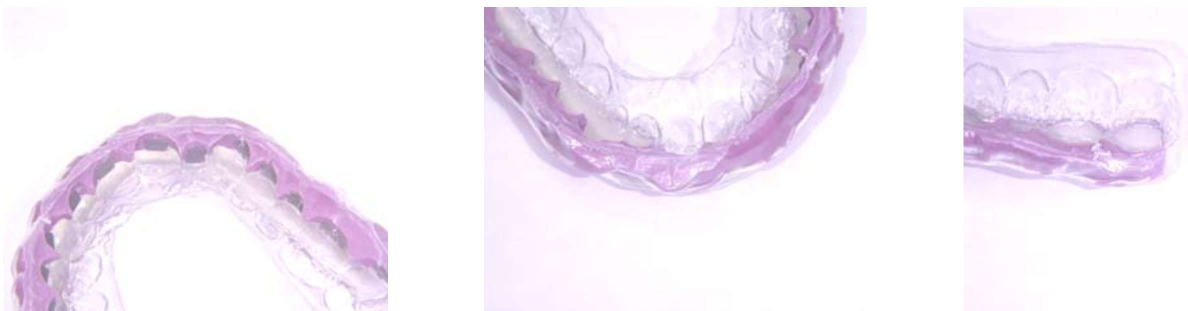
15) Apply a 1mm A+ or Ace tray material (available from OrthoQuest or Raintree Essix) using vacuum forming machine.

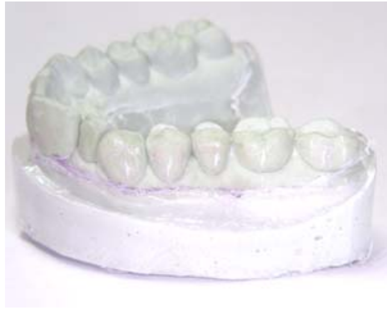
16) Cut the Essix tray material on the buccal side at the margin of the purple matrix material and on the lingual side 3-5mm apical to the gingival margin.

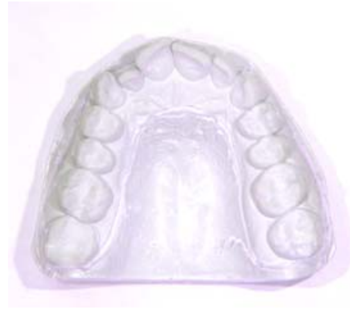


17) Insert a scaler or similar instrument through the buccal/facial cut and through the rubbery tray material to access the brackets and break their bond to the model. By breaking the bonds of the brackets to the model, removal of the tray from the model is greatly simplified.

18) Be sure all bracket bonds are broken and then remove the tray from the model.

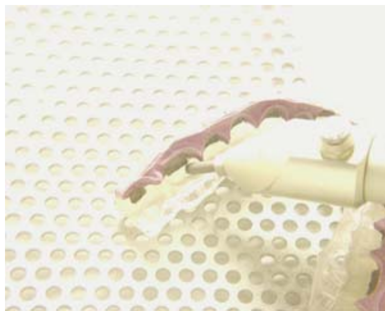


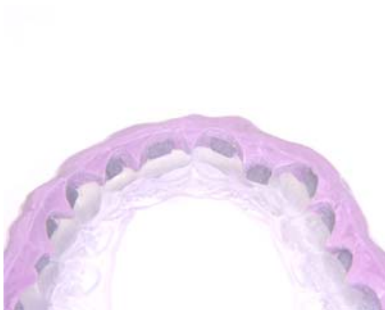


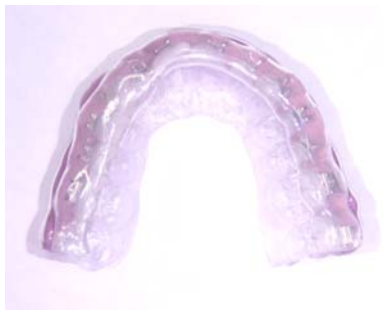


19) With an acrylic bur, trim the Essix tray to relieve undercuts on the buccal and facial that interfere with the path of removal. Also, remove the rigid material that forms the distal wall around the second molar. This is vital for making the tray easy to remove.

20) Clean the bases of excess adhesive and stone particles/debris using aggressive micro-abrasion with 90- micron aluminum oxide. We recommend complete removal of the adhesive from the bracket bases. Clean the tray of aluminum oxide dust using dry compressed air only (do not attempt cleaning brackets with liquids such as water, alcohol, or acetone etc.). Cleaning of the remaining dust that will reside on the bases is done in the subsequent step using the sealant/primer.







Part 3: Intra-oral Quest Indirect Bonding Protocol

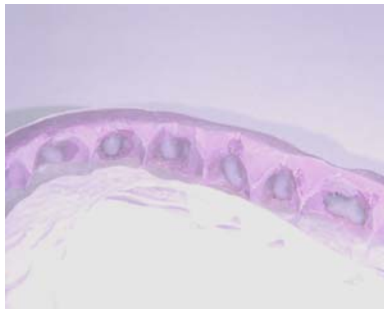
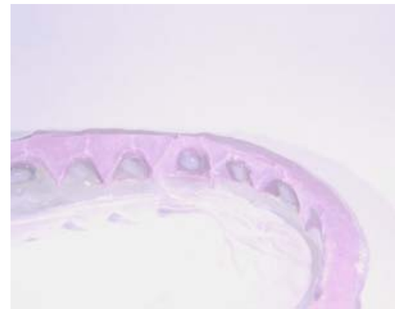
1. Enamel surface cleaning.
   a. It is imperative for the purpose of ensuring consistent maximum bond strength that the enamel surface is not contaminated. Often, although the enamel will appear perfectly clean, a thin layer of adherent plaque exists that will reduce bond strength. Also we believe that cleaning with a prophy cup and pumice alone is insufficient for removing all adherent plaque. Therefore, it is highly recommended that one of two alternative methods of cleaning by employed.

      i. Clean all enamel and porcelain surfaces with a carbide finishing bur in a high-speed hand piece (porcelain surfaces should be roughened and cleaned with a diamond bur).

      ii. Clean all surfaces via micro etching with aluminum oxide particles (50 or 90 micron).

2. Aggressive surface cleaning is especially vital on second and third molars. Patients tend not to clean the buccal surfaces of these teeth nearly as well as others and there will very often be a significant plaque layer that requires removal.

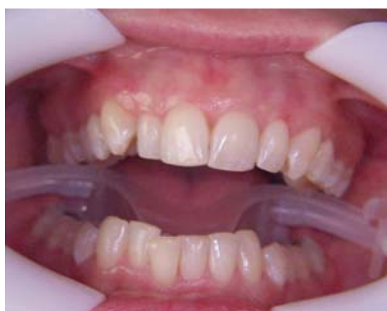
3. It is best to prepare trays completely prior to patient isolation and store them in a light sealed box to await intra-oral seating. First, apply Light Bond Sealant liberally to all bracket bases followed by a brief stream of moisture-free compressed air to thin. The primer/sealant serves to clean any remaining dust that resides on the brackets and also to wet the bases in preparation for the adhesive. Next, apply the Quest Indirect Bonding Adhesive to each bracket base. The adhesive dispenser is designed to facilitate the application of precise, small quantities of adhesive.

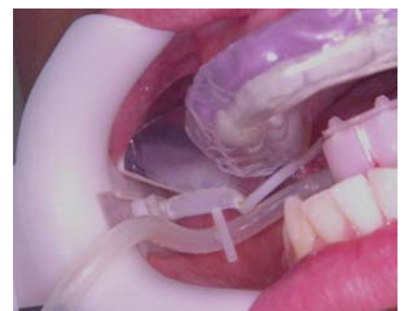



4. A good means of full arch isolation is vital. A combination of the new Quest Dry Field System and the Nola system is ideal for this purpose.

5. Isolation

   a. Upper arch isolation is partially accomplished using the Nola dry field system. The most critical and difficult aspect of isolating the entire upper arch (#1 thru #16: all 16 teeth) is isolating the buccal surfaces of the second and third molars. This is due to the fact that the cheek will tend to contact these surfaces and the coronoid process of the mandible will press the cheek against these surfaces. As such, direct bonding can sometimes be impossible or, at best, very difficult. However, using an indirect method, isolation becomes quite simple and predictable. To protect the buccal molar surfaces from the cheek simply cut in half a "dry-angle" and round its sharp corners. Then wedge the dry angle in between the buccal molar surfaces and the cheek with its superior edge pressed against the vestibule and its inferior edge supported by the arm of the arm extension of the Nola tongue shield (see photos below).





b. Once the upper arch is isolated, the enamel (and porcelain) is etched as indicated for typical bonding. After rinsing, it is often prudent to replace the wet dry angles with fresh dry ones. Then, the arch is completely dried, sealant is applied to the teeth as per normal bonding protocols, and then the tray is seated. Pressure should be applied to the tray in the area just prior applying the curing light. Applying pressure ensures full seating of the brackets against the teeth. Only an initial tacking for several seconds need be done by the doctor. An assistant can finish the curing (15-30 seconds) later.

6. Isolation of the lower arch is impeded by the arms of the tongue shield of the Nola system because these arms will often lie on the first or second molars. Therefore, it can be difficult to isolate and then slide the bonding tray underneath these arms. Therefore, we recommend removing the Nola tongue shield and replacing it with the Quest Dry Field System. (The Nola retractor is left in place.) As with any device, it is important to provide careful and explicit patient instruction to effectively use this device.

7. Perform normal tooth preparation and etching procedures. For enamel, etch 15-30 seconds with 37% phosphoric acid. When bonding to porcelain or metal, we recommend Reliance materials and protocols for bonding.

8. To bond to a metal crown, we recommend the following protocols prescribed by Reliance. Abrade the metal with a course diamond to roughen the surface. Then, while isolated, aggressively micro-etch the metal with 90-micron aluminum oxide. This creates mechanical retentive properties similar to that of a metal bracket base. Also, it is best to use porcelain brackets on metal teeth (yes, even if that means using a premolar bracket on a molar). This permits access of light for curing the adhesive. Otherwise, if you use a metal bracket, it is nearly impossible for light to access the small interface between two metal surfaces.

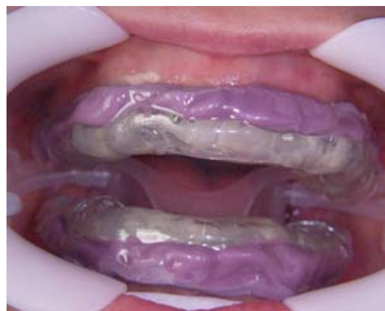
9. Seat the tray immediately following enamel preparation and application of sealant to the enamel surfaces. Immediate seating reduces the chance of moisture contamination.

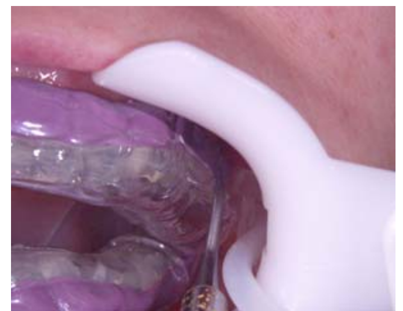
10. After seating the tray, apply gentle localized pressure to the tray just prior to exposure with light-cure unit. Start curing at the most posterior tooth and use a mouth mirror (or a finger) to apply gentle pressure to the buccal side as the light cure unit tip applies occlusally directed pressure to the tray.

11. It is best to always apply light pressure immediately prior to and during light exposure to ensure complete seating of the brackets and expulsion of excess adhesive.

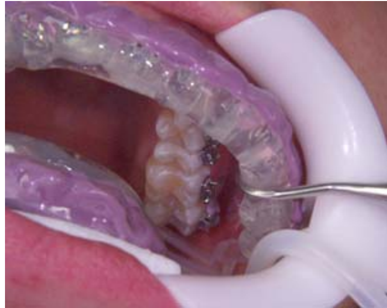
12. Curing time depends primarily upon the intensity of the light generated by your particular curing lamp and the type of bracket (metal versus ceramic). With the Optilux 501 unit, 30 seconds per metal bracket is sufficient. Use of laser units will reduce curing time. More time may be required with less powerful units. Less time is needed when using ceramic brackets. More time should be allowed for curing metal brackets against porcelain or metal crowns.

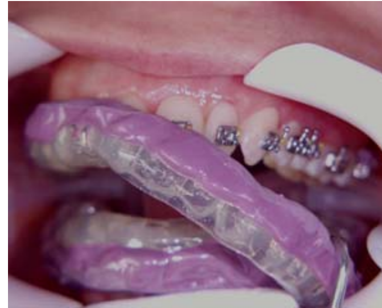
    a. The upper arch bonding should always precede the lower so that the ledge of the upper bonding tray is present to hold a cotton roll to control parotid saliva during the lower arch bonding. Once the Quest tongue shield and the cotton rolls are in place, the lower arch should be completely isolated and ready for bonding as per the upper arch.

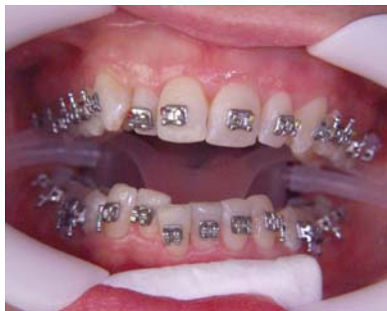




b. When both trays have been seated and tacked with light, completion of the cure is performed and then the trays may be removed. The outer Essix tray should first be removed by grasping the distal gingival margin with a scaler and pulling down (toward the occlusal as the case may be) to dislodge it and then work it forward. Once the Essix tray is removed, the inner matrix can be removed by engaging a finger on the occlusal and pushing/rolling out and down (gingival) starting at the posterior and working forward (mesial).







Part 4: Time Analysis

Laboratory Procedures

	Doctor Time
Position Brackets	50 Minutes

	Doctor	Assistant Time
Clear & Purple Matrix Application	0	2
Essix Application	0	5
Cut-out Tray, Trim, Polish	0	5
Micro-etch	0	7
Totals	50 minutes	19 minutes

Intra-oral Procedures

	Doctor	Assistant Time
Enamel cleaning	5	
Prime brackets, apply adhesive		10
Isolate and initial etch		10
Prime and Deliver	10	
Light Cure	2 (Tack)	12 (complete)
Tray Removal		2
Totals	17 min.	34 min.