The Truth About Bond Failures

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Dr. Sondhi has used indirect bonding for the past 16 years, and has presented seminars and continuing education courses to several dental and orthodontic organizations in the United States and Canada. He has also lectured in Europe, Africa, Asia, and Latin America. In addition to his orthodontic practice, Dr. Sondhi devotes a significant amount of his clinical work to the diagnosis and management of patients with disorders of the temporomandibular articulation. Dr. Sondhi also serves as a consultant to the American Journal of Orthodontics and Dentofacial Orthopedics.

“I hate bond failures.” This little bit of philosophical vitriol was presented to me by my friend, Harry, as he and I settled into our lounge chairs to enjoy a classic summer evening with our favorite single malt scotch. “They routinely throw off a well organized schedule, stress the staff and me, lead to confrontational conversations with patients and parents, and generally complicate our clinical lives,” he continued, between sips. Harry and I had remained close friends since we both completed our orthodontic education 20 years ago, and he was responsible for cultivating my taste in scotch whiskey. I have always enjoyed our get togethers, and Harry’s occasional bursts of brilliant observation about life in orthodontic practice could prove to be entertaining and informative. This was not one of those moments.

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All bond failures are not the same!

You see, orthodontists tend to think of bond failures in generic terms. “Bond failure” is frequently mentioned as a generic term, almost as if it were a monolithic event. All bond failures are not the same.

It seemed time to analyze individual bond failures more carefully, and to suggest that the cause of failure should determine the corrective action.

Bond Failures Are Expensive

Bond failures are invariably more expensive than most of us realize. And I don’t mean the cost of the bracket itself. A careful understanding of the process actually reveals that the cost of the bracket is virtually inconsequential. Although no one enjoys spending more on operating overhead than is necessary, it does little good to focus on the cost of the bracket, which is, literally, the smallest part of the problem. Lost clinic time and lost treatment time are the major concerns, and the major source of added cost in treatment induced by bond failure. Add the cost of bad public relations, patient perception, etc. After all, it is never the patient’s fault, is it? With the exception of a few rare honest citizens, who will confess to crunching on ice cubes and biting on pen caps, the degree of inventiveness most patients can display in explaining how a bracket came off can be fascinating. “She was just sitting there, sucking on a marshmallow, and it just came off!”, we are told by earnest sounding parents. The unspoken implication — did you use cheap glue, Doctor? Sooner or later, we all learn that arguing with people about this sort of thing is rarely productive. Except in cases of egregious and repeated abuse, it is not worth the time or the effort. Remember, people don’t like to lie, and they resent the people they have to lie to.

The True Cost of Bond Failures

Let’s give some careful thought to what the actual cost of bond failures can be. In the best case scenario, if there is no loss of tooth movement, there is a minimum investment of 20-30 minutes of chair time. This would include front desk time in taking the phone call from the patient, scheduling the patient, untying an archwire, preparing the tooth, rebonding the bracket, and retying the archwire. Add to that the cost of tray set ups, sterilization, etc. I don’t care how efficiently you run your office, even this best case scenario will add a cost of $70 to $80 for a single bond failure. Even if the patient is aware that they did something to cause the bond failure, they are still irritated by the inconvenience to them, having to take time from work or school, and you will generally be the recipient of those bad feelings. If there is some loss of tooth movement, such as the relapse of a rotation, then the average cost of a bond failure will be 30-40 minutes of chair time, and two appointments. This is further enhanced if you have to drop to a lighter archwire to recover a displaced or rotated tooth. In this instance, the cost of a bond failure may range between $150 to $200. And I must emphasize the possibility that the projected treatment time has been increased, with the resulting loss of public relations and rapport with your patient. In short, nothing good ever came of a bond failure.

Rather than argue about these events with our patients, I believe it would be much better if we were to focus on the cause of bond failures, and to take measures designed to minimize them. We can’t make the problem go away, so we might as well focus on having it visit us less frequently.
The Source of Bond Failures

As I mentioned earlier, all bond failures are not the same. For example, if the bond failure occurs at initial archwire insertion, that is obviously not the patient’s doing. The cause of such bond failure would be either a technique error, or material contamination during the bonding process. Since I use indirect bonding almost exclusively, if the bond failure occurs at tray removal, then the problem is also obviously related to technique or material contamination. In a recently published article, we presented a new resin developed specifically to deal with this problem. In the enclosed graph (Fig. 1), it is evident that this material has an extremely fast cure rate, and that bond strength at the five minute mark is substantially higher than resins we have previously used. The five minute window is important because that is when the tray is removed, and the archwire inserted. That is why, in the indirect bonding technique we have developed, I use vacu-formed trays. Although it makes the tray difficult to remove, it is an excellent test of bond strength at the chair side. If the bracket is going to fail, it is better that it fail during the bonding appointment, when it can be easily rebonded. If the patient has to return the following day, that is a ridiculous inconvenience to them. While the other resins that we compared will eventually catch up in bond strength, that will not help in dealing with the first cause of bond failure that we are discussing here.

If a bond failure occurs within 24-48 hours of appliance placement, I believe that the source of the problem is still technique error or material contamination. The reason is quite simple. Following the initial banding appointment, most patients have teeth that are tender enough that they are unlikely to bite down on anything hard, or to fiddle aggressively with their appliances. There is little point in glaring at a patient that arrives the day after the bonding with one or two loose brackets. Since the probability of technique error or material contamination is high, it wasn’t the patient, it was us. This is where APC™ Brackets and Tubes have proved to have a significant advantage, since material contamination is virtually eliminated, and the potential for an error in technique greatly reduced. If the bond failure occurs 48-72 hours after bracket placement, it gets a little more difficult to identify the source. It could still be technique error or material contamination, of course, but the patient may now be contributing to the problem. This could be due to the fact that the tenderness of the teeth has started to subside, and the patient becomes more adventurous with hard and sticky objects. After 3-4 days have elapsed, the likelihood that a bond failure would be due to technique error or material contamination is extremely low. Generally, bond failures after this time are due to patient abuse, with one exception. If a bond failure occurs during archwire tying, we should think carefully about how we, or our staff members, are tying in archwires.

I find it useful to explain this to patients, so that they understand that 3-4 days following appliance placement, the resin will be completely cured, and that “the glue doesn’t dissolve”. In essence, while I rarely want to argue with a patient about whose fault it is that the bracket came off, except in cases of egregious abuse, we do gently remind them that brackets are rarely suicidal, and do not generally jump off the teeth spontaneously.

Improper Archwire Tying

There is only one point that I really want to make here. When tying in an archwire that is active to a rotated tooth, or a rectangular archwire that has a significant amount of torque, it is important to remember one detail. If you simply force the archwire into the bracket slot with the force of the ligature itself, this places a shear force on the bracket (Fig. 2). Well, if you think about the procedure we follow for debonding, that is exactly how you remove a bracket from a patient’s tooth. Regardless of which debonding instrument you might use, the preferred method of removing the bracket from the tooth is to apply a shear force to it. This, in my opinion, increases the probability of bond failure during archwire tie in, because the activation procedure is similar to the debonding procedure. It is my recommendation, therefore, that the archwire be pushed into the slot with a ligature director, and then the archwire be engaged completely in the slot with the ligature pliers (Fig. 3). Similarly, when tying in a torqued archwire, it will be substantially better to torque the archwire into the slot with a torquing key (Fig. 4), instead of trying to engage the archwire into the slot with the ligature tie itself. What we want to avoid here is a bond failure induced by a shearing force.

Figure 1: Bond Strength Comparison at 5 minutes

![Figure 1: Bond Strength Comparison at 5 minutes](image1.png)

Figure 2: Ligature Tying creating Shear Force

![Figure 2: Ligature Tying creating Shear Force](image2.png)


**Indirect Bonding vs. Direct Bonding**

Regardless of whether brackets are placed with direct bonding or indirect bonding, the bottom line remains that we eventually want adequate bond strength during treatment to minimize the number of bond failures. Accurate bracket placement on the anterior teeth can generally be achieved with both indirect and direct bonding, of course, but bracket placement on posterior teeth is a different matter. As a general rule, accurate bracket positioning with direct bonding on posterior teeth is substantially less accurate than with indirect bonding. If direct bonding posterior teeth isn’t particularly easy, rebonding them isn’t any easier! Therefore, the more accurate the bracket positioning at the initial appliance placement, the better. This is where indirect bonding presents substantial advantages. As mentioned earlier, we have developed a cohesive indirect bonding system, which is supplemented with a resin developed specifically for this purpose. This has reduced time lost in treatment, and the cost of rebonding, substantially. It is my opinion that previous failures with indirect bonding systems were related to the use of resins that had actually been designed for direct bonding, and were merely adapted for indirect bonding.

**Conclusions**

I have tried to elucidate the cause of bond failures following appliance placement, and believe that the breakdown of possible causes explained above allows us to focus on the specific cause, and to implement the appropriate corrective action. If the bond failure occurs the day after appliance placement, I would strongly urge you to consider the possibility of material contamination, and to analyze your own bonding technique carefully. If the bond failure occurs several days or weeks after appliance placement, quit beating up on yourself! Some of the marshmallows out there can be very hard! Focus on reducing the number of bond failures that you can control, and watch your operating overhead, and your stress level, decrease.

**REFERENCE**


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