Evidence-Based Dentistry

Early Failure of Class II Resin Composite Versus Class II Amalgam Restorations Placed by Dental Students


Abstract: Using the information from remake request slips in a dental school’s predoctoral clinic, we examined the short-term survival of Class II resin composite restorations versus Class II dental amalgam restorations. In the student clinic, resin composite is used in approximately 58 percent of Class II restorations placed, and dental amalgam is used in the remaining 42 percent. In the period examined, Class II resin composite restorations were ten times more likely to be replaced at no cost to the patient than Class II dental amalgam restorations. A total of eighty-four resin composite restorations and six amalgam restorations were replaced due to an identified failure.

Dr. Overton is Associate Professor, Department of Comprehensive Dentistry, University of Texas Health Science Center at San Antonio Dental School; and Dr. Sullivan is Assistant Professor, Department of Comprehensive Dentistry, University of Texas Health Science Center at San Antonio Dental School. Direct correspondence and requests for reprints to Dr. J.D. Overton, Department of Comprehensive Dentistry, Dental School, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78229; 210-567-3705 phone; 210-567-6354 fax; overtonj@uthscsa.edu.

Keywords: dental education, clinical education, clinical competence, dental school clinics, resin composite, dental amalgam, Class II restoration

Submitted for publication 3/16/11; accepted 6/6/11

One research study found that resin composite survival may be nearly equal to the survival of amalgam in Class II restorations. Other research has suggested that amalgam survival is far superior to resin composite. Most research studies approach a zero failure rate in the first year of the study for direct restorations. These studies, however, were conducted on restorations placed by skilled practitioners. Our study was conducted to determine the short-term survival of Class II resin composite restorations relative to Class II dental amalgam restorations placed by dental students.

Methods

Our chart review involved only adult and adolescent patient records because children are not treated in the University of Texas Health Science Center at San Antonio (UTHSCSA) Dental School predoctoral clinic. In this clinic, the instructors determine if a restoration placed in the student clinic should be remade at no cost to the patient. A form is filled out by the student and instructor, and the form goes to the director of clinics for approval.

Results

According to the charts we reviewed, there were 2,318 Class II composite restorations and 1,691 Class II amalgam restorations placed in our student clinic during 2010. In that same period, eighty-four Class II composites (3.6 percent) and six amalgams (0.35 percent) were replaced at no cost to the patient. Twenty-one Class II resin composites were replaced with less than one month of service. Two amalgam restorations were replaced with less than one month...
of service. Another forty-five resin composites were replaced after more than one and less than twelve months. For amalgams, four restorations were replaced in that period. Eighteen resin composites were replaced at no cost that had been in the mouth thirteen to twenty-four months, but no amalgams were replaced for free that had lasted thirteen to twenty-four months.

Discussion

We do not have a data set that represents 100 percent follow-up on all the restorations placed, so the most this study can conclude is a feel for how well we are doing. By our estimate, Class II resin composites are failing, in the short term, at a rate ten times higher than those with dental amalgam. Clearly, if amalgam is our gold standard, then we are falling short with posterior tooth-colored restorations.

This snapshot of performance has the advantage of involving 4,009 direct Class II restorations. It was by design limited to Class II restorations, while many clinical trials mix Class I and Class II restorations. After five years of observation, Opdam et al. reported ninety-four of 346 Class II dental student-placed resin composite restorations had failed (27 percent). In that study, twenty-seven of the ninety-four failures happened within the first year (29 percent). Our composite resin failure rate is not that high, which could be related to the material or the difference in the discrimination of the chart review.

A few U.S. dental schools still do not teach Class II resin composite restorations. In 2004, our school determined that the reality of the marketplace gave us a mandate to teach posterior composite restorations. After five years of observation, Opdam et al. reported ninety-four of 346 Class II dental student-placed resin composite restorations had failed (27 percent). In that study, twenty-seven of the ninety-four failures happened within the first year (29 percent). Our composite resin failure rate is not that high, which could be related to the material or the difference in the discrimination of the chart review.

A few U.S. dental schools still do not teach Class II resin composite restorations. In 2004, our school determined that the reality of the marketplace gave us a mandate to teach posterior composite restorations. The thought process was that when done well, resin composites could be equal to amalgam. Even if they were not equal, students needed training to place them rather than for the school to graduate dentists with no experience in a complex procedure commonly done in private practice. While our students are tested on Class II amalgam and Class II resin composite restorations, there is no individual requirement for a certain number of each type of restoration. A material-specific treatment plan is written, and in general, that material is used. At times, size or isolation problems will change the treatment plan from resin composite to dental amalgam. Seldom is a restoration planned as an amalgam changed to resin composite.

Through periodic patient reevaluations and with patient-reported concerns, remakes of recently placed restorations are identified. Once a restoration is determined to warrant a remake, the predoctoral student fills out a form to back out charges for the remake procedure. We used these remake slips to identify Class II restorations that were replaced between January and December 2010. From the chart entry, we determined how long the restoration served the patient. Most of the notes identified clearly why the restoration was being replaced. For a few records, the entry was so unspecific that “defective restoration” was recorded in the data set (Table 1).

This was a retrospective study with several obvious problems if our goal was to report a percent failure versus all restorations placed. First, not every Class II restoration placed is reevaluated. Second, if the defective restoration is being replaced by the same student who placed the original restoration, some instructors do not have the student fill out a remake slip. We could therefore not identify those replacements from our retrospective examination of the charts.

One study conducted by experienced providers in a controlled setting found very, very few failures in the first two years. However, we have novice providers doing multistep procedures with each step being critical. It is obvious to us that, in the student clinic, resin composite is significantly more likely to fail in the short term than is amalgam due to the technique sensitivity of posterior composites.

Scotchbond Multipurpose (SBMP) is used in the preclinical labs for every bonded restoration placed on plastic teeth and extracted teeth used in preclinical lab training. SBMP is the only dentin bonding agent used in the student clinic. SBMP/Z-100 is

<table>
<thead>
<tr>
<th>Reason for Failure</th>
<th>Composite</th>
<th>Amalgam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Missing</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Void</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Loose</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Open contact</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Residual caries</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Failed/defective</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Sensitive/painful</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Open margin</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>6</td>
</tr>
</tbody>
</table>
by far the most used bonding agent/resin composite combination in our clinics. At four years, Baratieri and Ritter examined 726 restorations and found zero failures with this SBMP/Z-100 combination, so we think it highly unlikely there is a problem with the bonding agent or restorative material.4

Prior to this data collection, our instructors predicted that voids noted on radiographs would be the most common error found in the short term. Our instructors as a group were therefore surprised by how many Class II composites had short-term bond failures. The speculation of why has run the full list of options. Contamination, overetching dentin, failure to evaporate off the primer solvent, failure to adequately cure the adhesive layer, improper positioning of the curing light, trapped air at the composite interface, and errors that only novice clinicians make could contribute to failure. It is well known that the forces generated on posterior teeth are greater than anterior teeth, but we assumed composite was up to the task. Could it be that something as simple as failure to round the marginal ridge contributed to the high number of fractures?

**Conclusions**

Can we teach Class II composite placement better? The group that teaches direct restorations is reevaluating all aspects of Class II resin composite restorations. One suggestion is that at the start of each clinical year the student would demonstrate in a one-on-one monitored examination on a manikin every step of bonding, light cure, and finishing in order to identify technique errors. Consideration is also being given to encouraging postoperative bitewing radiographs when multiple Class II composite restorations are done for a patient rather than waiting until the end of treatment assessment. Errors then could be corrected by the same student who made the errors. Most of the treatment records reported a rubber dam was used for isolation, but if not done well, contamination of Class II restorations is clearly possible with a rubber dam in place. We have few expectations for minimal depth and preparation outline form for resin composite preparations. Is this lack of precision in the preparation leading to early failure? What we know now that we did not know last year is that, at our school, students are not as good with resin composite as amalgam. Now we need to try to get better.

**REFERENCES**