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Effect of new laser and LED light curing units the adaptation of Bulk fill composites in deep preparations



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Introduction

Laser curing lights have the advantage of low divergence, coherent and collimated light beam in comparison to LED curing lights. The aim of this in vitro study was to measure the degree of debonding of bulkfill composite at the floor of a cavity in a deep class I restoration, using conventional LED curing light in comparison to monochromatic laser light.

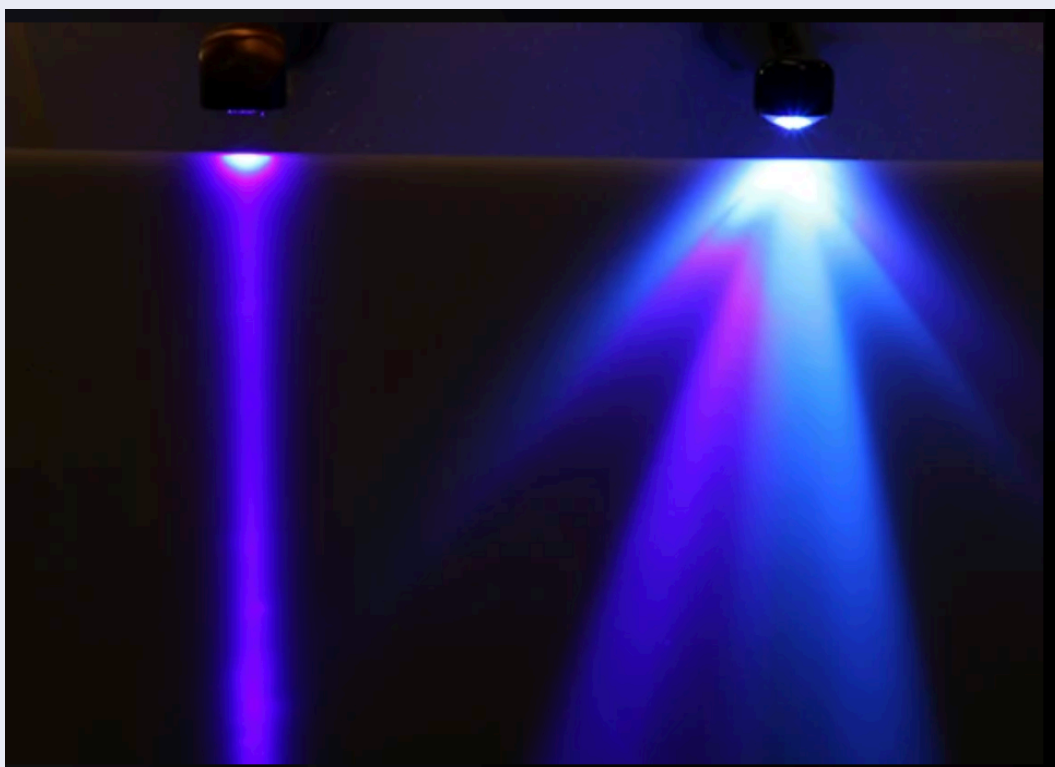


Figure 1 – Comparing collimated and coherent laser light (on left) to non-collimated and non-coherent LED light (on right). Image copied from www.amdlasers.com



Figure 2 – Monet laser curing light and its eye protection glasses.



Figure 3 – Paradigm deepcure LED curing light.

Hypothesis: Laser curing light improves debonding of the cavity floor, in comparison to LED curing light, when using Bulk fill composites and when the light source is at a distance from the cavity surface.

Null hypothesis: There is no significant difference between laser and LED curing light, in debonding of the cavity floor, when using Bulk fill composites and when the light source is at a distance from the cavity surface.

Methods & Materials

In this study we created 40 specimens using Estelite flow quick composite in shape of a cylindrical mold (3mm diameter, 4mm depth) in 8 groups. The experiment consisted of 2 composites: 3M bulk fill and SureFil SDR bulk fill (SF); 2 light curing systems: Monet laser curing light (3s) and Paradigm Deep cure (LED; 20s); 2 curing distances from composite surface: 1mm and 8mm. 3M Scotchbond Universal Adhesive was applied to the interior of each mold, according to the manufacturer's instructions and cured using Paradigm deep cure. Subsequently, the cavity space was filled with each composite and cured using each curing light at the pre-determined distance. In order to assess the degree of debonding, we used Optical Coherence Tomography (Yoshida Dental OCT) to record the debonding in 3D at the cavity floor during the curing process. Data was statistically analyzed at 0.05 significance level.



Figure 4 – Two types of bulk fill composites: SureFil SDR and 3M Filtek.

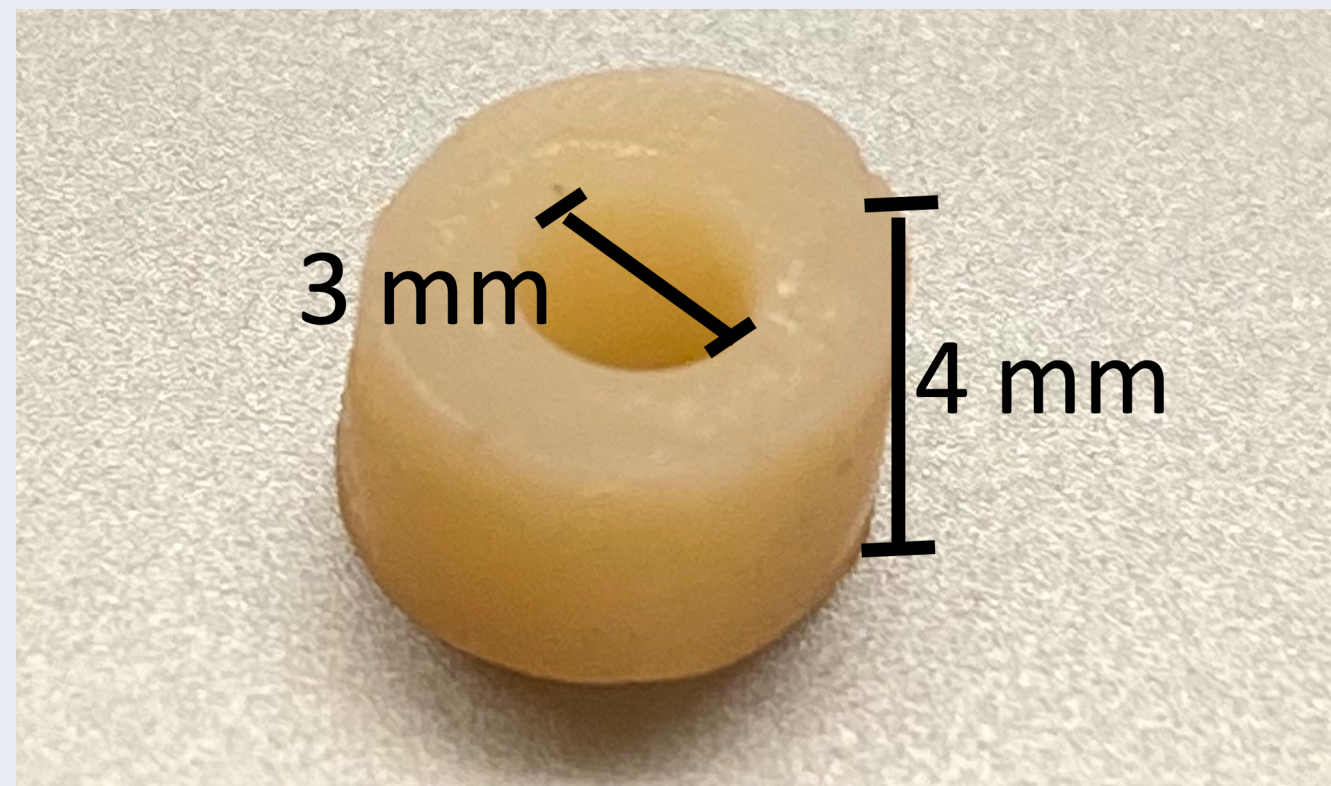


Figure 5 – Cylindrical mold made with Estelite flow quick composite.

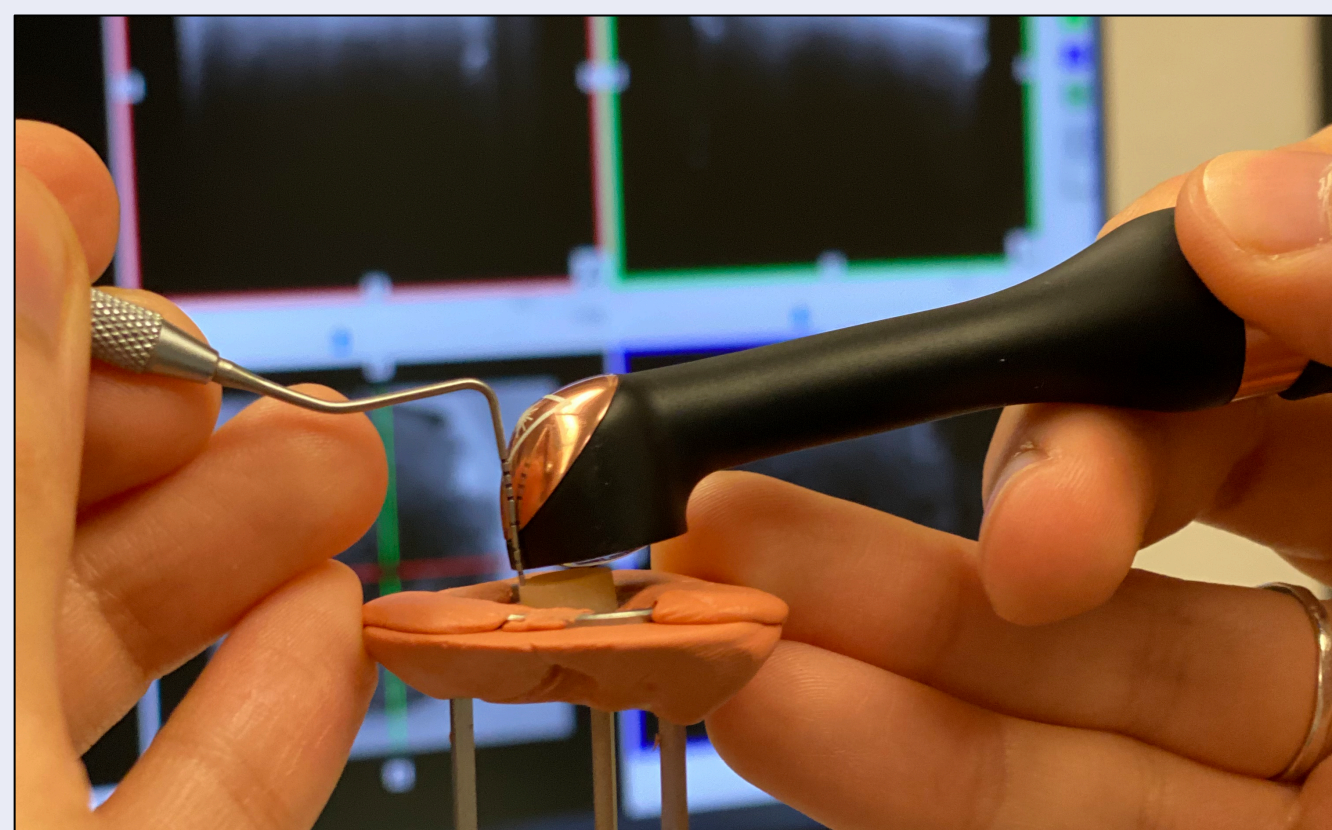


Figure 6 – Light curing unit at 1 mm distance from composite surface. Periodontal probe used for accurate measurement.



Figure 7 – Light curing unit at 8 mm distance from composite surface. Periodontal probe used for accurate measurement.

Results

The laser curing light on 3M composite showed less debonding in both 8mm and 1mm distances, compared to LED curing light. In SF composite, the laser showed less debonding for 8mm distance, but no significant difference was found for 1mm depth compared to LED.

Samples	3M, PD, 8mm	3M, LS, 8mm	SF, PD, 8mm	SF, LS, 8mm	3M, PD, 1mm	3M, LS, 1mm	SF, PD, 1mm	SF, LS, 1mm
1	2	2	2	4	3	2	1	2
2	3	2	4	2	3	3	1	1
3	3	1	3	1	4	3	1	2
4	4	2	2	1	2	1	3	4
5	4	3	4	1	2	1	2	2
Total	16	10	15	9	14	10	8	11

Table 1 – Data entry table. 0 debonding = 1, < 25% = 2, 25-75% = 3, > 75% = 4

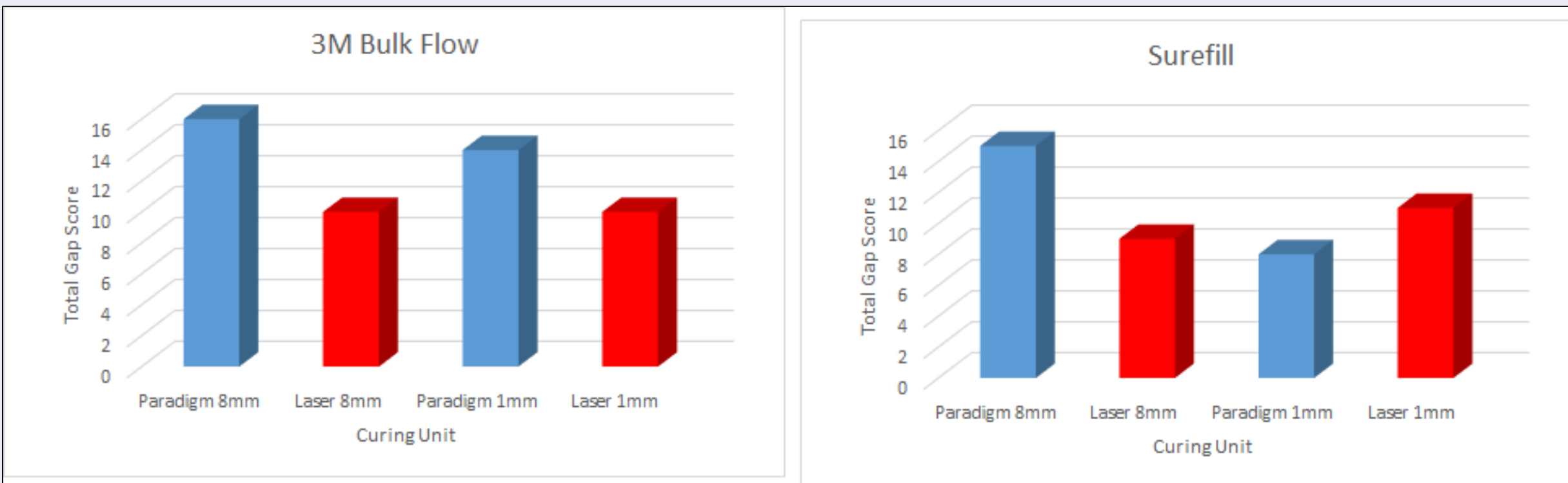


Figure 8 – Summarized data to demonstrate debonding area of each group. Data was statistically analyzed at 0.05 significance level.

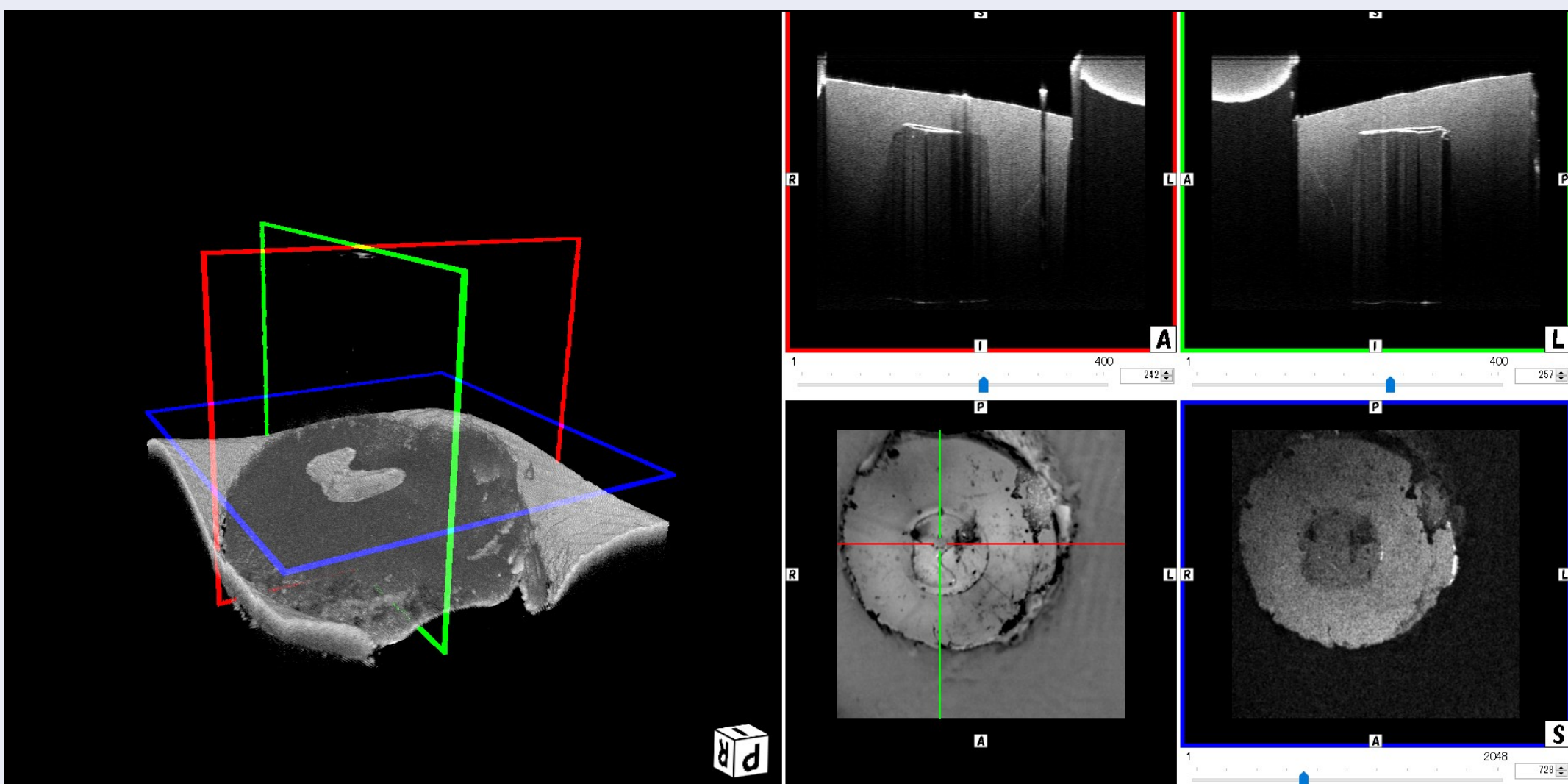


Figure 9 – Optical Coherence Tomography (Yoshida Dental OCT) demonstrating 3D image (on left) and 2D images (on right) of a composite sample debonded after being cured.

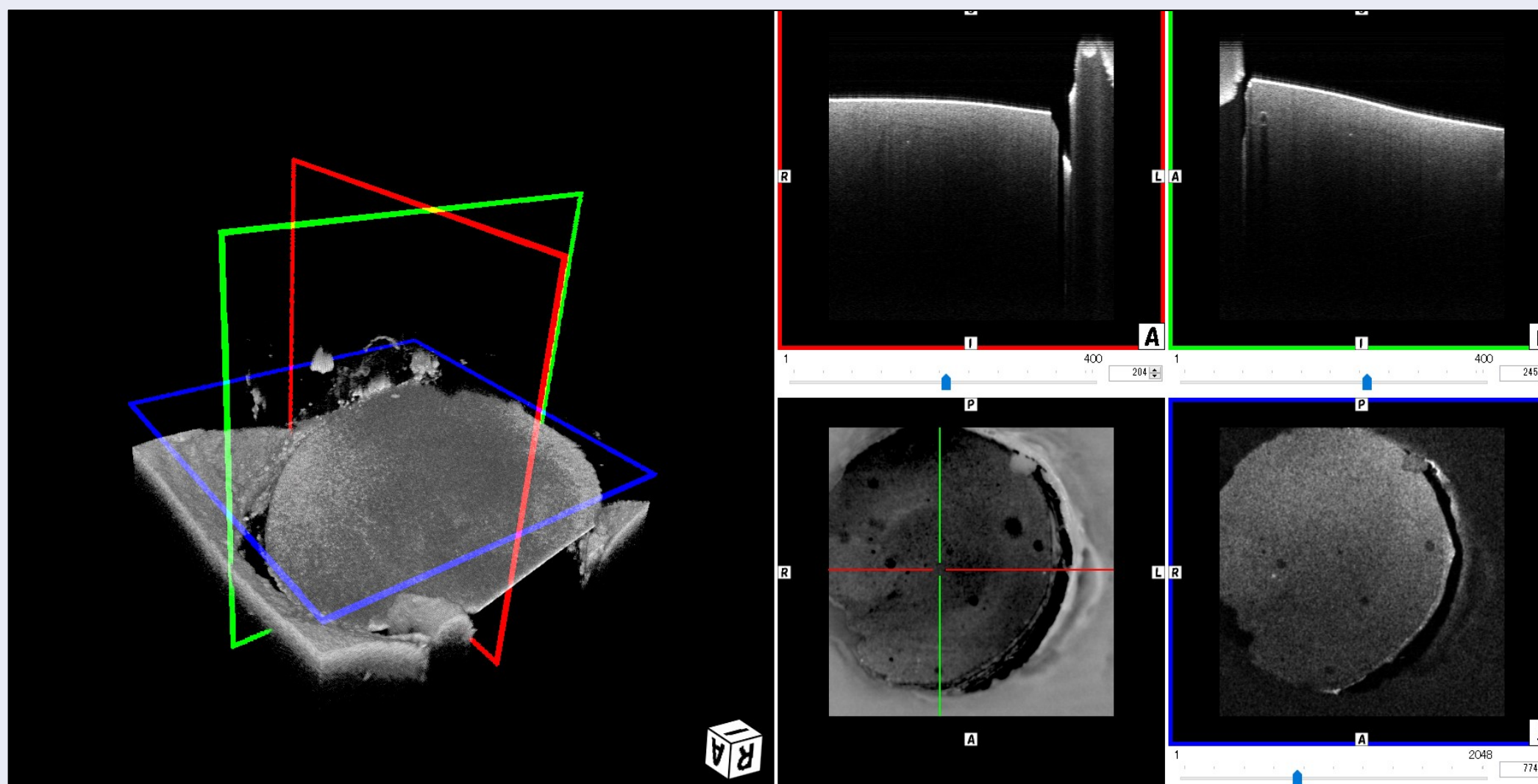


Figure 10 – Optical Coherence Tomography (Yoshida Dental OCT) demonstrating 3D image (on left) and 2D images (on right) of a composite sample with an intact base with no debonding after being cured.

Conclusion

Within the limitations of this in vitro study, the new laser curing light could decrease the time required for curing of bulk fill composites while reducing the debonding and improving the adaptation in a deep preparation, particularly when there is a distance between the curing light and surface of the composite.

Acknowledgements

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