

Soleil 770 LED Curing Light LED Lab Evaluation

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Benco Dental is releasing a new curing light, the *Soleil 770 LED Curing Light* and asked our lab to evaluate it and compare it to a competitive light. Before we jump into the results, here's a little background on the science behind curing lights.

Light activated resin composite restoratives uses light energy to initiate polymerization. This light energy needs to be strong enough to create free radicals, which are molecules with an unpaired valence electron. This leads to a chain reaction, binding many short carbon chains (monomers) together to form long interconnecting chains of molecules called a polymer. If the light energy introduced to this system isn't high enough, some monomers won't join the polymer system and can leach out, form soft spots, lower retention, result in increased discoloration and generally weaken the resulting restoration. Light energy is also scattered as it passes through the composite reducing its effectiveness at curing the composite in thicker layers. Depth of cure then, is the thickness of the composite material that will be adequately cured with a given light exposure.

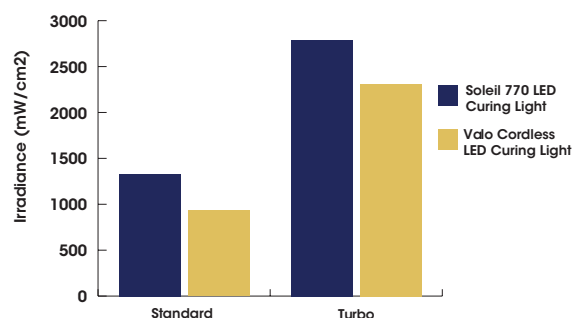
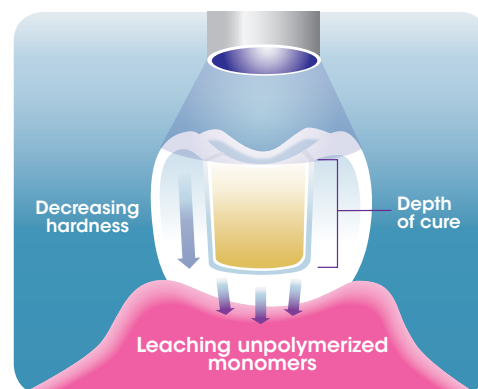
The light exposure received by the composite can be described by **irradiance**, which describes the energy received over an area per second, usually in units of mW/cm^2 . The overall energy received is the **radiant exposure**, given in units of J/cm^2 . A high enough irradiance is necessary to initiate the reaction, while the radiant exposure can describe how much overall energy, and hence how many seconds a curing light must be used in order to cure the restoration.

How does one ensure a new curing light will adequately polymerize a composite? We compared this new curing light to a similar curing light on the market by Ultradent, the *Valo Cordless LED Curing Light*. First we measured the irradiance of the lights using a radiometer, the *Bluephase Meter II* (Ivoclar Vivadent, Inc.) which is accurate to within +/- 10% over the relevant 380-550 nm wavelength range.

From this chart we can see the new *Soleil 770 LED Curing Light* has equivalent or higher irradiance for the same curing modes as the *Valo Cordless LED Curing Light*. Additionally, the tip diameter was measured to be within 0.2 mm of each other, or roughly the same. The irradiance was overall measured to be within 10% of the manufacturer's stated levels for the *Soleil 770 LED Curing Light*.

For comparing the performance in curing composites, we chose a universal composite from Dentsply Sirona, *TPH Spectra HV* which has a common camphorquinone initiator system. We used the standard method recommended by the ADA which includes curing a column of composite material in a stainless steel cylinder, removing the uncured soft composite, and measuring the height.

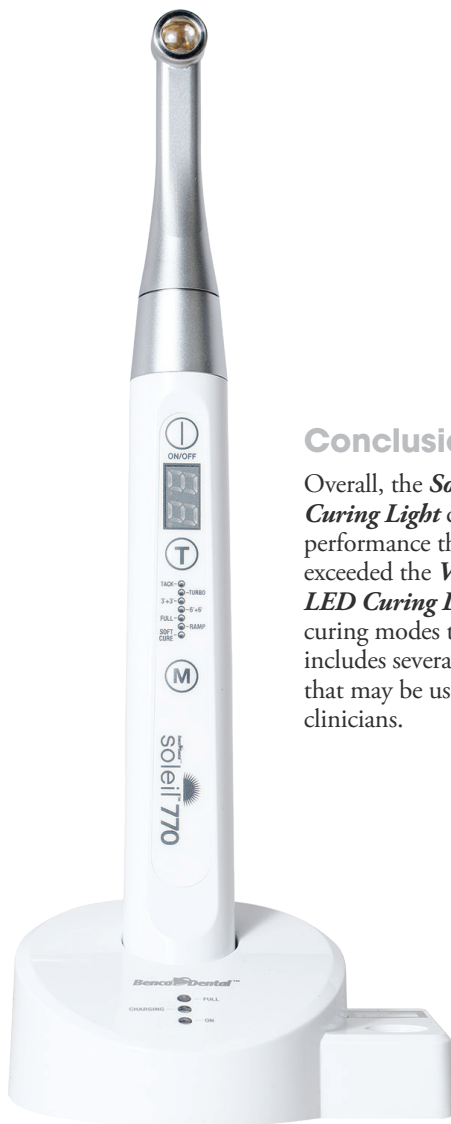
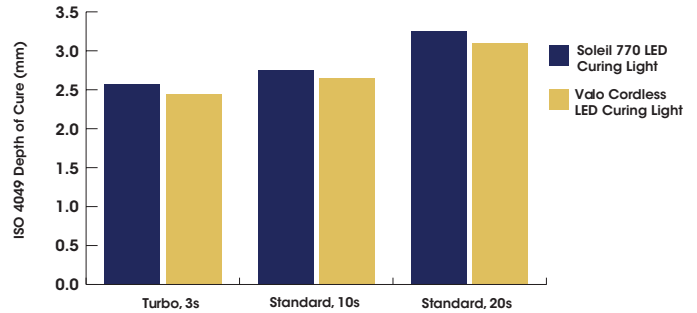
Half of the height of the column is reported as the depth of cure per the standard, because even though the composite may appear to be one piece, approximately half of the cylinder of composite won't be adequately cured. Often however, slightly more than half of the cylinder is usually adequately cured per hardness testing and spectroscopy methods, but the method works as a conservative estimate of depth of cure for safety reasons. For our purposes, we used this method to compare two similar lights, and the resulting depth of cure is useful for this relative comparison.



From this chart we see the resulting depth of cure of the **Soleil 770 LED Curing Light** was equivalent or better than the **Valo Cordless LED Curing Light** for the comparable curing modes indicating that the output of the light is compatible with the most common initiator system. Note, that the Valo curing light doesn't have a ramp mode feature, so we couldn't directly compare these modes.

Other features of note for this new curing light is the 7 different curing modes, and dual-range wavelength output to be compatible with other initiator systems. Three of the curing modes include tack curing, and Ortho-specific bracket bonding modes. Then in addition to standard power and turbo power (3 second) curing modes, it includes ramp and soft cure modes.

Generally, a ramp cure starts with a lower light intensity and then gradually increases over time, which can reduce the initial stresses of the composite bonded to the margins and reduce polymerization shrinkage. Based on the testing for this light, we can recommend using the ramp mode in place of the standard mode without a significant loss of depth of cure. Similarly, the soft cure mode slowly increases the irradiance over 5 seconds, but it stops at a lower peak irradiance to reduce heat generation.



Conclusion

Overall, the **Soleil 770 LED Curing Light** demonstrated performance that met or exceeded the **Valo Cordless LED Curing Light** for the curing modes tested and includes several features that may be useful to some clinicians.