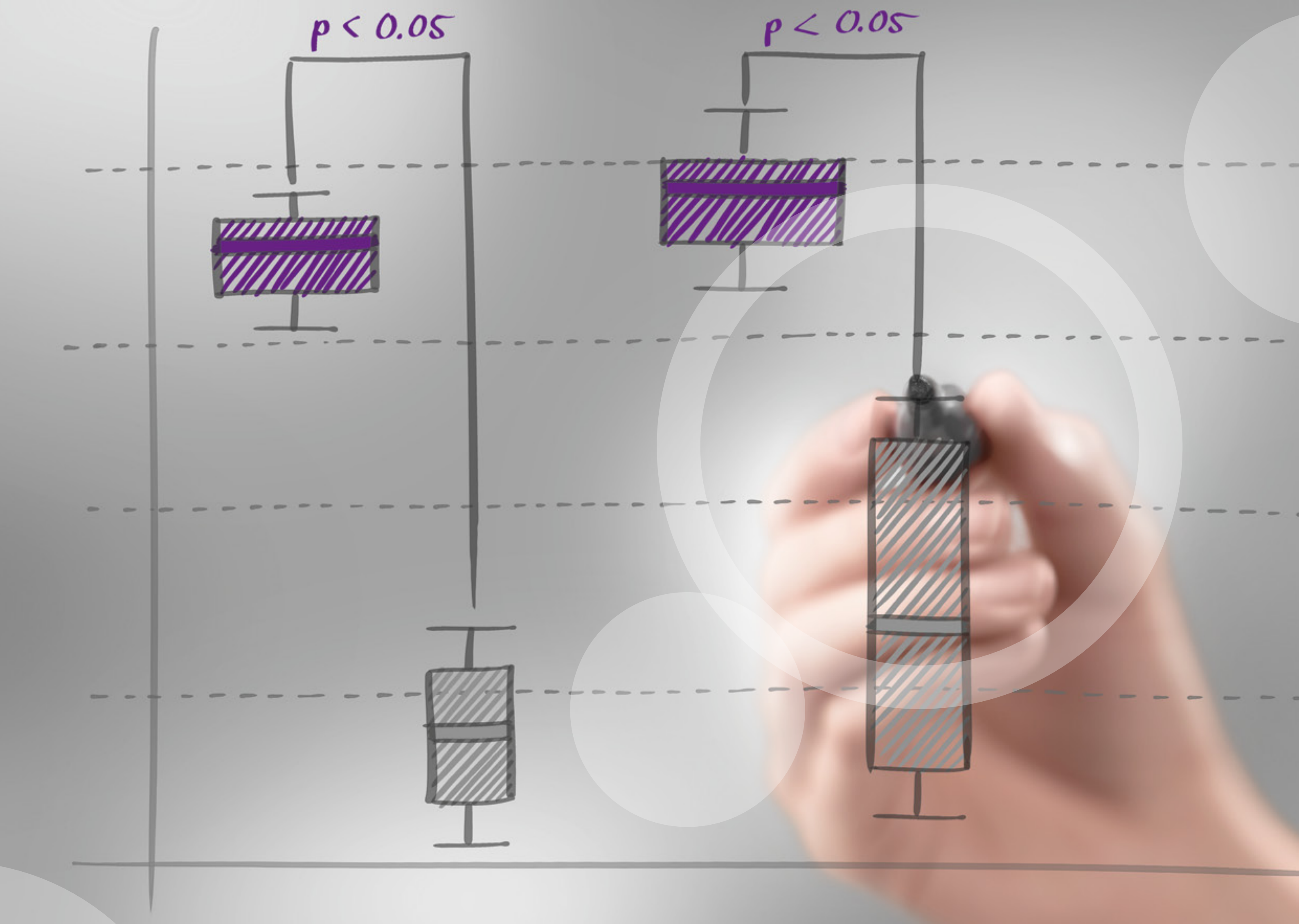

Translux® 2Wave

Beam profile – Dalhousie University, Halifax, Canada
Beam uniformity evaluated in real-time light transmission with Translux® 2Wave and another light curing unit

Nearly 146 million resin restorations and sealants are placed annually[1]. Hence, the target should be to achieve long-lasting restorations to slow down the circle of restoration replacement and to preserve as much tooth structure as possible. A sufficient curing is one of the most important steps for long-lasting resin-based restorations. Different photo-initiators are available for intraoral light curing dental materials. Their individual activation spectra are different and range from violet light (400 nm – 410 nm) to blue light (450 nm – 470 nm). Polywave LED curing lights can cure photo-initiators which require violet or blue light.

So, a light curing unit must deliver the required irradiance, exposure patterns and spectral emission to safely cure resin based materials. The distribution of light need to be homogeneous and should show a minimum irradiance around 500 mW/cm^2. The following study displays the beam uniformity from the polywave LED light curing unit Translux 2Wave.

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[1] 2005 – 2006 Survey of Dental Services Rendered. ADA, 2007:1-181.

Beam profile – Dalhousie University, Halifax, Canada
Beam uniformity evaluated in real-time light transmission with Translux® 2Wave and another light curing unit

Objective

The aim of this study was to characterise the light output of the Translux 2Wave compared to the Bluephase® Style curing light (Ivoclar Vivadent).

Materials & Methods

Power and spectral emission:
The radiant power of both lights was measured using a thermopile and an integrating sphere connected to an optic spectrometer. The entire light output was recorded.

Beam profiling:
The irradiance distributions of the light beams were measured across the emitting surface of the light guide using a laser beam profiler.

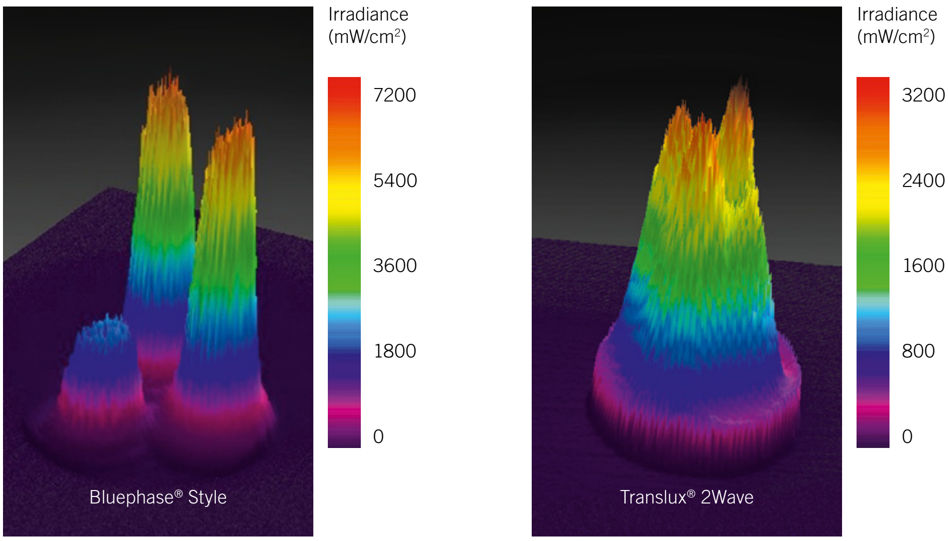
Simulation of the effect of the beam profile on a small cavity:
To replicate the amount of light that would be received by a common small composite restoration (diameter 4 mm), the spectral emission was further sampled at various regions across the tip of the light tips through a 4mm aperture.

Dependency of irradiance from light tip distance:
The beam profile was recorded at different distances of the light tip from the surface.

Results

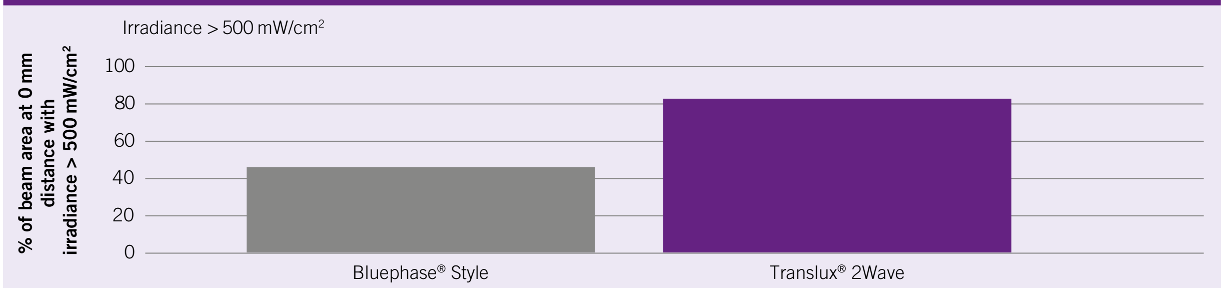
The Bluephase® Style showed a power output (integrating sphere) of 705 mW and an irradiance of 1108 mW/cm^2, whereas the Translux 2Wave emitted 475 mW, leading to an irradiance of 1135 mW/cm^2 due to the smaller light tip. Both polywave curing lights showed wavelength peaks at ~405 nm and ~455 nm caused by the violet (near UV-light) and blue LEDs. The 3D beam profile of both lamps directly at the light tip is demonstrated in the images below. The irradiance is represented by the individual peak height of the different illuminated areas. The higher the peak, the higher is the irradiance of a single surface spot.

Higher irradiance uniformity of the Translux 2Wave



3D view of irradiance at 0 mm distance from the tip through a narrow band pass filter.

Translux 2Wave shows higher curing safety

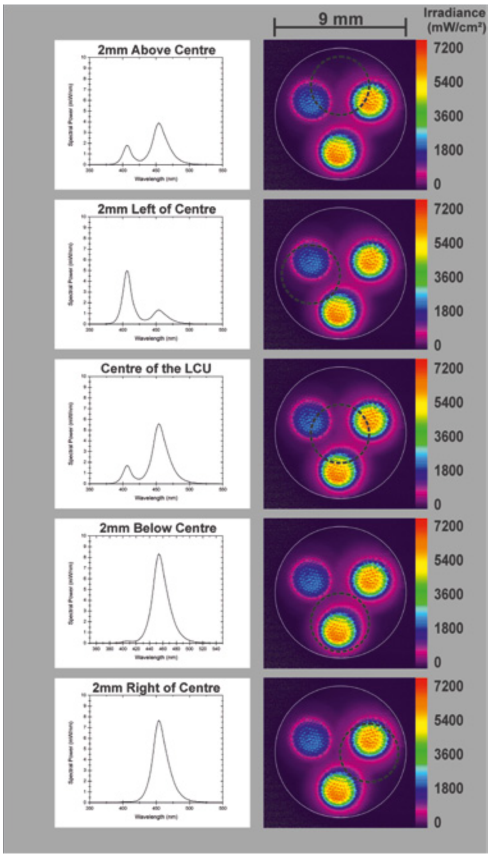


Translux 2Wave is showing more areas possessing an irradiance above 500 mW/cm² which is needed to cure resin materials sufficiently. 39 % of the beam area of the Bluephase® style show less irradiance than 300 mW/cm², whereas the Translux 2Wave only has 5 % of the beam area below this threshold.

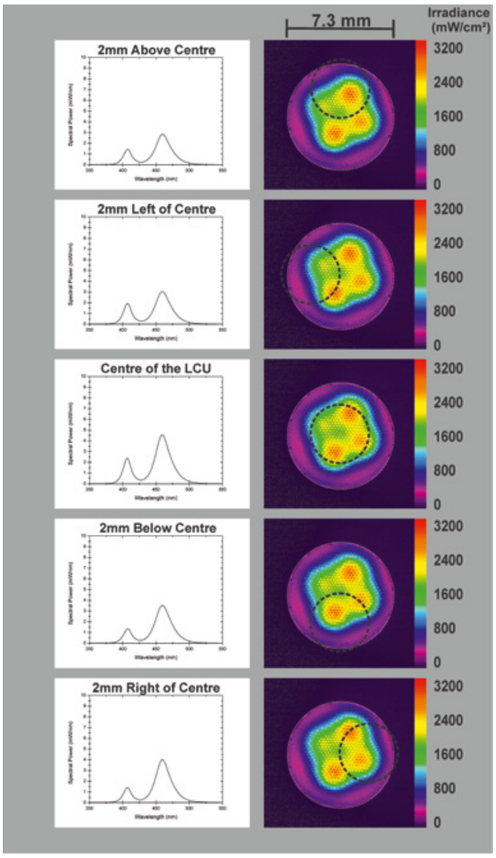
The following images simulate what happens if small restorations are light cured. The circled areas show the position of the aperture on the light tip. Each spectral power diagram represents the wavelength distribution of the corresponding aperture position only.

The Translux 2Wave shows more uniform irradiance

Bluephase® Style



Translux® 2Wave



Irradiance measured with a 4 mm aperture simulating the irradiance distribution on a small cavity.

Depending on the location of the aperture the spectral irradiance of the Bluephase® Style changes (e.g. the lowest image: only blue light and no violet light reaches the restoration). The Translux 2Waves shows always a uniform distribution of the 2 wave length spectra.

The following chart shows the results of the irradiance dependency from the distance of the light tip to the cavity surface through a 5 mm aperture (cavity simulation):

The irradiance is decreasing with higher distance from the light tip.

Conclusion

The Translux 2Wave is a polywave light that delivers less power compared to the Bluephase® Style. But the irradiance of both curing lights is comparable because of the different tip diameters.

At the tip face, 47 % of the Translux 2Wave tip area delivered an irradiance greater than 1000 mW/cm^2 compared to the Bluephase® Style which had only 30 % of the tip area with an irradiance greater than 1000 mW/cm^2.

The decline in irradiance over the distance of 10 mm is similar for both units, although the Translux 2Wave appears to have less of a decline compared to the Bluephase® Style.

The beam uniformity of the Translux 2Wave is better than the Bluephase® Style.

Comment

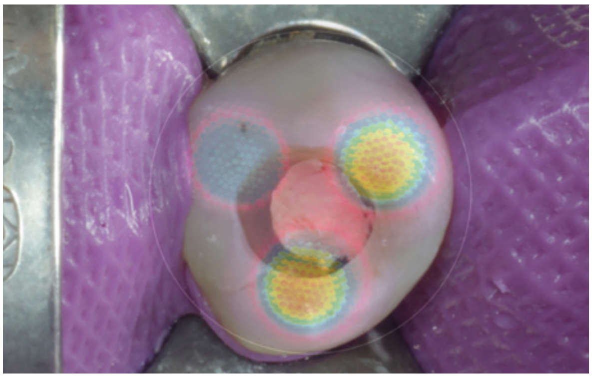
A homogeneous irradiance of the cavity or the resin is mandatory for a sufficient curing result. If there are spots with a very low irradiance in the beam profile (cold spots) the resin has a high risk of undercuring in those areas. But also the opposite can be worse. Areas with an extreme high irradiance (hot spots) might bear the risk of thermal pulp damaging.

That means when buying a curing light it is not sufficient to select a light with high power output and irradiance only. It plays a decisive role how the irradiance is distributed over the light tip. The uniformity should be as high as possible.

This study shows a good uniformity of the spectral irradiance of the Translux 2Wave. Both wave lengths areas are also distributed across the light tip which allows also curing of photo initiators which need a violet light activation.

A great uniformity of the beam profile is especially needed when curing small cavities. This is demonstrated in an endo-cavity example:

Which beam profile would you select for this cavity?



Bluephase® Style

Translux® 2Wave

A small cavity like shown in this case could be undercured when a light curing unit with a non-uniform beam profile is used.

The Translux 2Wave shows also good irradiance when distance between light tip and surface is higher. In interdental cavities the distance from the tip often reaches 5 to 6 mm.

Source

Price, R B, Rueggeberg, F A, Labrie, D, Strassler, H, Alshaafi, M: Light transmission and beam uniformity from curing lights through resin. Test report, 1st May 2014, Dalhousie University, Canada

Unpublished data. Data on file.

The study was abbreviated, summarised and commented and all diagrams and titles have been established by Kulzer.

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Contact in Germany
Kulzer GmbH
Leipziger Straße 2
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