

Ortholux™ Luminous Curing Light: The Next Step in Light Curing

by Darrell S. James



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The History of Curing Lights

Bonding of orthodontic brackets with light cured adhesives has been the state of the art in orthodontics since the 1980s. Polymerization is accomplished through the use of a light sensitive chemical that acts as the initiator when subjected to high intensity light. The most commonly used photoinitiator is camphorquinone (CPQ). The absorbance spectrum of CPQ is 370 to 520 nm with the peak absorbance at 470 nm.

The first curing lights used a halogen lamp as the light source. Halogen lamps have outputs from 250 nm (ultraviolet) through 1000 nm (infra red). Filters are used to limit the light output to the blue range required to activate CPQ.

Improvements in curing time were realized with the introduction of the plasma curing lights. Plasma arc lights rely on a xenon bulb that emits high intensity white light. As with the halogen lights, filters are required to limit the light to the 400 to 500 nm range. The high intensity output approaching 2000 mW/cm² allowed for curing of orthodontic adhesives in as little as 3 seconds.

The introduction of Light Emitting Diodes (LEDs) allows for a more precisely tuned light output. A LED curing light is capable of producing continuous and efficient illumination from a simple twin-element semiconductor diode. The wavelength bandwidth of emitted photons is a characteristic of the semiconductor material; therefore, different colors can readily be achieved by making changes to the semiconductor composition of the chip. The newer high-power LEDs generate sufficient intensity to provide a useful illumination source for a wide spectrum of applications. The peak wavelength of a blue LED is approximately 455 nm. The range of emitted light is around a much tighter band, for example 430-490 nm for the blue LED. LEDs are efficient enough to be powered by low-voltage batteries. Improvements in LED technology, battery technology and heat management have led to the development of improved orthodontic light curing units.

Ortholux™ Luminous Curing Light

3M Unitek will update its curing light offering in the summer of 2009 with the introduction of the Ortholux™ Luminous Curing Light (Figure 1). The Ortholux Luminous curing light takes advantage of the latest technology in high-intensity LEDs and an optimized fiber optic light guide to achieve an output of 1600 mW/cm², approximately 60% higher than its predecessor, the Ortholux™ LED Curing Light. The peak wave length of the LED at 455 nm closely matches the absorbance peak of CPQ (Figure 2).



Figure 1: Ortholux™ Luminous Curing Light.

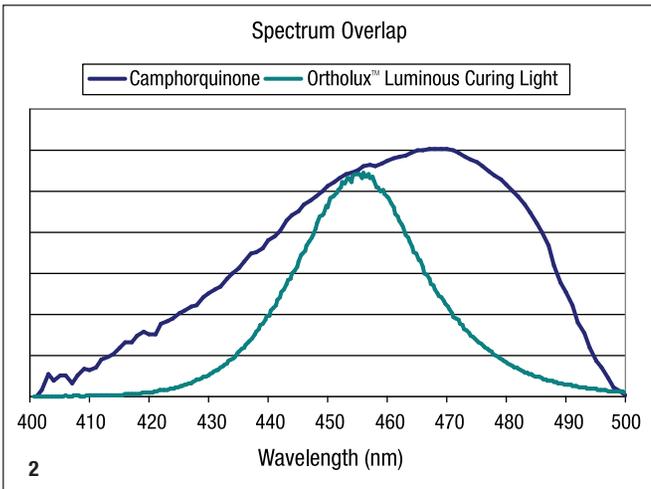


Figure 2: Spectrum Overlap.

The Ortholux™ Luminous Curing Light is equipped with the latest, high performance, LEDs available. Excess heat is managed by mounting the LED on a heat sink. The heat sink allows for a fanless design which results in quiet operation.

The Ortholux Luminous curing light is powered by a Lithium ion battery. Lithium ion batteries can store 1.5 to 2 times the power of a nickel metal hydride battery. They do not have to be conditioned with three charge/discharge cycles, hold their charge better and have no memory effect, meaning that the batteries do not have to be completely discharged between recharge cycles. Additionally, Lithium ion batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. The batteries should be disposed of according to the applicable state and local regulations.

In addition to the high intensity LED, the black-coated, 8 mm light guide contributes to the 1600 mW/cm² output of the Ortholux Luminous curing light (Figure 3). The light guide diameter is

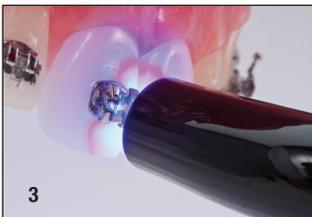


Figure 3: 8 mm light guide on the Ortholux™ Luminous Curing Light.



Figure 4: The Ortholux™ Luminous Curing Light has larger activation buttons.

designed to provide a high intensity output and to optimize the orthodontic curing pattern for the recommended mesial and distal curing technique or the alternative interproximal curing technique. The black coating of the light guide assures the user that the high intensity light is being directed into the oral cavity and not extraneously throughout the operator. In addition, the light guide utilizes a magnetic mounting feature which facilitates easy rotation of the light guide independent of the eye shield. The improved eye shield serves as a table rest for the light and prevents the light from rolling off a surface when not seated in the charging base.

The on/off and activation buttons of the Ortholux Luminous curing light have been improved by making them larger and more tactile than those of other lights (Figure 4). The single piece stainless steel housing makes the unit more resistant to breakage and easy to disinfect. The raised buttons, smooth housing and pen-shaped design contribute to the ergonomic feel of the light. The charging base includes an integrated light intensity meter with values from 60% to 100% intensity. The light intensity is not a function of battery charge level or battery life.

The Ortholux Luminous curing light includes time settings of 3, 6, 9 and 12 seconds. These settings are applicable to curing all orthodontic appliances, including ceramic brackets, metal brackets,

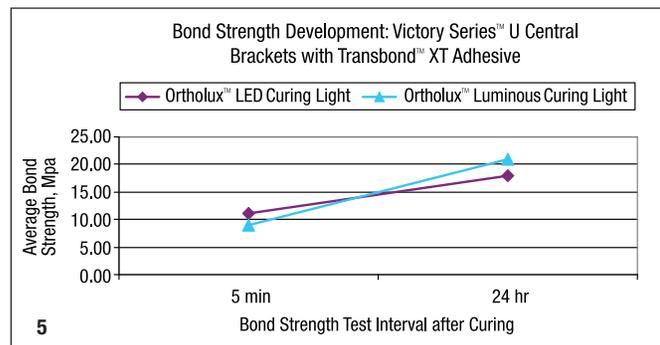


Figure 5: Bond Strength Development: Victory Series™ U Central Brackets with Transbond™ XT Adhesive.

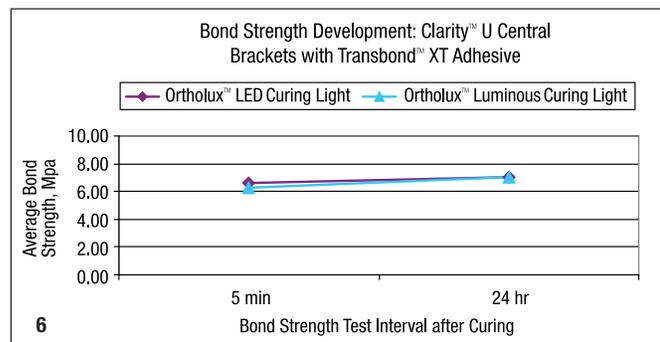


Figure 6: Bond Strength Development: Clarity™ U Central Brackets with Transbond™ XT Adhesive.

buccal tubes, bands and lingual retainers. The light also includes a convenient 1-second tack cure function. The tack cure function is a feature that many customers requested. The one second burst of light allows the clinician to get an initial cure before moving on to place other brackets. This may be particularly useful in sealing the gingival seam on patients where moisture control is an issue.

Bond strength achieved with the Ortholux™ Luminous Curing Light at three seconds is equivalent to the Ortholux™ LED Curing Light at five seconds. Mesh based Victory Series™ Upper Central Brackets or ceramic Clarity™ Metal Reinforced Upper Central Ceramic Brackets were bonded to bovine teeth with Transbond™ XT Light Cure Adhesive. Bond strength was tested five minutes after curing and 24 hours after curing. The bond strengths are similar at each test interval (Figure 5 and 6).

Customer acceptance evaluations conducted with orthodontists in the US, show a 94% satisfaction with the performance of the Ortholux Luminous curing light and 88% satisfactions with the features of the light. The most often mentioned improvement was the time savings from the 3-second curing time. Evaluators were also impressed with the larger raised TIME and START buttons and the ease of cleaning and disinfecting the stainless steel handpiece and light guide.

The improvements offered by the Ortholux Luminous curing light will benefit the orthodontist in several ways. The high intensity light

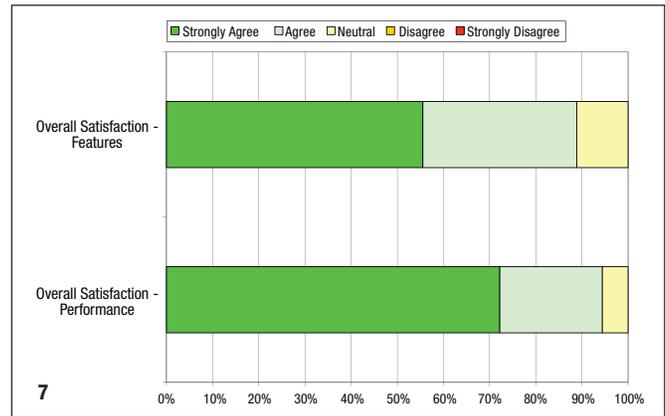


Figure 7: Customer Acceptance Evaluation.

will reduce the time required to cure brackets, thus reducing the chair time for the patient and the time required of the orthodontist or assistant. The ergonomic shape and improve tactile feel of the buttons will be appreciated by the user as well. Disinfections and cleaning are improved via the one-piece stainless steel housing. The Ortholux Luminous curing light is lightweight, portable and quiet. The Lithium ion battery overcomes many of the issues with the older Nickel metal hydride batteries. All-in-all, the Ortholux Luminous curing light is a step in the right direction; efficiency, ease of use, and ease of care, for curing of orthodontic appliances in the busy orthodontic practices of the 21st century.