Several generations of LED (light-emitting diode) light-curing units have been introduced over the last few years. The 1st-generation LED lights generally were low in intensity and did not cure materials completely. The diodes were designed to activate CQ (camphorquinone) initiator around 460 nm. However, alternative photo-initiators used in bleach shades and incisal (translucent) shades of composites and in sealants and bonding agents are not activated by these “blue-light” units.

The 2nd-generation LED light-curing units (bluephase, Elipar Freelight 2, L.E. Demetron 1, Allegro, SmartLite iQ, the CURE) have a single, high-powered diode with multiple emission areas. These units have a large surface area of emission and high-energy output. The 3rd-generation LED light-curing units (UltraLume 5) have two or more diode frequencies and emit light in different ranges to activate CQ and alternative photo-initiators.

While most dentists are still using quartz-tungsten-halogen (QTH) light-curing units, the convenience of the LED units is making them increasingly popular.

Advantages
- Battery powered
- Portable – compact, lightweight
- Energy-efficient – long battery life
- Low emitted heat
- Durable – diodes last 5,000 hours

Disadvantages
- Narrow spectral range – most units only work with CQ initiator
- Heat generated in chip

Light Emission
- Glass-fibered tip – less spread of radiation with increasing distance and perhaps more uniform distribution of power over the irradiated area
- Small plastic lens in front of the uncovered diode – light may not be uniformly distributed
- Uncovered diodes – output pattern varies the most with tip-to-tooth distance and is probably the least uniform
- Observe the pattern of light distribution over an area and relate this pattern to how far to hold the tip away when exposing
Cooling

- Indicator of an internal heat-sink capability – greatest detriment to diode life is overheating
- Increased diode temperature results in decreased output
- More expensive units use internal fans or large metallic components to draw heat away from the diode
- Less expensive units merely shut themselves down to avoid overheating

Heat – In Curing Unit And In Tooth

- High-power units get hot internally, having the potential to damage a patient’s lip, tongue, or cheek
- Units heat at target based on “photo-thermal effect” resulting in a rise of intrapulpal temperatures with no infrared energy present
- Run the unit through a number of sequential, repeated exposures and sense the temperature to gauge amount of heat at housing and tip

Battery

- Lithium-ion – longer charge, no memory effect, 40% more capacity than Ni-Cad
- Nickel-metal-hydride (Ni-MH) – less memory effect and greater capacity than Ni-Cad
- Nickel Cadmium (Ni-Cad) – older technology, must use battery until drained before recharge or develops a “memory effect”

Corded vs Cordless Units

- Corded units – no recharge time, no worry about battery
- Cordless units – must have a ready supply of batteries for operation. It is a good idea to select a light that comes with an extra battery or optional AC cord

Ergonomics

- Pencil grips – easy use of many controls with one finger
- Gun – familiar, requires adjusting controls with two hands
- Cordless units – battery size, weight, and positioning affect unit balance and ease of use
- Corded units – balance between unit and cord affects holding comfort
- Investigate the ability to place the tip easily into difficult-to-reach regions

Curing Time

- Depends on intensity of light-curing unit, composite, and shade
- Do a test cure

Intensity Readings

- Wide variation in output values
- Radiometers only give a relative indication of output for that light over time
- Comparison of output between LED and other light types is not valid

THE DENTAL ADVISOR Recommends:

- Allegro, Elipar Freelight 2, L.E.Demetron 1 and Smartlite iQ

Table:

<table>
<thead>
<tr>
<th>Product</th>
<th>Company</th>
<th>Cordless</th>
<th>Built-in Radiometer</th>
<th>Weight</th>
<th>Extra Battery</th>
<th>Spectra Wavelength Range, nm*</th>
<th>Cost</th>
<th>Clinical Rating</th>
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</thead>
<tbody>
<tr>
<td>bluephase</td>
<td>Ivoclar Vivadent</td>
<td>Yes**</td>
<td>Yes</td>
<td>9.5 oz.</td>
<td>Yes</td>
<td>430–490</td>
<td>$1,350</td>
<td>cc</td>
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<td>Coltolux LED</td>
<td>Colene Whaledent</td>
<td>Yes</td>
<td>No</td>
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<td>No</td>
<td>450–470</td>
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<td>Elipar Freelight 2</td>
<td>3M ESPE</td>
<td>Yes</td>
<td>Yes</td>
<td>7.8 oz.</td>
<td>No</td>
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<td>Flashlite 1001</td>
<td>Discus Dental</td>
<td>Yes</td>
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<td>3.6 oz.</td>
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<td>$695</td>
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<td>Smartlite iQ</td>
<td>DENTSPLY/Caulk</td>
<td>Yes</td>
<td>Yes</td>
<td>8 oz.</td>
<td>No</td>
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<td>L.E.Demetron 1</td>
<td>SDS/Kerr</td>
<td>Yes</td>
<td>Yes</td>
<td>12.9 oz.</td>
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<td>radii</td>
<td>Southern Dental Industries, Inc.</td>
<td>Yes</td>
<td>Yes</td>
<td>5.4 oz.</td>
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<td>Allegro #033959000</td>
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<td>Yes</td>
<td>Numeric value</td>
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<td>Yes</td>
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<td>$997</td>
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<td>the CURE</td>
<td>Spring Health</td>
<td>No</td>
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<td>TPC Uni-LED</td>
<td>TPC Advanced Technology</td>
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<td>UltraLume 5</td>
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</table>

*na = not available, ce = currently evaluating

Costs are listed for comparison only and are not used to calculate ratings. All costs are shown in U.S. dollars.

*As reported by the manufacturer.

**This product has an optional AC cord.

Editors’ Note: The Allegro is now available with a glass tip as well as two acrylic tips.