

- **Curing depths**
- **Curing depths correlate logarithmically with light intensity, basically following the law of diminishing returns. The improvement of curing depth is minimal with intensities over 800 mW/cm².**

Types of curing light

Basically we have four polymerization technologies: halogen, laser, plasma arc (PAC), and light emitting diode (LED).

Laser curing lights: Laser curing units can practically be disregarded at the present time. With their relatively high cost, they offer no significant advantages in curing efficiency when compared to standard halogen lights of similar intensity.

Plasma arc lights: With PAC lights the situation is similar. Their light intensity can be significantly higher than the strongest presently available halogen curing units, but this extra intensity is clearly in the range of diminishing returns for curing depth and curing time. What remains is additional heat, higher shrinkage stress, and a higher price tag.

- **L.E.D impressive base of 1,200 mW/cm² to a peak of approximately 1,600 mW/cm².**
- **We term it Periodic Level Shifting or PLS. PLS drives cool, continuous high output for a true 5-second cure without overheating intrapulpal tissue or the unit itself.**

Cool, continuous high output.

True 5-second cure. Consistent high-intensity output of PLS delivers a true 5-second cure for A3 or lighter shades.

- **Never shuts down. Whisper-quiet fan and unique thermal-control system partners with PLS to keep unit cool for uninterrupted operation. Extends life of the unit.**
- **Output never degrades. Battery provides consistent output throughout its entire charge.**

- **L.E.Demetron II with**

LED curing lights: Currently, many manufacturers are offering blue LED lights. Two main advantages stand out:

- 1. Relatively low power requirements, making battery-powered cordless units feasible.**

2. A narrow emission spectrum of around 468 nanometers, so filters are not required.

The emission spectrum lies in the optimal absorption range of camphor quinone. However, claims that the effective curing power is doubled when compared to the same measured light intensity with a halogen light are vastly exaggerated. Additionally, many adhesives and some composites (particularly so-called "bleaching shades") utilize catalysts that the LED lights cannot activate.

Without light emission in higher wavelength ranges, less radiant heat is produced. However, the LED light units themselves do get warm, and some presently available units exhibit overheating problems; their automatic shutdown feature requiring fairly long cooling periods. Additionally, with the exception of PAC lights and possibly very high-intensity halogen lights, most heat is produced by the exothermic reaction of polymerization and not the light source.

LED light intensity also decreases more rapidly than halogen light with increased distance between the light tip and the surface of the composite, which is clinically relevant because we cannot always place the tip directly on our composite resin

- At the moment, halogen lights appear to offer the best value for the money. A unit with a slow-start program is advisable, particularly if you frequently place large direct composite restorations. Higher intensities offer advantages for polymerization through indirect adhesive restorations.**

LED lights are extremely interesting, and no doubt progress will be made in coming years. At the moment, however, the disadvantages would appear to outweigh the advantages. Because of its portability, an LED light also could be considered an ideal reserve unit if your standard unit malfunctions

Radii

- highest intensity**
The higher the intensity, the more the light penetrates to cure the underlying restorative, thus achieving a higher depth of cure.
The Radii has the highest intensity available.
no noisy fan
The Radii does not require a fan. It uses heat sink technology to reduce the amount of heat emission. Furthermore, using a combination of pulse technology and steady current, the Radii can achieve a higher light output without generating excess heat.

ramp up mode

During the first 5 seconds, the Radii's light output power gradually increases. This minimizes polymerization stress in the restoration.

efficient energy use

The light emitted by the Radii corresponds to the maximum absorbance of camphorquinone ensuring efficient curing of most restoratives.

- **Built in radiometer**

The Radii's built-in radiometer provides a simple test to ensure the functionality of the light.

depth of cure

The greater the depth of cure, the more complete the curing of the restoration.

This ensures better marginal adaptation and longevity of the restoration.

Technical Data

- **Curing Light Handpiece wavelength range: 440 nm - 480 nm**
- **peak wavelength range: 460 nm**
- **ramp to full intensity: 5 seconds light**
- **intensity: 1400 mW/cm² (peak)**
- **duration of continuous use: 65 seconds total continuous run time with fully charged battery: 67 minutes**
- **dimensions: 25mm diameter x 243mm long**
- **weight: 155g / 5.4 ounces**
- **battery: 2 x 4.2V Lithium Ion - 1200 mAh Plug Pack**

"Soft-start" .

During early polymerization, the resin composite cross-linking network is relatively weak - allowing "flow" to fairly easily accommodate for stresses and prevent damage to adhesive bonds. With further polymerization, contraction and flow decrease, while stiffness and stress increase. This may cause adhesive failure.

- **The bond strength must exceed the contraction stress to provide a stable marginal adaptation.**
- **"Soft-start" polymerization proposes that a slower rate of conversion will allow better flow of resin with a decrease in contraction stress.**

- "Soft-start" polymerization may be divided into three separate techniques:
- A stepped program emits a low irradiance and then increases immediately to a maximum value for the duration of the exposure.
- In a ramped program, the irradiance gradually increases after which it remains constant for the duration of the exposure.
- Pulse delay uses a short low-level and finally a long exposure at full intensity.
- no difference.

• **Resin cure is inhibited by oxygen.**

. **For many years, dentists were often asked to refrigerate their composites**

To the contrary, the warming of composites to body temperature.

- **Curing depths**

Curing depths correlate logarithmically with light intensity, (basically following the law of diminishing returns).

Physical properties

First, it should be noted that the type of light used for polymerization is not the main factor influencing the strength or wear resistance of a resin composite. Any properly functioning curing unit can polymerize any composite adequately if the factors of layer thickness and polymerization time are taken into consideration.

Polymerization with a high intensity light can improve the flexural strength of a composite slightly and increase its modulus of elasticity. While the former would always be an advantage, the latter has

Disadvantages.

Shrinkage force

Faster polymerization leads to more rapid development of the elasticity modulus and, therefore, increases shrinkage stress

This has led to the development of "soft-start" polymerization units.

Reduction of shrinkage stress with soft-start polymerization is approximately 20%.

Temperature

The two sources of heat during light curing :

- 1-The exothermic reaction of polymerization
- 2-Heat produced by the light of the curing unit.
- Higher light intensities will produce more rapid polymerization and higher peak temperatures since the same exothermic energy is produced in a shorter time.
- Laser and LED curing lights produce the least additional heat.
- Halogen and plasma arc lamps, heat development is generally proportional to the intensity of the light,
- Also depends on the filters used by the manufacturers.
- The effect of heat on the pulp.

we should try to keep heat development to a minimum.

Factor influencing curing depth:

- 1-**The shade** and opacity of the composite resin. Therefore, if you worry about curing depths, change to a more transparent composite!

2-Time of polymerization

Required polymerization time relates both to intensity and the catalyst system of the resin composite.

- Doubling the intensity does not permit a 50% reduction in curing time due to the above mentioned energy reduction at increased depths as well as to incomplete energy absorption.
- At a depth of 2 mm, doubling the intensity permits a curing time reduction of only about 35%.

3-A composite can be manufactured to react quickly or more slowly. We will assume that composite "A" requires 40 seconds with 250 mW/cm² to polymerize well at a depth of 2 mm; composite "B" is formulated to require only 30 seconds. As we can see, with a light producing 1000 mW/cm², composite "A" would polymerize in about 16 seconds; composite "B" in about 13 seconds.

- Composites with a catalyst system designed for rapid curing have the disadvantage of higher sensitivity to ambient light, and the working time under operatory lighting is usually very short.

4-Depth of cure

The greater the depth of cure, the more complete the curing of the restoration.

This ensures better marginal adaptation and longevity of the restoration.

- **built in radiometer and Voltage control.**

The light intensity is affected by various clinical exposure uses.

1-It is recommended to place the light guide as close as possible to the surface of the light-cured adhesive.

- **The distance of approximately 10 mm may adversely affect the light intensity received by the light-cured adhesives.**

2-The performance of the light curing unit itself,

3-Light scattering is affected by shade, translucency, filler content, particle size, etc. Lighter shade shows a greater depth of cure because light can pass easily.

4-Enamel with darker color is related to decreased light transmission.

5- Close to the perpendicular as possible.

6-The maximum light intensity occurs when the surface of light guide is perpendicular to the surface of light-cured adhesives.

- **As the light guide is tipped, the circular spot changes to an ellipse, whose area is greater than that of the circular spot, and thus the light density is decreased. Tipping at 40° from the perpendicular decreased light intensity by 18%.**

7-During light exposure with transillumination, the light passes through the tooth structure including enamel and dentin. One mm of tooth structure was sufficient to reduce the light intensity to approximately 30% of its initial value.

- **The light intensity is also affected by the distance between the end of light guide and the surface of adhesive. The drop in light intensity with distance is exponential, and one mm of air reduces the light intensity by approximately 10%.**

6-Contaminations of light unit rod by composite.

7-Contamination with humidity.

8-Scan the light or fixed cure.

9-Diameter of the glass rod.

10-The performance of the light curing unit itself,

11-Light scattering is affected by shade, translucency, filler content, particle size, etc.

12-Enamel with darker color is related to decreased light transmission.

13-During light exposure the light passes through enamel and dentin.

One mm of tooth structure was sufficient to reduce the light intensity to approximately 30% of its initial value.

14-Placement of dental composite.

15-Post cure.

16-Plaque accumulation.

Light output diminished severely at distances more than two mm and was just by 25% of the maximum value at four-mm distance.

- **Clinically realistic distances of five to 10 mm would dramatically decrease the light intensity .**