Confidential report to:

Discus Dental

Depth of cure and Hardness of Various Composites Using Flash-lite, a new LED Curing Light

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By

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Title:

Depth of cure and Composite Hardness of Various Composites Using a new LED Curing Light

Introduction:

Conventional halogen light is the most common method of polymerizing dental composite restorations, however there has been a concern that the quality of the composite restoration will depend on the capability of the light source to adequately polymerize the resin within a specified exposure time. High intensity curing lights such as that of a laser or plasma arc have been developed to address the polymerization time. Recent findings suggested that these lights might polymerize adequately the outer layer but will under polymerize the deeper layers.

An alternative method to polymerize composite is by gradually increasing the light intensity, as to give the composite sufficient time to polymerize the deeper layers first. Research by Goracci (1996) has indicated that by slowly polymerizing the composite, marginal gap and microleakage are reduced.

Recently a new system of polymerization that is said to produce a better light source has become available. These new systems use a light emitting diode (LED) which produces a focused light source, less heat and are said to be portable.

The purpose of this study was to evaluate the polymerization hardness of a new LED light-curing lamp using multiple composites and shades. A conventional Quartz Halogen curing light was used a control

Methods and Materials:

The following composites and shades were used:

Matrixx Anterior Hybrid	Shades B1 and C3
Matrixx Flow	Shades B1 and C3
Matrixx Posterior	Shades B1 and C3
Matrixx Anterior Microfill	Shades B1 and C4

A specially fabricated specimen holder 6 mm in depth and 6 mm in diameter was placed on a glass slab, composite condensed, a cover glass plate placed on top and polymerized for 40 sec using the new LED or the halogen curing light.

The Knoop hardness of the top of the composite specimen was measured with a Leco M-400 H1 hardness tester and the readings averaged. Five locations were measured for each specimen and surface. The measurements were made within the first 30 minutes of polymerizing the specimen.

The specimen was then sectioned with a special circular saw very carefully to make sure that the specimen was kept cold. The specimen was lightly polished and measurements were made at 0.5 mm, 1.5mm, 2.5mm, 3.5 mm, 4.5 mm and 5.5 mm.

Results and Discussion:

The top surface hardness previously reported in other publications is not an indication of adequate polymerization at the floor of the cavity. It is of more clinical value to determine the polymerization depth of the composite using a light and a dark shade composite as comparisons.

The mean depth of cure hardness values are indicated in Tables 1-2 and Figure 1-6. Results of these materials and shades revealed that the shade and the product produced significantly different results.

Overall Halogen light produced a slightly higher Knoop Hardness numbers that the LED light but was not statistically different. An exception was Matrixx Posterior, in which the LED had higher values than the halogen light. Previous studies have indicated that a Knoop hardness number (KHN) of 50 to 60 for hybrid composites and 25 to 35 for microfilled composites will provide sufficient depth of cure on a composite as to not affect its physical properties. At 2.00 mm of depth, all the composites had a hardness above the minimum required

Matrixx AM C4 had the lowest polymerization depth that was measurable, which was at 2.5 mm.

The trend in the data indicates that the LED curing light (680 mW/cm2), with almost less than the light output than the halogen light (1000mW/cm2), is able to produce acceptable curing depths for all the composites.

Using a modified ADA depth of cure measurement (length of polymerized specimen divided by 2) all the composites achieved the minimum polymerization depth of 2 mm (Figure 6), except the C3 flowable composites that were below the 2 mm depth of cure.

Conclusions:

1.- An LED, with less light output than a halogen curing light was able to produce similar depth of cure for both light and dark composites.

2.- The Posterior Matrixx B1 and C4 had the highest Knoop Hardness number, while Anterior Microfilled Matrixx B1 and C4 had the lowest KHN.

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