

A Xenon Arc Light-Curing Unit for Bonding and Bleaching

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The disadvantage of the first ultraviolet curing lights was that one minute of curing was required per millimeter of thickness.^{1,2} The benzoin methyl ether component of the early light-cured composites was sensitive to light in the 340-nanometer spectrum.³ Because of safety concerns about the long-term use of UV light, however, visible light curing (VLC) was introduced around 1980. The camphoroquinone used in VLC resins is sensitive to light in the 470-nanometer range.⁴ VLC units, which usually have a tungsten-halogen light source, can cure each bracket in 40 seconds while achieving a greater curing depth than with ultraviolet units.⁵

The argon lasers introduced in the late 1980s and early 1990s are capable of curing in only 10 seconds for filled resins and five seconds for unfilled resins, at a wavelength of 488 nanometers. Argon lasers produce an even greater degree of polymerization than is possible with VLC units.⁶

More recently, xenon arc light units have been introduced for rapid light curing in restorative dentistry. The Plasma Arc Curing (PAC) System* (Fig. 1) has filters that narrow the spectrum of visible light to a band centered on the 470-nanometer wavelength for activation of the

*American Dental Technologies, 5555 Bear Lane, Corpus Christi, TX 78405.



Fig. 1 Plasma Arc Curing System.

camphoroquinone. This allows curing times to be as short as those with the argon laser. For orthodontic bonding purposes, since the amount of composite on each bracket base is very thin, only two seconds of curing time is needed per tooth.

Bonding Procedure

1. Clean the tooth surfaces to be bonded with a mixture of water and pumice, using a rubber polishing cup on a low-speed handpiece. Rinse with water to remove the polishing paste, and dry with an oil-free air syringe.
2. Etch the tooth surfaces for 30 seconds with 37% phosphoric acid (Fig. 2). Rinse with water, and dry the enamel completely.



Fig. 2 Enamel surface of right central incisor is cleaned, then etched for 30 seconds.



Fig. 3 Thin coat of resin primer applied to enamel.

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3. Apply a thin coat of resin primer (Fig. 3).
4. Place a small amount of composite resin on each bracket base. Position each bracket on the labial surface of the tooth with enough pressure to express excess adhesive.
5. Adjust the bracket positions as desired, and remove the excess adhesive.
6. Light-cure each bracket for two seconds with the PAC System (Fig. 4). Archwires can be inserted and ligated immediately after curing.

Discussion

Blankenau and colleagues evaluated the compressive diametral modulus of elasticity and transverse strength of a composite resin cured with PAC, VLC, and argon laser lights.⁷ After 24 hours, there was no significant difference in strength among the three curing units. The authors concluded that xenon light units produced physical properties similar to those of the argon and VLC lights, with a reduction in polymerization time similar to that of the argon laser. Other studies have demonstrated a significantly higher degree of polymerization with high-energy curing than with VLC units.^{6,8} Apparently, xenon lights act on a greater number of mole-

cules simultaneously compared to VLC lights.

Since the PAC System is able to cure composite resins through enamel, the light can be operated from the lingual. This produces optimal bonding of the bracket to the labial tooth surface, because composite resins are attracted by the light source when cured. With exposure time limited to two seconds per tooth, there is no need to be concerned about pulpal temperature effects.

The xenon light can also be used for tooth lightening, and thus offers an effective alternative to conventional bleaching systems (Fig. 5).

The reduced curing times made possible by xenon lights are advantageous for both the



Fig. 4 After bracket positioning and removal of excess adhesive, bracket cured with PAC System for two seconds.



Fig. 5 Patient before and after bleaching with PAC System.

patient and the orthodontist. Further clinical investigations comparing the failure rate of direct-bonded brackets cured with the PAC System to that of brackets cured with conventional VLC units are currently in progress.

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