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Led Curing Unit in Orthodontics - A Review

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ABSTRACT

Introduction of light-cured adhesives has given a great contribution and has been the greatest advances in the field of orthodontics. The most popular orthodontic adhesive is the light-cure composite resin. These adhesives have provided the practitioner the luxury of unlimited curing time. They have reduced the risk of contamination, easier removal of excess peripheral adhesive, and increased working time to position the brackets accurately on the teeth. Compared with the halogen curing system, LED lights can achieve clinical bonding success with shorter curing time. Curing-light manufacturers claim that by increasing the light intensity, less curing time will be required to reach adequate bond strengths.

Keyword: ***Halogen Curing System, LED light Cure Unit.***

1. INTRODUCTION

Dr. George Newman and Professor Fujio Miura introduced bonding of orthodontic brackets to enamel in the mid-1960s. Many inventions have occurred in the following decades, including various adhesives, refined base designs, different bracket materials, efficient and faster curing methods, self-etching and moisture insensitive primers and fluoride-releasing agents [1]. In 1974, Dentsply/Caulk (Milford, Del) introduced the first single-paste ultraviolet (UV) light curable bracket adhesive, Nuva Tach; a system that used a UV unfilled bonding resin (Nuva Seal) on the enamel and a single UV curable paste. This allowed indefinite working time to position brackets on the teeth and to clean the peripheral composite flash. However, these curing systems were reported to cause harmful effects on exposed skin and eyes and consequently, the use of these UV light cured systems was cut short. Later, in the early 1980s, visible light–cured restorative materials became available in dentistry. These materials gained increasing popularity in orthodontics for bonding brackets and fixed bonded retainers. Unlike UV curable paste, these adhesives contain camphor Quinone as a catalyst, which cures in the visible light range (440-480 nm) with a quartz-tungsten-halogen light which makes them safe for exposed skin and eyes, recently, a new high intensity LED (Woodpecker I-LED curing light) has become available in the market by the manufacturer of Woodpecker that aims of curing 2 mm of composite resin in 3 seconds.

2. COMPARISON OF LIGHT-EMITTING DIODE LIGHT CURING UNITS (LED LCUS), PLASMA ARC AND HALOGEN LCUS

Bikram reported that plasma arc showed a greater tendency for failure at the adhesive/tooth interface than LED and halogen light cure units [2]. Yaman reported that the LED light curing units was superior to halogen light curing units when micro hardness and curing depth properties were compared [3]. Hubbezoglu I in a study evaluated micro hardness of resin composites polymerized by three different light sources. The study reported that composites cured with light-emitted diode or halogen light yielded higher micro hardness values, whereas plasma arc yielded the lowest value, although it also appeared to depend on the type of composite cured [4].

3. HIGH INTENSITY LIGHT EMITTING DIODE CURING UNIT

There are 3 keys to light polymerization. These are intensity, proximity, and duration. Keeping these factors in mind, the operator must cure the composite for sufficient amount of time and should use enough intensity to polymerize the composite completely. Also, the distance from the bracket to the light curing unit must be optimum. Evaluation of LEDs with relatively low power densities, recommends curing time of 20 to 40 seconds for bonding orthodontic brackets. However, high-intensity LED lamps, with shorter curing times and an increased performance, have become currently available [5]. Krishnaswamy et al. [6] Pandis et al [7], Koupis et al. [8] and Mirabella et al. [9] compared the effect of short curing times with a high-intensity light-emitting diode and high-power halogen on shear bond strength of metal brackets. These studies have reported no significant difference in shear bond strength. Erion Cerekj in a study showed that the curing time of composite can be reduced to 6 seconds with high-power halogen light and to 10 seconds with high-intensity LED without compromising shear bond strength of metal brackets [10]. Justin D. Ward assessed the clinical performance of brackets cured with a high-intensity, light emitting diode (LED) with a shorter curing time. Both, conventional as well as experimental method, showed bond failure rates low enough to be considered clinically significant. It was concluded that the high intensity LED light used with a shorter curing time may be considered an advantage due to the reduced chair time.

4. WOODPECKER I-LED CURING LIGHT

A high intensity LED (Woodpecker I-LED curing light) has been launched by the manufacturer of Woodpecker that claims of curing 2 mm of composite resin in 3 seconds and primer in 1 second with the intensity of 3000 mW/ cw^2. This intensity is high enough to cure the composite and the time is low enough to cause the pulpal damage.

5. CLINICAL IMPLICATION

If the clinical bond failure of brackets bonded using high intensity LED curing light is insignificant and if the bond strength is found to be satisfactory then the clinical application of high-intensity LED curing lights for shorter irradiation times will be a clinically valid procedure that will save the chair side time without compromising results.

6. CONCLUSION

In clinical practice, various developments have evolved to reduce the chair side time. If the high intensity light provides satisfactory results, then the use of it may be advantageous in saving the time of both, the operator as well as the patient.

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