Assessment of Efficacy and Maintenance of Light-curing Units in Dental Offices Across Punjab: A Clinical Survey

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Abstract

Aims and Objectives: Curing units in dental offices across Punjab are analyzed for a practical purpose. Materials and Methods: One thousand light-curing units regularly used by the dentists in dental offices across the state of Punjab were examined for their output intensity. Various factors include as follows: type, power of light-curing unit, material molecule formation on tip (YES/NO), diameter of guide tip, and frequency of bulb replacement. A radiometer, a magnifying glass, and a Vernier caliper were used. Data were collected and analyzed. Results: About 75.80% of dentists use light-emitting diode (LED) lights, while 24.20% utilize halogen lamps to cure dental composites. 36.60% of light-curing units of the state had light intensity below 300 mW/cm², out of which 61.60% were quartz–tungsten–halogen (QTH) and 28.60% LED light-curing units. 17.40% of light-curing units recorded light intensity between 301 and 400 mW/cm². 46% of light-curing units registered an output intensity of >400 mW/cm². 79.60% of light units showed material particle buildup on light-curing tips. 62.40% of dentists never replaced the bulbs of their light-curing units. Two-third of dental the practitioners avoided infection control barriers on the tips of curing units. Conclusions: There is a deficit of knowledge among dental practitioners in Punjab regarding care of light-curing units. Dental light-curing units should be regularly checked and infection control remedies should be opted.

Keywords: Light intensity, light-curing unit, radiometer

INTRODUCTION

The utilization of visible light to cure dental materials has extended over ongoing years to include a wide range of items, including luting cements, temporary filling materials, periodontal pack materials, reline and impression materials, composite resins, glass ionomers, and bonding agents. Effective utilization of these items specifically depends on correct working of the visible light-curing unit.[1] Light restored composite resins depend on adequate light to accomplish satisfactory polymerization. The effect of the adequate intensity yield of curing lights in guaranteeing the life span of filling materials and keeping away from unfortunate clinical results is all around accepted.[2-3] As the curing light unit ages, the light yield reduces which prompts deficient polymerization causing minor breakdown, expanded wear, diminished quality, poor shading readiness and expanded water sorption, secondary caries, pulpal sensitivity, and diminished life span of the restoration.[1,3,4] To cure composite of 2-mm thick increment, a power of 400 mW/cm² is acceptable.[5] Light units with powers of under 300 mW/cm² are depicted in the literature as inadequate.[6] The strength of light-curing unit conversely corresponds to the diameter of light-curing tip.[7]

The power of curing lights is essentially lessened due to the presence of composite material development on curing tip.[7] Light-curing units are inclined to bacterial tainting after repeated utilization and various measures can be undertaken to decrease and prevent this. A dental radiometer ought to be utilized intermittently to gauge light intensity and decide if there is a requirement for bulb replacement. This estimation is made on a regular timetable either weekly or monthly, depending on frequency of utilization of the curing light.[8]
**Materials and Methods**

One thousand light-curing units routinely utilized by the dental practitioners in dental workplaces crosswise over Punjab were analyzed. Consent of the dental practitioner was obtained so as to inspect the light-curing unit in the operatory. Type, output power, diameter of light-curing unit, tip of curing unit, frequency of bulb replacement, and infection control barrier on the device tip were examined.

The radiometer was standardized by estimating the intensity of two curing lights of known intensity. One light-curing unit was light-emitting diode (LED) [Figure 1], while other was quartz-tungsten-halogen (QTH) [Figure 2]. The radiometer [Figure 3] was consistently checked against these light sources.

The yield intensity (mW/cm²) of all the examined light-curing units was sorted into three groups:

a. <300 mW/cm²  
b. In the middle of 301–400 mW/cm²  
c. >401 mW/cm²

- Examination of light-curing tip – Tip of the light-curing unit was inspected with magnifying glass for the presence/absence of material particles
- Diameter of light guide tip – Diameter of the light-curing tip was estimated with digital Vernier caliper
- Frequency of bulb replacement – Dental practitioners were addressed about the history of bulb replacement and their reaction was recorded likewise in months
- Exercising with infection control on the light-curing device tip – Dental practitioners were put to the question about the application of protection barriers on the light-curing device tip and their reaction was documented.

**Results**

The information gathered and analyzed demonstrated that 75.80% of dental practitioners utilize LED-curing lights, while 24.20% utilize QTH restoring lights to cure dental composites [Figure 4]. About 36.60% of light-curing units of the state had light intensity beneath 300 mW/cm², 17.40% of light-curing units recorded light intensity between 301 and 400 mW/cm², while 46% of light restoring units demonstrated a yield intensity of more than 400 mW/cm² [Figure 5]. 79.60% of light units showed material particle buildup on light-curing tips [Figure 6].

Only one-third of dentists used infection control barriers, while two-thirds did not use infection control barriers on the tips of...
Light-cured resin composites depend on adequate intensity of light to accomplish satisfactory polymerization. A yield force of 400 mW/cm² for 40 s is acceptable to completely cure a 2-mm thick increment. Under experimental conditions, light units with intensities of under 300 mW/cm² are considered as inadequate. The intensity of light-curing units ought to never dip under 300 mW/cm² to sufficiently polymerize a 2-mm thick increment of universal shade composite resin. Deficient polymerization of composite resins in more deeper layers cause diminished mechanical properties prompting minor breakdown, expanded wear, diminished quality, poor shading stability, expanded water sorption, and secondary caries.

The adherence of composite resin to the light tip diminishes the productivity of light-curing tips. This energy range is almost perfect for activating materials that utilize camphorquinone as a photoactivator. LED requires less power to work; therefore, these are with rechargeable batteries. This component makes them cordless, versatile, and moderately lightweight. Moreover, low-power requirement wipes out the need for a cooling fan since heat delivering infrared wavelengths are eliminated.

**Discussion**

The utilization of composite resins has expanded in the modern era as a result of expanding patient’s interest for all the more esthetically satisfying restorations and visible light-curing units have turned into an integral component of modern adhesive dentistry. QTH lights and LED units are utilized most often in everyday clinical practice. Three-fourth of dental practitioners of the state utilize LED, while just one-fourth utilize QTH-curing lights in dental facilities acrosswise over Punjab.

LED technology has a few points of interest contrasted with halogen relieving lights. To start with, unlike halogen lights, LED delivers light inside a limited spectral range. This energy range is almost perfect for activating materials that utilize camphorquinone as a photoactivator. LED requires less power to work; therefore, these are with rechargeable batteries. This component makes them cordless, versatile, and moderately lightweight. Moreover, low-power requirement wipes out the need for a cooling fan since heat delivering infrared wavelengths are eliminated.

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The adherence of composite resin to the light tip diminishes the productivity of light-curing tip tends to dissipate the light, extensively decreasing the yield power. In this way, the tip ought to be free of composite resin.

About 79.60% of light-curing units indicated composite resin material buildup on light-curing tip. Resin-based composite development has a critical negative impact on irradiance on the grounds that the resin-based composite material hinders the light output.

Light-curing units are utilized for a more extensive scope of clinical applications. As a result of lower irradiance values, bigger diameter tips might be less powerful than smaller diameter tips in polymerizing light-activated materials.
8 mm (91.30%) followed by 10 mm (8.70%) among dental practitioners across Punjab. The QTH lights have a constrained life expectancy of 100 h because of consecutive degradation during repeated working cycles. QTH bulb replacement ought to be supplanted every 6 months to guarantee ideal performance.\textsuperscript{[19]}

Tainting of light guides and light control unit (LCU) handles is common after clinical utilize. LCU and light guides utilized for curing resins ought not be in direct contact with oral tissues, which can be responsible of transmission of infectious agents from one patient to another.\textsuperscript{[18,20,21]}

About 68.10% dental specialists did not utilize contamination control barrier on the tip of light-curing units. The presentation of dental practitioners and auxiliaries to a variety of infectious agents is generally ignored. Light-curing devices are a potential wellspring of infectious diseases because of tainting of the light tip, which specifically contacts oral tissues.

**Conclusions**

From the present investigation, it can be presumed that there is an absence of awareness among dental practitioners in Punjab with respect to intensity and maintenance of light-curing units. Radiometer ought to be accessible in each dental office for occasional checking of light force of curing unit. Bulb of light-curing unit ought to be supplanted when the intensity of the light-curing unit falls beneath 400 mW/cm\(^2\). Tips of ought to be free from any sort of material molecule development. Light-curing tip of minimum diameter and disposable barrier tips ought to be utilized.

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**Conflicts of interest**

There are no conflicts of interest.

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