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Dental Curing Lights and its Health Risks: Is there any Solution?

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Abstract

Light-activated materials are used in Dentistry for many purposes such as teeth restoration, ceramic cementation and in general material adhesion. However, to be effectively light activated, these materials require high-irradiance blue light (from 420 to 495 nm). The high-irradiance curing LEDs used in Dentistry are capable of polymerizing dental light-activated materials in less than 10 seconds. However, despite the advantage over the light activation time, high-irradiance blue light is able to cause serious health risks. Thus, this short commentary will place the issues within dental curing lights and it health risks. Lastly, it will be presented thoughts for future considerations in the field.

Introduction

Light-activated materials are used in Dentistry for many purposes such as teeth restoration, ceramic cementation and in general material adhesion. These materials contain an organic matrix based on methacrylate monomers, which form a solid polymer at oral temperature after a polymerization reaction. The polymerization reaction initiates when the material is irradiated with a visible light spectrum that is capable of activating the photoinitiator system inside it.

Camphorquinone has been the most common photoinitiator in Dentistry since the 80s. However, to be effectively light activated, it requires high-irradiance blue light (from 420 to 495nm). Technological developments have enabled the production of light emitting diodes (LEDs) with high capacity of light emission (from 1000 to 6000 mW/cm^2) [1]. Thus, these devices are capable of polymerizing dental light-activated materials in less than 10 seconds [2]. However, despite the advantage over the light activation time, high-irradiance blue light is able to cause serious health risks.

Short visible wavelengths, such as the blue spectrum, are able to penetrate the human eye and sensitize the photoreceptor cells (cones) located in the macula near the central portion of the retina. The constant awareness of these photoreceptor cells causes a cellular oxidative stress process and the inflammation of the macula. Thus, chronic exposure to short visible wavelengths can cause the degeneration of the macula leading to progressive vision loss. Moreover, high-irradiance can accelerate this process [3]. Thus, dental curing lights pose risks to dentists and assistants who are constantly exposed to its radiation.

Exposure to high-irradiance blue light is necessary for dentists because they must place the dental curing light on the teeth and keep it stabilized during the light activation process [4]. This exposureis capable of producing irreversible damage to the eyes in just 5 weeks of clinical practice when blue-blocking goggles are not used [5]. However, even though these goggles are able to reduce the high-irradiance blue light to tolerable levels and its short-term effects [5-6], they are not capable of preventing the long-term cumulative effects of the blue light spectrum [6].

LEDs or laser emitting medium of long visible wavelengths (495 to 750 nm) might be an alternative with less health risks for Dentistry. These wavelengths are not able to promote severe damage to the photoreceptors of the human eye [3]. Other benefits could be associated with the use of these longer wavelengths. The red light spectrum (590 to 750nm), for example, is already used in photodynamic therapy [7]. This could attenuate the damages caused due to other dental procedures during tooth preparation. However, it is challenging, because long wavelengths have lower ionization energy and its use would require photoinitiators with high molar extinction coefficient in order to be as efficient as camphorquinone and high-irradiance blue light for dental light activated materials.

References

1. Shortall AC, Felix CJ, Watts DC. Robust spectrometer-based methods for characterizing radiant exitance of dental LED light curing units. Dent Mater. 2015;31(4):339-50. doi: 10.1016/j.dental.2015.02.012.
2. Randolph LD, Palin WM, Bebelman S, Devaux J, Gallez B, Leloup G, et al. Ultra-fast light-curing resin composite with increased conversion and reduced monomer elution. Dent Mater. 2014;30(5):594-604. doi: 10.1016/j.dental.2014.02.023.
3. Stamatacos C, Harrison JL. The possible ocular hazards of LED dental illumination applications. J Mich Dent Assoc. 2013;93(2):30-31.
4. Price RB, Felix CM, Whalen JM. Factors affecting the energy delivered to simulated class I and class v preparations. J Can Dent Assoc. 2010;76:a94.

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5. Labrie D, Moe J, Price RB, Young ME, Felix CM. Evaluation of ocular hazards from 4 types of curing lights. J Can Dent Assoc. 2011;77:b116.

6. Rassaei M, Thelen M, Abumuaileq R, Hescheler J, Luke M, Schneider T. Effect of high-intensity irradiation from dental photopolymerization on the isolated and superfused vertebrate retina. Graefes Arch ClinExpOphthalmol. 2013;251(3):751-762.

7. Holder MJ, Milward MR, Palin WM, Hadis MA, Cooper PR. Effects of red light-emitting diode irradiation on dental pulp cells. J Dent Res. 2012;91(10):961-966.