

## Biological effects of blue light on human gingival fibroblasts: an *in vitro* study

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**INTRODUCTION:** Studies of the effects of blue light on human cells report negative or positive impacts<sup>1, 2</sup> depending on the light sources and the type of cells used. Concerning exposure to blue light emitted by dental curing lamps, Wataha et al.<sup>3</sup> reported a negative impact of PAC- and QTH-light on human gingival fibroblasts (HGF). However no studies, to our knowledge, have investigated the impact of LED light on cells. Compared to QTH curing units, LEDs emit light with higher efficiency, produce less heat and have a longer lifespan. They are therefore becoming the more frequently used technology in dental practise. The aim of this study was to assess the effects of light emitted by a LED curing unit on the viability and morphology of HGF, respecting clinical procedures for use (distance, light intensity and time exposure).

**METHODS:** Fibroblasts were cultured from biopsies of clinically healthy human gingival tissues. The cells were irradiated at a distance of 9 mm, and the exposure durations and curing programs used were those recommended by the manufacturer to cure one layer of dental bonding and three layers of composites (Table 1), as can occur for deep restorations. The morphology of the HGF was observed by means of a scanning electron microscope. Viabilities of exposed and non-exposed cells (control group) were compared by means of the MTT assay.

	1 cycle (polymerization of bonding)	3 cycles (polymerization of dental resin)	Total duration
LED (Bluephase®, Ivoclar-Vivadent)	<b>Program LOP</b> (650 mW/cm <sup>2</sup> ) 20 s	<b>Program HIP</b> (1100 mW/cm <sup>2</sup> ) 3 × 20 s = 60 s	<b>80 s</b>

Table 1: Curing programs used for cell exposure.

**RESULTS:** Despite their exposure to blue light, microscopic analysis showed that irradiated cells presented a typical fibroblastic morphology (fig.1).

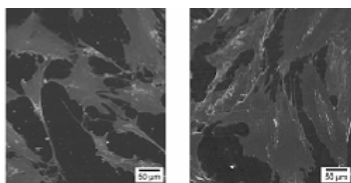


Fig.1: HGF observed by SEM (x 25): (left) control cells, (right) exposed cells.

The viability of cells exposed to the LED light was significantly greater than that of control cells 72h post-exposure (p=0.0275) (fig.2).

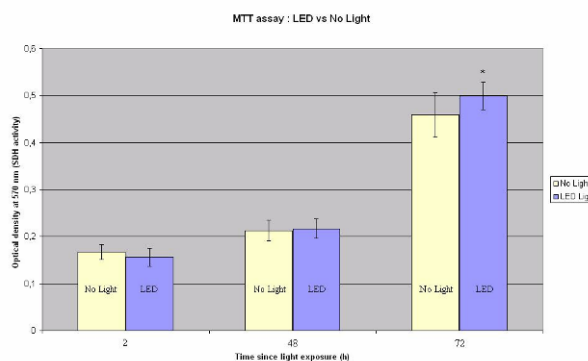


Fig.2: Effect of clinically relevant LED light exposure on HGF. Cellular mitochondrial SDH activity was measured (n=10 per condition) at 2, 48 and 72h post-exposure. Asterisk represents a significant difference between exposed and non-exposed cells (ANOVA, Tukey,  $\alpha=0.05$ ).

**DISCUSSION & CONCLUSIONS:** Cell morphology was unaffected, in the current study, by exposure to the LED light. Unlike Wataha et al., who found a decrease of HGF viability after exposure to PAC- and QTH light, this study showed a greater viability of exposed cells 72h post-exposure when compared to control cells. In conclusion, irradiation of HGF with a LED curing unit respecting a clinically relevant procedure did not alter cell morphology and even stimulated cell proliferation 72h post-exposure, another advantage of LED light.

**REFERENCES:** <sup>1</sup>B.F. Godley, F.A. Shamsi, F.Q. Liang, et al (2005) *Blue light induces mitochondrial DNA damage and free radical production in epithelial cells* J Biol Chem **280**:21061-21066. <sup>2</sup>J.B. Lewis, J.C. Wataha, R.L. Messer et al. (2005) *Blue light differentially alters cellular redox properties* J Biomed Mater Res B:**72**:223-229. <sup>3</sup>J.C. Wataha, J.B. Lewis, P.E. Lockwood, et al (2004) *Blue light differentially modulates cell survival and growth* J Dent Res **83**:104-108.

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