

## **Broadband wavelength LED inhibits growth of Porphyromonas gingivalis**

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**【Objectives】** It has been found that irradiation of visible light with a specific wavelength inhibits growth of Porphyromonas gingivalis (P.Gingivalis). The aim of this study is to examine the inhibitory effect on periodontopathogenic bacteria and the cytotoxicity after irradiation with broadband white LED based on our clinical application.

### **【Materials and Methods】**

3 types of periodontopathogenic bacteria and 3 types of oral streptococci controls were included in this study. The periodontopathogenic bacteria are *P. gingivalis* FDC381, *Actinobacillus actinomycetemcomitans* (Aa) Y4, and *Fusobacterium nucleatum* (Fn) ATCC25586. The controls are *Streptococcus mutans* MT6R, *Streptococcus salivarius* HHT, *Streptococcus sanguis* HA34.

Each sample is washed twice with isotonic sodium chloride solution after 24-28 hour culture in each liquid culture medium, adjusted to OD 0.3 at 540 nm, and then offered to the experiment. Blue LED NSSB100BT and white LED NSSW100DT (Both from Toyo Living Co., Ltd., Yokohama) are used as light irradiation device.

Growth inhibition test: a 6-well culture plate is used and the irradiation distance is fixed to 20 mm. Then serial dilution method is employed after 0.5, 1, 5, 10, and 15 minutes from irradiation, and colony forming method is employed on a sheep blood agar plate, or a sheep blood agar plate with Haemin and Vitamin K, or a BHI agar plate.

Cytotoxicity test: Subcultured KB cells and 3T3 cells are used. They are disseminated and grown to  $1 \times 10^4$  cells/well on a 48-well culture plate. After static cultured at 37 degrees C for 4 hours in a carbon dioxide incubator, the cells are irradiated by the light under the same condition with the growth inhibition test, then cultured for 24 hours in a carbon dioxide incubator.

After the culture, the cell survival rates are measured by Cell Quanti-Blue™ Cell Viability Assay Kit (Bioassay Systems, Hayward, CA) with fluorescence microplate reader Fluoroskan Ascent FL (Dainippon Sumitomo Pharma, Tokyo), which serve as the indicator of the cytotoxicity test.

**【Results】** Blue LED and white LED have not shown inhibitory effect on Streptococcus, Aa and Fn with 0.5-15 minute duration of action. However, 70-90% of growth inhibitory effect has been found on P.gingivalis with 5-15 minute duration of action. And cytotoxic effect on the 3 types of cells has not been observed.

**【Discussion】** This study indicates that broadband white LED inhibits the growth of P.gingivalis selectively and has no cytotoxicity, thus may well contribute to the inhibition of periodontopathogenic bacteria by application to the oral cavity.