

Thursday, 4:00 p.m. – 4:20 p.m. Salon 5

**DR. EUGENE SEIDNER STUDENT SCHOLAR:**

**Mechanism of Antimicrobial Effects of an 810-nm Diode Laser**

Elieza Tang, BS, Imran Khan, PhD, Praveen Arany, BDS, MDS, MMSc, PhD

National Institutes of Health, Bethesda, Maryland, USA

### **Introduction and Objective**

Human  $\beta$ -defensin-2 (hBD-2) is a small cationic peptide with antimicrobial properties of innate immunity. Oral fibroblasts can produce hBD-2 when stimulated by proinflammatory cytokines or antimicrobial agents. Low-power laser treatment has shown to generate reactive oxygen species in biological systems, which in turn activates the latent transforming growth factor beta-1 (TGF- $\beta$ 1) complex. TGF- $\beta$ 1 has been shown to induce the expression of hBD-2. The goal of this study was to examine whether the antimicrobial effects noted with laser treatment were mediated via expression of hBD-2 in human oral fibroblasts.

### **Design**

Human oral fibroblasts were laser treated with an 810-nm laser (AMD Lasers, Indianapolis, Ind., USA) (4 J/cm<sup>2</sup>): TGF- $\beta$ 1 (2.5 ng/ml), TGF- $\beta$  inhibitor (SB431542, 1  $\mu$ M), TGF- $\beta$  inhibitor with TGF- $\beta$ 1, and TGF- $\beta$  inhibitor with laser treatment. Expression of hBD-2 was evaluated at 24 hours using quantitative real-time polymerase chain reaction (qRT-PCR) analyses.

### **Results**

Cells treated with 4 J/cm<sup>2</sup> of 810-nm laser irradiation demonstrated significantly higher expression of hBD-2 compared to untreated cells. TGF- $\beta$ 1 induced hBD-2 expression as reported previously. However, pre-incubation of the TGF- $\beta$  inhibitor was noted to prevent the laser-induced hBD-2 expression.

### **Conclusions**

This study demonstrates a mechanism for the laser antimicrobial effects via activation of TGF- $\beta$ 1 and induction of hBD-2. In addition, hBD-2 has also been shown to promote fibroblast proliferation, suggesting it may have an important role in tissue repair. The antimicrobial effects of lasers could have a key role in protection against pathogenic microorganisms such as in periodontitis and other oral infections.

**Note:** This presentation discusses investigational devices that have not yet received U.S. FDA approval or clearance for the specified clinical indications, or describes off-label uses.

### **Educational Objective**

1. Identify the molecular mechanism of laser (810 nm)-induced expression of human  $\beta$ -defensin-2 in human oral fibroblasts.