Introduction and Objective

Human β-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-β1) complex. TGF-β1 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/cm²): TGF-β1 (2.5 ng/ml), TGF-β inhibitor (SB431542, 1 µM), TGF-β inhibitor with TGF-β1, and TGF-β 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/cm² of 810-nm laser irradiation demonstrated significantly higher expression of hBD-2 compared to untreated cells. TGF-β1 induced hBD-2 expression as reported previously. However, pre-incubation of the TGF-β 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-β1 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 β-defensin-2 in human oral fibroblasts.