

High-frequency low-level diode laser irradiation promotes proliferation and migration of primary cultured human gingival epithelial cells

Kenichiro Ejiri & Akira Aoki & Yoko Yamaguchi & Mitsuhiro Ohshima & Yuichi Izumi

Received: 29 October 2012 / Accepted: 25 February 2013
Springer-Verlag London 2013

Abstract In periodontal therapy, the use of low-level diode lasers has recently been considered to improve wound healing of the gingival tissue. However, its effects on human gingival epithelial cells (HGECs) remain unknown. The aim of the present study was to examine whether high-frequency low-level diode laser irradiation stimulates key cell responses in wound healing, proliferation and migration, in primary cultured HGECs *in vitro*. HGECs were derived from seven independent gingival tissue specimens. Cultured HGECs were exposed to a single session of high-frequency (30 kHz) low-level diode laser irradiation with various irradiation time periods (fluence 5.7–56.7 J/cm²). After 20–24 h, cell proliferation was evaluated by WST-8 assay and [³H]thymidine incorporation assay, and cell migration was monitored by *in vitro* wound healing assay. Further, phosphorylation of the mitogen-activated protein kinase (MAPK) pathways after

irradiation was investigated by Western blotting. The high-frequency low-level irradiation significantly increased cell proliferation and [³H]thymidine incorporation at various irradiation time periods. Migration of the irradiated cells was significantly accelerated compared with the nonirradiated control. Further, the low-level diode laser irradiation induced phosphorylation of MAPK/extracellular signal-regulated protein kinase (ERK) at 5, 15, 60, and 120 min after irradiation. Stress-activated protein kinases/c-Jun N-terminal kinase and p38 MAPK remained un-phosphorylated. The results show that high-frequency low-level diode laser irradiation promotes HGEC proliferation and migration in association with the activation of MAPK/ERK, suggesting that laser irradiation may accelerate gingival wound healing.

K. Ejiri · A. Aoki (✉) · Y. Izumi
Department of Periodontology, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8549, Japan
e-mail: aoperi@tmd.ac.jp

Y. Yamaguchi
Department of Biochemistry, Nihon University School of Dentistry, 1-8-13 Kanda-Surugadai, Chiyoda-ku, Tokyo 101-8310, Japan

M. Ohshima (✉)
Department of Biochemistry, Ohu University School of Pharmaceutical Sciences, Misumido 31-1, Tomitamachi, Koriyama, Fukushima 963-8611, Japan
e-mail: m-ohshima@pha.ohu-u.ac.jp

Y. Izumi
Global Center of Excellence (GCOE) Program, International Research Center for Molecular Science in Tooth and Bone Diseases, Tokyo Medical and Dental University, Tokyo, Japan