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Penetration Time Profiles for Two Class 3B Lasers in In Situ Human Achilles at Rest and Stretched

Daniel Huseby Bordvik, MSc, PT,[1–3] Sturla Haslerud, MSc, PT,[1,2] Ingvill Fjell Naterstad, MSc, PT,[1,2] Rodrigo Alvaro Branda˜o Lopes-Martins, PhD,[4] Ernesto Cesar Pinto Leal Junior, PhD, PT,[5] Jan Magnus Bjordal, PhD, PT,[1,2,6] and Jon Joensen, PhD, PT,[1,2,6]

Abstract

Background and objective: The majority of studies investigating penetration of laser light are performed in vitro on skin flaps, with measures of immediate penetration depth and energy loss. The aim of this study was to investigate the penetration time profiles for two different lasers used in low-level laser therapy, during 150 sec of exposure both in stretched and relaxed human Achilles in situ. Materials and methods: Thirty-four Achilles tendons from 17 healthy volunteers were irradiated by an 810 nm, 200mW, continuous- and a 904 nm, 60 mW, super-pulsed laser. Irradiation was performed with the Achilles tendons in relaxed and stretched condition. The energy penetrating skin–skin was measured every 30 sec using an optical power meter.

Results: The 810 nm laser penetration ability did not differ significantly in relaxed and stretched condition with 0.17% [standard error of the mean (SEM) 0.02] of mean output power (MOP) and 0.02% (SEM 0.004) of MOP, respectively. The 904 nm laser demonstrated a statistical significant ($p < 0.05$) and almost linear increasing penetration ability both in relaxed and stretched Achilles from 0.25% (SEM 0.03) to 0.38% (SEM 0.04) of MOP and from 0.05% (SEM 0.01) to 0.13% (SEM 0.01) of MOP, respectively. The penetrated ability differed between lasers and tissue conditions at all measure points ($p < 0.05$).

Conclusions: The 904 nm laser penetrates relatively more energy than the 810 nm laser in in situ human Achilles. Moreover, penetration from the superpulsed 904 nm laser increased during exposure time, whereas penetration from the 810 nm laser was constant. In addition, stretching the Achilles causes a higher energy attenuation by the tissue.