Skin penetration time-profiles for continuous 810 nm and Superpulsed 904 nm lasers in a rat model.

Joensen J¹, Ovsthus K, Reed RK, Hummelsund S, Iversen VV, Lopes-Martins RÁ, Bjordal JM.

Abstract

OBJECTIVE: The purpose of this study was to investigate the rat skin penetration abilities of two commercially available low-level laser therapy (LLLT) devices during 150 sec of irradiation.

BACKGROUND DATA: Effective LLLT irradiation typically lasts from 20 sec up to a few minutes, but the LLLT time-profiles for skin penetration of light energy have not yet been investigated.

MATERIALS AND METHODS: Sixty-two skin flaps overlaying rat's gastrocnemius muscles were harvested and immediately irradiated with LLLT devices. Irradiation was performed either with a 810 nm, 200 mW continuous wave laser, or with a 904 nm, 60 mW superpulsed laser, and the amount of penetrating light energy was measured by an optical power meter and registered at seven time points (range, 1-150 sec).

RESULTS: With the continuous wave 810 nm laser probe in skin contact, the amount of penetrating light energy was stable at ~20% (SEM±0.6) of the initial optical output during 150 sec irradiation. However, irradiation with the superpulsed 904 nm, 60 mW laser showed a linear increase in penetrating energy from 38% (SEM±1.4) to 58% (SEM±3.5) during 150 sec of exposure. The skin penetration abilities were significantly different (p<0.01) between the two lasers at all measured time points.

CONCLUSIONS: LLLT irradiation through rat skin leaves sufficient subdermal light energy to influence pathological processes and tissue repair. The finding that superpulsed 904 nm LLLT light energy penetrates 2-3 easier through the rat skin barrier than 810 nm continuous wave LLLT, corresponds well with results of LLLT dose analyses in systematic reviews of LLLT in musculoskeletal disorders. This may explain why the differentiation between these laser types has been needed in the clinical dosage recommendations of World Association for Laser Therapy.

PMID: 23025702 [PubMed - indexed for MEDLINE]