Lasers Med Sci
DOI 10.1007/s10103-017-2284-9

ORIGINAL ARTICLE

Photobiomodulation therapy by NIR laser in persistent pain: an analytical study in the rat

Laura Micheli[1] & Lorenzo Di Cesare Mannelli[1] & Elena Lucarini[1] & Francesca Cialdai[2] & Leonardo Vignali[2] & Carla Ghelardini[1] & Monica Monici[2]

Received: 1 March 2017 / Accepted: 5 July 2017

Abstract Over the past three decades, physicians have used laser sources for the management of different pain conditions obtaining controversial results that call for further investigations. In order to evaluate the pain relieving possibilities of photobiomodulation therapy (PBMT), we tested two near infrared (NIR) laser systems, with different power, against various kinds of persistent hyperalgesia animal models. In rats, articular pain was reproduced by the intra-articular injection of sodium monoiodoacetate (MIA) and complete Freund's adjuvant (CFA), while compressive neuropathy was modelled by the chronic constriction injury of the sciatic nerve (CCI). In MIA and CFA models, (NIR) laser (MLS-Mphi, ASA S.r.l., Vicenza, Italy) application was started 14 days after injury and was performed once a day for a total of 13 applications. In MIA-treated animals, the anti-hyperalgesic effect of laser began 5 min after treatment and vanished after 60 min. The subsequent applications evoked similar effects. In CFA-treated rats, laser efficacy started 5 min after treatment and disappeared after 180 min. In rats that underwent CCI, two treatment protocols with similar fluence but different power output were tested using a new experimental device called Multiwave Locked System laser (MLS-HPP). Treatments began 7 days after injury and were performed during 3 weeks for a total of 10 applications. Both protocols reduced mechanical hyperalgesia and hindlimb weight bearing alterations until 60 min after treatment with a higher efficacy recorded for the animals treated using the higher power output. In conclusion, this study supports laser therapy as a potential treatment for immediate relief of chronic articular or neuropathic pain.

Keywords NIR laser · PBMT · Osteoarthritis · Rheumatoid arthritis · Mononeuropathy CFA · MIA

Abbreviations

MIA	Monoiodoacetate
CFA	Complete Freund's adjuvant
CCI	Chronic constriction injury
NIR	Near infrared
PBMT	Photobiomodulation therapy

* Lorenzo Di Cesare Mannelli
lorenzo.mannelli@unifi.it

[1] Department of Neuroscience, Psychology, Drug Research and Child Health—NEUROFARBA —Pharmacology and Toxicology Section, University of Florence, Viale Pieraccini 6, 50139 Florence, Italy

[2] ASA Campus Joint Laboratory, ASA Res. Division —Department of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Florence, Florence, Italy

Published online: 28 July 2017