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Guest Editorial

The Necessity for Increased Attention to Pulsed Low-Level Laser Therapy

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The term low-level laser therapy (LLLT) is broadly defined as the therapeutic benefit of lasers. After Mester, in Hungary, first uncovered the therapeutic value of lasers, different wavelengths of continuous wave (CW) LLLT have been shown to promote healing in skin and musculoskeletal tissues. CW LLLT has been used in the treatment of serious medical conditions and for pain control.[1] However, the benefits of CW LLLT in cell proliferation and wound healing are controversial; numerous other authors have failed to observe positive effects of CW LLLT on cell proliferation, wound healing models *in vivo* and *in vitro*, and the repair of fractures and osteochondral defects.[2–8]

Both CW LLLT and pulsed wave (PW) LLLT devices are currently available. These devices provide medical practitioners with a wide range of therapeutic options. The PW LLLT device has more laser (illumination) parameters, such as peak and average power outputs, pulse frequency, and pulse duration, than CW LLLT, all of which add to the medical applicability of this technique.

It is assumed that by investigating different values of these parameters, researchers can select better protocols and achieve more satisfactory outcomes with PW LLLT devices than with CW LLLT devices. Barolet et al.[9] have investigated the impact of various light delivery modes on collagen production in human primary fibroblasts cultured in monolayers. The fibroblasts underwent three treatments with a red light-emitting diode illumination at 630 nm, irradiance of 8 mW/cm^2, total fluence of 1–33 J/cm^2, time duration of 1000 sec, pulse duration (PD) of 500 μs, pulse interval (PI) of 150 μs, four pulses per pulse train (PPT), and pulse train interval (PTI) of 1550 μs. The remainder of the reference light parameters remained constant. In this research, they evaluated two PDs, three PIs, four PTIs, and three PPTs compared with a CW light. The results showed that the manner in which the light was delivered impacted the cellular response. Sequentially pulsed optical energy was reported to be more efficacious in stimulating collagen production than the CW mode in a suction blister model.[9] Low PD (100 μs), PTI (750 μs), and four PPTs as well as high PI were the best pulsing parameter levels that enhanced collagen secretion in fibroblast cells.[9] Brondon et al. investigated the photoradiation outcome after delivery of 670 nm (10 mW/cm^2, 5 J/cm^2) light through a 0.025% melan via both the CW and PW delivery techniques at various frequencies. The PW photoirradiation had a significantly greater stimulating effect on cell proliferation and oxidative burst than did CW photoirradiation.[10]

These results agreed with recent work in my laboratory.[8,11–16] CW LLLT did not accelerate the osteochondral defect healing process in rabbits according to biomechanical evaluation,[8] nor did it accelerate the second and third degree burn healing process in rats.[11,12] Our studies showed that PW LLLT significantly increased the stiffness of repaired osteochondral tissue at the defective site in rabbits,[13] and accelerated the healing process in surgically induced open skin wounds, and in second and third degree burns in rats.[15,16] Despite the failure of some earlier studies to show positive effects of PW LLLT on the healing of radiation-induced wounds in mouse models[17] and in pressure ulcers in human patients,[18] other studies have reported positive effects of PW LLLT on healing pressure ulcers in patients,[19] and wounds in volunteers,[20] as well as wounds in animal models.[11–16]

In conclusion, the PW LLLT devices provide more laser (light) parameters than CW LLLT devices. It is assumed that by investigating different values of these parameters, research models can be more effectively studied in these devices compared with CW LLLT devices, with the purpose of achieving better outcomes.

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