

Irradiance vs. Dosage

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Relevance of laser irradiance threshold in the induction of alkaline phosphatase in human osteoblast cultures.

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Induction of matrix synthesis by low-level laser has been demonstrated extensively. However, the question of dose- or power intensity-dependency is under-investigated. To address this issue we chose human osteoblast cell cultures and measured their alkaline phosphatase (ALP) activity after laser irradiation. The cell cultures were irradiated periodically by 690 nm radiation via optical transmission fiber-based laser needles, reaching into the culture dishes. The osteoblasts showed no induction of ALP activity when we used a single laser needle stimulation with a laser irradiance of 51 mW/cm², an increase of approximately 43% at 102 mW/cm² irradiance (two needles per well) and a ninefold increase at 204 mW/cm² irradiance (four needles per well), leaving the temperature of the culture medium unaffected. We concluded that the osteoblastic response in ALP activity to a laser stimulus shows a logarithmic relationship, with a distinct threshold, rather than a linear dose-dependency. Secondly, the laser irradiance, rather than the dose, is relevant for the impact of the laser.