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The Effect of Low-Level Laser on Healing Of Jaw Fracture: Experimental Study

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Abstract:

The current study was conducted in an attempt to accelerate the healing process and minimizing the period of fixation of jaw fractures using low level laser therapy in respect to rate of callus formation. Material & Methods: This study was performed on twenty dogs, all of them were subjected to intentional fracture in their mandibles in both sides (right and left) and then were fixed using intra-osseous wiring , they were divided into 2 groups. Group I (3weeks groups) has received low level laser therapy (LLLT) to their left sides for the area of fractures post-surgery for 9 sessions while the right sides not subjected to laser and served as a control. Group II (6weeks group) has received low level laser therapy (LLLT) to their left sides for the area of fractures post-surgery for 15 sessions, while the right sides not subjected to laser and served as a control. The left sides were subjected to diode laser of 980nm wavelength for 2 minutes touching the outer surface of skin towards the fracture line. Results: There was a significant increase in bone density in the laser sides (left sides) of both groups comparing with the control sides (right sides). Conclusion: 1. Low level laser therapy was proved to have the ability to assist and accelerate the healing process of jaw fractures. It has a bio-stimulatory effect on osteoblast-like cells after laser irradiation and so shortens the duration of fixation of fractured bone.

The primary aim of this study is to assess, in an animal model, whether bio stimulation of osteoporotic bone with low-level laser therapy improves the Osseo integration of dental implants.

Twenty-two female rabbits were randomly divided into two groups: sham-ovariectomy and bilateral-ovariectomy. Laser therapy was applied to the implants placed in the right tibial bones and was not applied to implants placed in the left tibial bones. The periotest device was used for the stability test. Periotest values were recorded after the implantation and when the animals were euthanized. The removal torque test and micro-computed tomography examination were evaluated.

Dental implants are frequently used in prosthetic treatment with the aim of restoring the loss of esthetic and function. Osseo integration is very important in the success of dental implants and is defined as “the direct structural and functional connection between a load-bearing implant surface and bone”. One of the factors influencing the Osseo integration is the quality of the bone surrounding the implant. In the presence of intense bone, the percentage of implant-to-bone contact increases and the implant is more stable during recovery. Low or poor bone quality and insufficient primary stabilization are important reasons for implant failure. Osteoporosis is one of the diseases that cause low bone quality. It has been defined as a systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, with consequent increase in bone fragility and susceptibility to fracture. Osteoporosis-related changes in the jaws are not different from the changes in the other bones of the body. Bone density and quality in aging and osteoporosis are negatively affected by the decrease in cell proliferation, cellular synthesis activity, cellular sensitivity, and in the number of mesenchymal stem cells. Decreased bone mass and bone mineral density have been reported to cause delayed healing of fractures and bone repair. This increases the risk of failure in the integration of any biomaterial implanted into the osteoporotic bone. The need for developing different treatment modalities for the treatment of osteoporotic fractures, improving the Osseo integrations of biomaterials applied to those bones, and reducing the risks of failed Osseo integrations is critical. Low-level laser therapy (LLLT) as a promising treatment option induces osteogenesis and contributes positively to bone healing. LLLT has been successfully used to improve bone healing after tooth extraction and fractures of bones to accelerate orthodontic tooth movement. The stimulating effect of LLLT on bone is related to proliferation of fibroblasts and osteoblasts during mesenchymal differentiation. LLLT has also been reported to increase the number of collagen fibers in bones. The increase in tissue vascularization by LLLT stimulates the production of bone matrix and improves bone healing by the release of mediators. These positive effects of LLLT on bone healing are thought to improve Osseo integration of dental implants in low-density bones.

The predictor variable was exposure of bone defect to LLLT or none. The outcome variable was bone density changes measured by digital radiographs at day 1 and days 90 postoperatively. Descriptive and bivariate statistics were computed. There were no statistically significant differences between the 2 groups for the bone density at day 1. There was a statistically significant difference in bone density changes in each group at day 90: Significant at $P \leq 0.05$. After adjusting for differences in day 1 for bone density, the estimated mean change in bone density changes at day 90 was significantly larger for Laser compared with control.

The results of this study suggested that LLLT can enhance bone healing in maxillary cystic defects. This can serve as an adjunct

method in preventing possible delayed healing and pathological fractures this also will be helpful for more researchers in early loading in case of dental implants to accelerate Osseo integration.