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Combined New Technologies to Improve Dental Implant Success -- Quantitative Ultrasound Evaluation of NIR-LED Photobiomodulation

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Article Outline

Background: Dental implants must be placed in healthy bone for successful osteointegration and stability. Low bone density (LBD) and ischemically damaged, desiccated bone both have a poor ability to remodel and are, therefore, contraindications for implants. Readily available diagnostic imaging devices, including dental radiographs, lack the ability to adequately identify such bone. However, the new technology of through-transmission or quantitative ultrasound (QUS) is specifically cleared by the FDA tc safely identify LBD and dehydrated bone and has a very low (<3%) false positive rate. Near-infrared light emitting diode (NIR-LED) therapy or photobiomodulation has been shown ir cultured cells and animal models to stimulate bone healing and production. The present investigation uses QUS to determine the efficacy of in-vivo NIR-LED phototherapy to increase bone density and/or hydration of abnormal alveolar bone.

Methods: 68 patients received LED therapy (OsseoPulse, version 1.0, Biolux Research Ltd., Vancouver, Canada; 15 minutes daily for 3 months) to 294 QUS positive edentulous alveolar sites of LBD/desiccation. Before and after QUS scans were graded blindly by two independent observers (5-point scale: 0 = normal bone, 4 = most severe), after calibration, and compared using matched pair analysis.

Results: After NID-LED photomodulation the average grade improved from 2.43 to 1.33 (44.3% improvement), with 42% of sites returning to completely normal bone and 18.4% returning to grade 1. The mean difference (improvement of bone quality) of -1.11 was very statistically significant (matched pair analysis: Std error 0.06914; t-Ratio -15.9896; DF 293; prob less than 0.0001; 95% confidence interval 0.558-1.242).

Conclusion: NID-LED therapy seems to hold good potential for improving alveolar bone prior to implant placement, but long-term improvement must be evaluated, as must actual implant stability.

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