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Low-energy laser irradiation influences microcirculation in diabetic foot ulcers

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Background and aims: Low-energy laser beam irradiation has been demonstrated to augment wound healing. We sought to investigate its influence on microvascular blood flow. **Patients and methods:** 12 patients with diabetes mellitus (11 type 1, 1 type 2, average age 62.3 ± 10.2 years, HbA1c 8.97 ± 1.11 %, ankle/brachial index 1.18 ± 0.25) and chronic foot ulceration (area 4.0 ± 4.9 cm²) were included in the study. Laser-Doppler flowmetry was performed at the ulcerated site at baseline and after 5 sessions of pulsatile laser irradiation, frequency 4 Hz, power density 4 J/cm² (portable BTL - 2000 laser therapy device, power 100 mW, wavelength 830 nm) which were performed at two-day intervals. Spectral analysis of the flowmetry signal by wavelet transform revealed 6 characteristic frequency peaks: 0.005-0.0095Hz and 0.0095-0.021Hz, both reflecting endothelial activity; 0.021-0.052Hz, influenced by sympathetic nerve activity; 0.052-0.145Hz, reflecting myogenic activity; 0.145-0.6Hz, synchronous with respiration; and 0.6-1.6Hz, synchronous with heart rate. **Results:** At baseline, mean flow was higher in D than in C ($p=0.0077$), the amplitudes of the low frequency oscillations were lower (all $p<0.05$). One session of laser irradiation in D decreased the mean flow ($p=0.3408$, ns) and increased normalised amplitudes of all oscillations ($p<0.05$). After 5 sessions, mean flow in D, although lower than at baseline ($p=0.806$, ns), remained higher than in C ($p=0.9048$, ns). The amplitudes of the low frequency oscillations in D increased insignificantly, but remained lower than in C ($p<0.05$). **Conclusion:** Our results indicate that laser irradiation may enhance wound healing through a favourable influence on microvascular flow dynamics.