Abstract

Mandibular osteoradionecrosis is a serious chronic complication which may follow radiotherapy. Therapeutic ultrasound is a highly effective, inexpensive and readily available means of promoting revascularisation and healing. 'Long wave' ultrasound increases penetration depth and, therefore, seems to be more appropriate than traditional high frequency ultrasound. The aim of this study was to compare a new treatment using 45 kHz with the current standard 1 MHz machine. A traditional 1 MHz machine, pulsed 1:4, at intensities of 0.1, 0.4, 0.7 and 1.0 $W/cm^{2(SAPA)}$ was compared with a long wave machine, 45 kHz, at intensities of 5, 15, 30 and 50 $mW/cm^{2(SA)}$. The ultrasound was applied to human gingival fibroblasts and mandibular osteoblasts *in vitro*. Cell proliferation (DNA synthesis) and collagen and non-collagenous protein synthesis assays were performed, using radiolabelled thymidine and proline, respectively. Controls were sham-insonated and all readings were given as a percentage of controls. Fibroblast proliferation increased by 47% at 0.7 W/cm^2 (1 MHz) and by 43% at 50 mW/cm^2 (45 kHz), and osteoblast proliferation increased by 52% at 1.0 W/cm^2 (1 MHz), and by 35% at 30 mW/cm^2 (45 kHz). Fibroblast collagen production increased by 48% at 0.1 W/cm^2 (1 MHz), and by 44% at 15 mW/cm^2 (45 kHz) and osteoblast collagen production increased by 55% at 0.1 W/cm^2 (1 MHz) and by 112% at 30 mW/cm^2 (45 kHz). Long wave ultrasound was, therefore, capable of inducing a comparable or even higher enhancement of bone formation compared with traditional ultrasound, which, with its greater penetration, may accelerate the healing effect of ultrasound on osteoradionecrosis. The suggested intensity for 45 kHz ultrasound is 30 mW/cm^2.