Ultrasound Modulates Pro-inflammatory Cytokine Release in Soft Tissue.

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Introduction: Ultrasound therapy promotes cytokine release in vitro[1] and has been suggested to improve the healing rates of pressure ulcers[2]. Unfortunately much of the evidence is conflicting, and it is difficult to draw firm conclusions on effectiveness[3]. Traditionally US is thought to promote the release of proinflammatory cytokines and speed up the inflammatory phase of tissue repair[5]. Thus the aim of this study was to investigate the effect of US on proinflammatory cytokine release in vivo.

Methods: Fifteen healthy volunteers were recruited following ethics approval. Microdialysis fibres were implanted at a depth of 1mm at two separate sites on the volar aspect of the non-dominant forearm. The fibres were perfused with PBS (3µl/min) and each site randomly allocated to receive either non thermal low intensity US at a pulse ratio of 1:4 and an intensity of 0.5 W/cm^2 and sham ultrasound (SUS) for 10 minutes. Dialysate was collected for 30 minutes prior to intervention and every 30 minutes following intervention and pro-inflammatory cytokines (IL-1ß, IL-6, IL-8, TNFα) quantified via immunoassay.

Results: The mean (± SEM) baseline concentrations of IL-1ß, IL-6, IL-8 and TNFα were 0.9 (0.2), 3.5 (0.8), 14.3 (4.1) and 0.3 (0.08) pg/ml. There was no significant difference in baseline values between the two sites. A significant ($p<0.05$) increase in all cytokines from baseline was observed following the application of sham US, with the mean (± SEM) concentrations of IL-1ß, IL-6, IL-8 and rising to 2.8 (0.5), 11.4 (1.6), 31.6 (3.6) and 0.8 (0.2) pg/ml. In contrast the increase seen in all cytokines, except TNFα, following HFUS was significantly ($p<0.01$) reduced, the mean (± SEM) IL-1ß, IL-6, IL-8 and TNFα concentrations being 0.8 (0.1), 5.6 (0.7), 20.1 (2.3), and 0.4 (0.05) pg/ml (Figure 1).

Discussion: This study demonstrates that US is able to modulate cytokine release in the superficial soft tissue and significantly reduces the release of proinflammatory cytokines compared to sham US.

Clinical relevance: This suggests that current thinking concerning the mechanism of action of therapeutic US may need to be re-evaluated, and further studies are needed to explore the mechanisms involved and the potential benefits to the management of pressure ulcers.

References:

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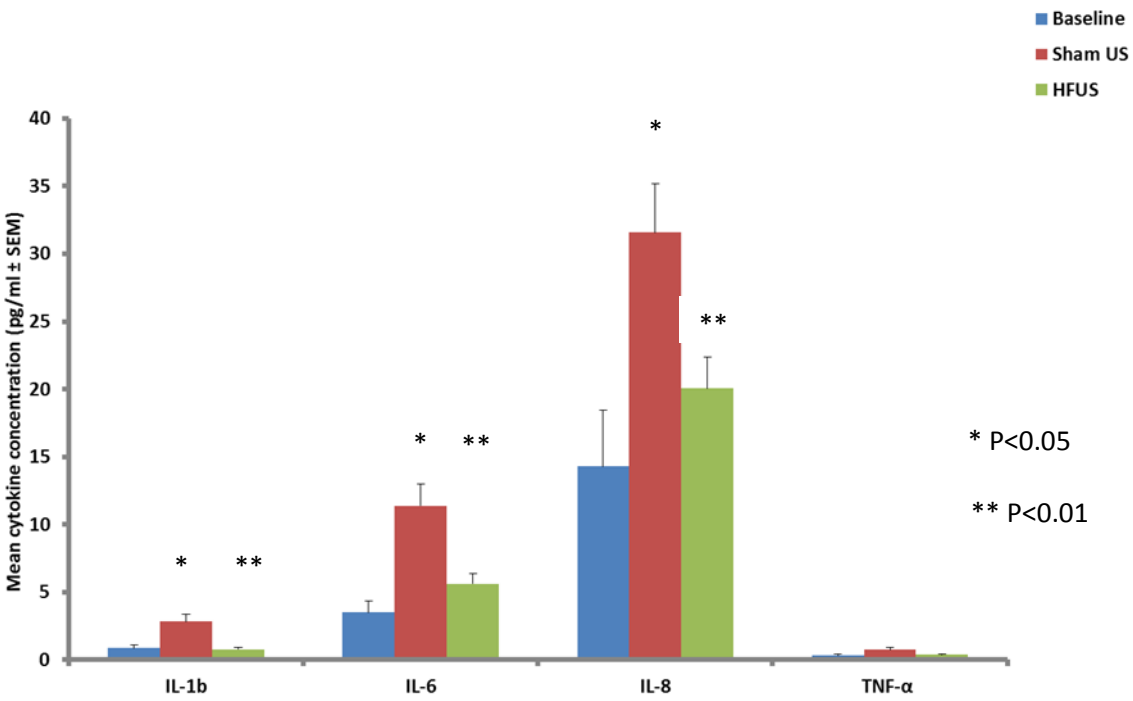
Baseline
Sham US
HFUS
Mean cytokine concentration (pg/ml ± SEM)
40
35
30
25
20
15
10
5
0
*
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*
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*
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IL-1b
IL-6
IL-8
TNF-α
* P<0.05
** P<0.01