Effects of mild electro-stimulation (Bodyflow™) treatment on healthy humans following exercise induced muscle damage.

Simon Sostaric; Alan Pearce; Bradley Gatt; Michael J McKenna; Christos Stathis and Craig Goodman. (2007).

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Exercise induced muscle damage has been widely reported in healthy humans, and characterised by morphological changes in muscle; protein leakage to the circulation; acute inflammatory responses; muscle dysfunction and subsequent soreness. The lymphatic system contributes to regulation of leaked fluid and plasma proteins, as well as producing lymphocytes. A recent study demonstrated that manual lymph drainage after treadmill exercise was associated with a faster decrease in serum levels of muscle enzymes (Schillinger et al 2006). More recently, low frequency electro-stimulation treatment (Bodyflow^{TM}) increased femoral venous velocity (24%) and blood flow (19.5%) and decreased P-selectin (15.9%) in healthy humans (Parsi et al 2007). Bodyflow^{TM} treatment also reduced fluid and limb volume by 30% and 15% respectively, in secondary lymphoedema patients (Piller et al, 2007). Theoretically, Bodyflow^{TM} treatment will accelerate recovery following muscle damage via an acute increase in lymphatic drainage and blood flow.

Sixteen healthy volunteers (11 M, 5 F) gave written informed consent to participate in the study. Volunteers were required to attend the laboratory on 8 separate occasions. The first two visits included baseline and variability exercise trials, including isotonic knee extension, vertical jump, and 90% VO_2 WR_{peak} to fatigue on a cycle ergometer; the third visit included a bench step test to induce muscle damage (45min, alternating feet, 15 steps per minute). Blood was collected from an antecubital vein prior to the step test, immediately after, and each morning thereafter for 7 days. Experimental (EXP) or control (CON) treatment (single blind, randomised) was administered for 20min immediately following the muscle damage step test, and for 7 days thereafter. Exercise trials and visual analogue pain scales (VAS) were also repeated each day prior to treatment.

No significant differences were found between the CON (n=8) and EXP (n=8) groups (mean ± SD) for age (CON 32±2.9 vs EXP 31.9±5.3 yrs), body mass (CON 73.9±10.3 vs EXP 73.2±15.3 kg), and VO_{2max} (CON 3.36±0.3 vs EXP 3.01±0.4 $L.min^{-1}$). There was a rapid increase in c-RP above baseline (5-fold at +2 days), following the muscle damage test in CON (FIG 1A, $P<0.05$), and was systematically higher than EXP each day, with a peak difference of 4.4-fold at +2 days (FIG 1A, $P<0.05$). CK increased above baseline in both trials (FIG 1B, $P<0.05$), and there was a tendency for CK to be greater at +1 day post damage in CON (FIG 1A, $P=0.08$). There was no time or condition effect for LDH (FIG 1C). Mb increased 3.4 and 2.9 fold, immediately post muscle damage for CON and EXP respectively (FIG 1D, $P<0.05$), but there was no condition effect. Leg extension force decreased at 180°s in both trials following muscle damage, continued to decrease in CON until +3 days, however, muscle force was re-established by +1 days in EXP (FIG 2B, $P<0.05$). Vertical jump decreased immediately following the step test (FIG 2A, $P<0.05$), however, vertical jump and 90% VO_2 WR_{peak} were not significantly different between trials. Subjects reported a significant increase in leg pain from baseline up to four days post muscle damage (FIG 3A, B, C, $P<0.05$), though not different between trials.

Bodyflow^{TM} treatment attenuated the rise c-RP and CK following exercise induced muscle damage compared to the CON group, suggesting decreased inflammation and damage, or accelerated recovery, which may in part be due to increased lymphatic and blood flow. The mechanisms responsible for these responses are at this point unclear, and require further investigation.

FIG 1

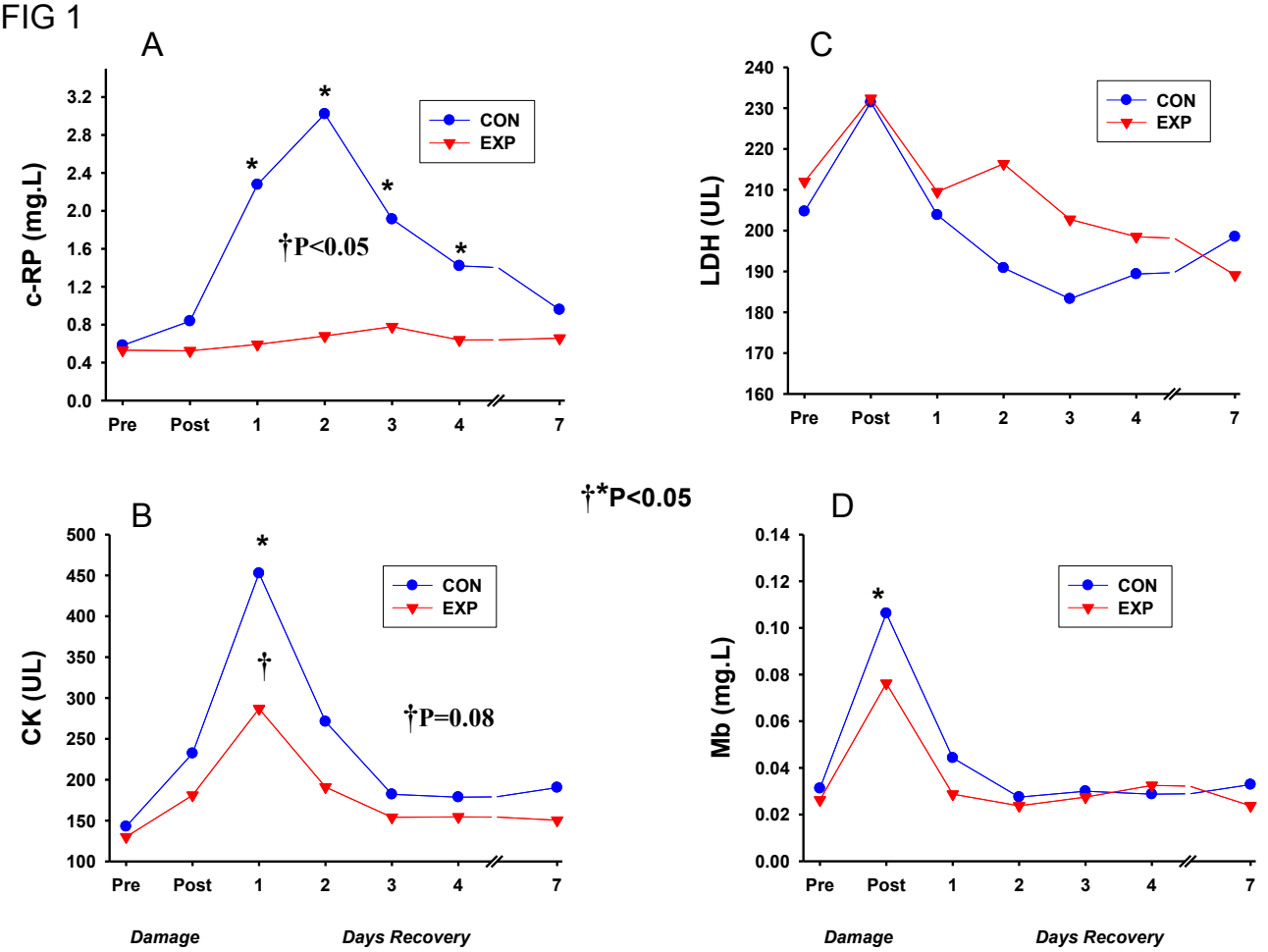

A
c-RP (mg.L)
CON
EXP
†P<0.05
C
LDH (UL)
B
CK (UL)
†P=0.08
D
Mb (mg.L)
Pre
Post
1
2
3
4
7
Damage
Days Recovery
†*P<0.05

FIG 2

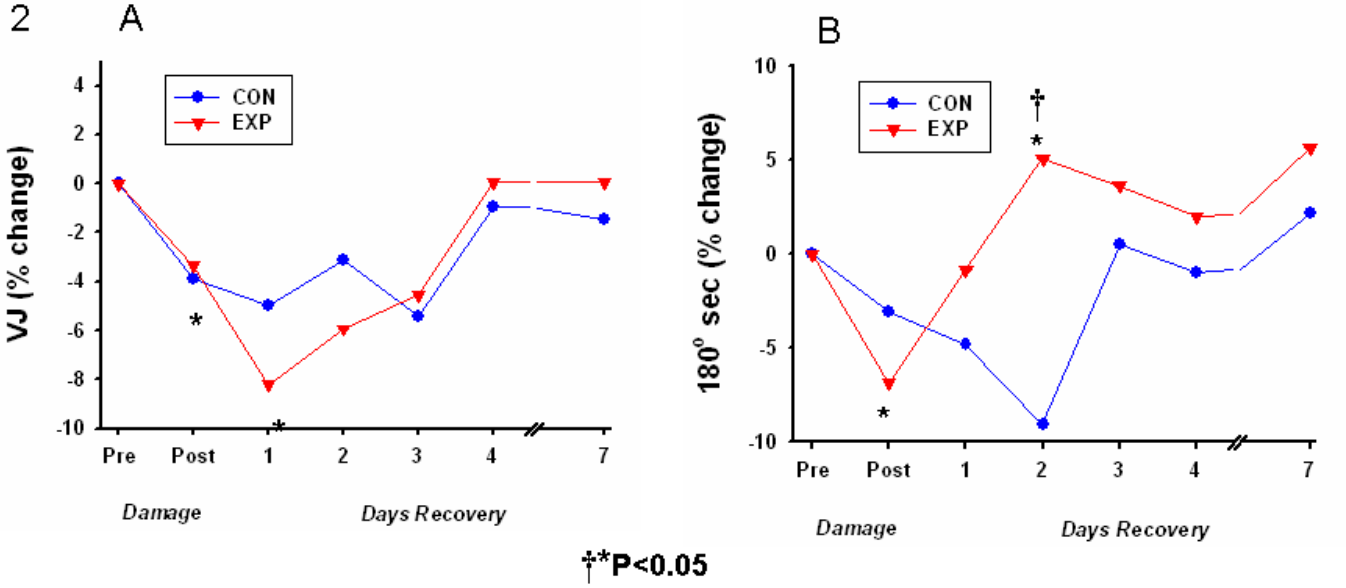
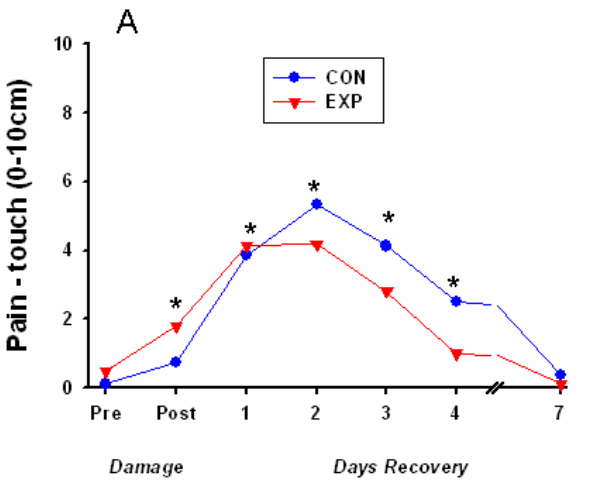
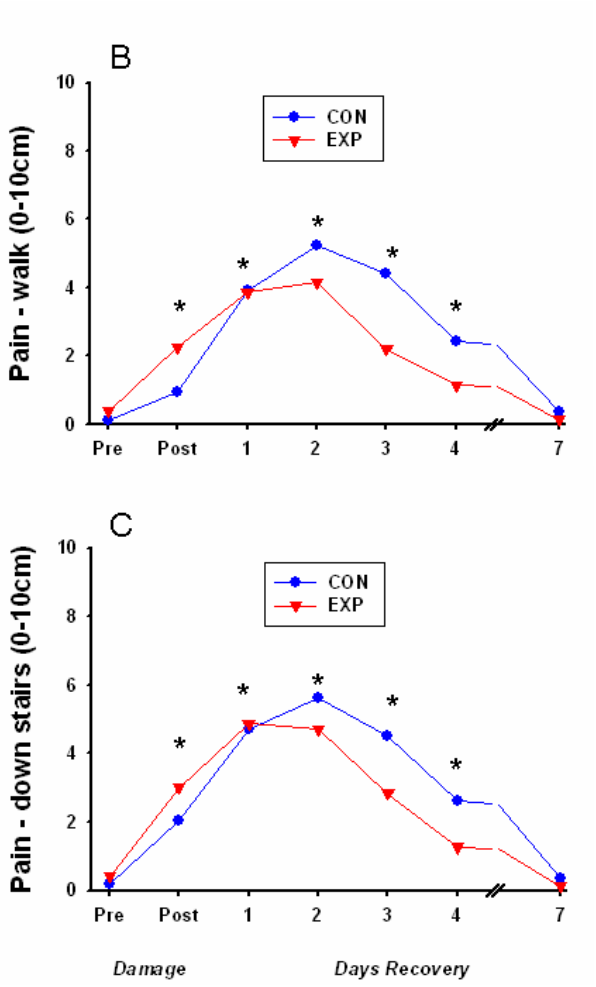

A
VJ (% change)
CON
EXP
B
180° sec (% change)
Pre
Post
1
2
3
4
7
Damage
Days Recovery
†*P<0.05

FIG 3





*** P<0.05**
Time main effect