

# Physiological effects of connective tissue manipulation on diabetic foot ulcer

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**Background:** Connective tissue manipulation (CTM) is a specialized manual therapy technique which causes mechanical and autonomic reflex effects in the peripheral vascular system resulting in peripheral vasodilatation. Therefore it is of interest to study the clinical effects of CTM on diabetic foot ulcer, as the diabetic foot (ischemic foot) is compromised with impaired peripheral blood circulation leading to ulceration and amputation. Hence the main objective of this pilot study is to evaluate the physiological and therapeutic effects of CTM on diabetic foot ulcer.

**Methods:** This was a pre and post interventional design – a non randomized control trial that was performed on 20 subjects with diabetic foot ulcers. The subjects were divided randomly into two groups who underwent conventional treatments for diabetic foot ulcer as usual treatment, but CTM was only applied for the intervention group (Group 1) additionally. Doppler ultrasound, skin thermometry, wound acetate tracing and bacterial colony forming unit (CFU) count in the wound were used as outcome variables to monitor weekly changes of ankle brachial pressure index, skin temperature of the foot, wound surface area and bacterial colonization in the wound during the 6-week intervention period. Repeated ANOVA measures, paired t test, U Mann Whitney and partial eta square analysis were performed.

**Results:** The intervention group (Group 1) had a large effect size (partial  $\eta^2=0.144$ ) with moderate power (58.9%) and showed positive changes of ABPI indicating peripheral vasodilatation effects. The moderate to large effect size and power of study indicated the probability of result would be significant if the sample size was increased. In the aspect of wound healing, the wound surface area was significantly reduced ( $p<0.05$ ) ( $p=0.004$ ,  $t=3.82$ ,  $df=9$ ,  $CI_{\text{lower}} -0.98_{\text{upper}} -3.8$ ) after six weeks of intervention in CTM and the control groups, respectively. The bacterial colonization counts were significantly decreased ( $p<0.05$ ) in both CTM and control groups. However, the difference in mean reduction of bacterial colony forming (CFU) unit and the reduction of wound surface area after six weeks between groups showed significant difference ( $p<0.05$ ). The interventional group showed better results than the conventional treatment group.

**Conclusion:** This study explored the clinical effects of the CTM on ABPI, skin temperature, reduction of wound surface and bacterial colonization count. It was found that CTM when administered along with the conventional treatment showed a significant trend to improve peripheral circulation. This study also provides evidence for enhanced wound healing effects among diabetic foot ulcers by a combined therapy of CTM and conventional treatment.