

Modeled Repetitive Motion Strain and Indirect Osteopathic Manipulative Techniques in Regulation of Human Fibroblast Proliferation and Interleukin Secretion

Kate R. Meltzer, MS; Paul R. Standley, PhD

Context:

Clinical studies have supported the efficacy of a variety of osteopathic manipulative techniques. However, an evidence base for the cellular mechanisms underlying these clinical findings is lacking.

Objective:

To investigate human fibroblast proliferation and interleukin secretory profiles in response to modeled repetitive motion strain (RMS) and modeled indirect osteopathic manipulative techniques (IOMT). The authors hypothesized that the RMS model would increase fibroblast proliferation and proinflammatory interleukin secretion, while the IOMT model would reverse these effects.

Methods:

Human fibroblasts were exposed in vitro to one of three conditions: (1) an 8-hour RMS; (2) a 60-second IOMT; or (3) an 8-hour RMS followed by a 60-second IOMT. Data on fibroblast proliferation and interleukins present in conditioned media were obtained immediately after RMS, at 24 hours after RMS (24RMS), at 24 hours after IOMT (24IOMT), and at 24 hours after RMS and IOMT (24RMS+IOMT). Cytokine protein array and enzyme-linked immunosorbent assay were used in data analysis. Fibroblast proliferation was also measured colorimetrically with a cell proliferation assay.

Results:

Fibroblasts that underwent RMS secreted several proinflammatory interleukins 24 hours after strain cessation, with substantially increased secretion of IL-1, IL-1 β , IL-2, IL-3, IL-6, and IL-16. At 24 hours after strain cessation, fibroblasts subjected to RMS also secreted increased amounts of the anti-inflammatory IL-1ra, and they displayed 15% less proliferation, compared with baseline cells ($P<.05$). Fibroblasts that underwent IOMT, when analyzed at 24 hours after IOMT, did not display increased interleukin secretion or proliferation. However, they did display a 44% reduction in proinflammatory IL-3 secretion when compared with baseline cells ($P<.05$). The use of 24RMS+IOMT did not induce interleukin secretion in fibroblasts that were analyzed 24 hours after the combined exposure. However, cells in the 24RMS+IOMT group did display a 46% reduction in proinflammatory IL-6 secretion compared with RMS alone (24RMS; $P<.05$), as well as a 51% increase in proliferation compared with the 24RMS group ($P<.05$).

Conclusion:

An in vitro strain model that simulates RMS has different effects on fibroblast proliferation and interleukin secretion than does an in vitro model that simulates IOMT. Modeled RMS appears to cause a reduction in fibroblast proliferation and a delayed inflammatory response. Modeled IOMT not only fails to induce this response, it also reverses inflammatory effects in cells that have been strained repetitively. Data from the present study suggest that fibroblast proliferation and expression/secretion of proinflammatory and anti-inflammatory interleukins may contribute to the clinical efficacy of indirect osteopathic manipulative techniques.