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Manual Mobilization of Subcutaneous Fibrosis in Mice

Mariane Altomare, MSc, and Andréa Monte-Alto-Costa, PhD

Abstract

Objective: The aim of this study was to induce the remodeling of subcutaneous fibrosis in mice by the manual mobilization of skin and subcutaneous tissue.

Methods: Seven days after the induction of subcutaneous fibrosis, mice were divided into 3 groups: control, stretch, and manual mobilization. Stretch was achieved by elongating the trunk, and manual mobilization was achieved by using the indicator fingertip of both hands, side by side, touching the back and performing a brief stretch. Stretch or manual mobilization was performed once a day for 7 days.

Results: Fibrosis was present in the subcutaneous tissue of control animals, whereas brief stretch and manual mobilization were found to reduce fibrosis.

Conclusions: Mechanical stimulation through manual mobilization, or brief stretching, reduced subcutaneous fibrosis after tissue injury. (J Manipulative Physiol Ther 2018;xx:1-4)

Key Indexing Terms: *Fibrosis; Extracellular Matrix; Musculoskeletal Manipulations; Mice*

Introduction

The wound healing mechanism after an injury is one of the most complex processes occurring in multicellular organisms. In mammals, the typical response to an injury is fibrotic scar formation, which re-establishes tissue integrity and function.[1] Adult human wounds heal with some degree of scar formation that may compromise function and appearance, and an estimated 230 million major surgical procedures are performed worldwide each year.[2,3] After skin injury, the mechanophysiological conditions drastically change during wound healing and considerably influence the degree of scarring.[4] The result can be a fine, thin scar that is barely perceptible or an exuberant fibrosis that can be dysfunctional and disfiguring.[5]

Extracellular matrix (ECM) component-accumulation, mainly collagen, and increased tissue stiffness are common features of fibrosis.[6] This accumulation alters the tissue mechanical properties, which, in turn, can deleteriously affect organ function.[7] Cells sense and respond to the ECM rigidity, which can regulate cell growth,[8] migration,[9] and differentiation.[10,11] Extracellular matrix rigidity also affects other parameters associated with fibrosis, including the deposition and organization of its own ECM.[12] It is now very clear that tissue stiffness may precede fibrosis or at least contribute to the ongoing fibrosis.

It is a common belief that once fibrosis has begun, it cannot be reversed. However, recent studies have illustrated that fibrosis can be reversed.[13] These studies suggest that alteration in the biomechanical properties of the ECM may be an important therapeutic target and that it is possible to modulate myofibroblast formation and fibrosis.[12] The aim of this study was to induce the remodeling of subcutaneous fibrosis in mice by the manual mobilization of skin and subcutaneous tissue.

Methods

All procedures in this study were carried out in accordance with Brazilian legislation for experimentation with animals (n° 11.794, October 8, 2008). In addition, this study was approved by the Ethics Committee for the Use of Animals of the State University of Rio de Janeiro (0011/2012).

In Vivo Microinjury Study Design

Male Swiss mice, 12 weeks old, underwent a subcutaneous microsurgical injury on the subcutaneous tissue of the dorsal region, as previously described.[14] Seven days later, the animals were divided into 3 groups: the control group (n = 5), in which no treatment was performed; the stretch group (n = 5), in which the animals were stretched

Tissue Repair Laboratory, Rio de Janeiro State University, Rio de Janeiro, Brazil.

Corresponding author: Andréa Monte-Alto-Costa, PhD, Tissue Repair Laboratory, Rio de Janeiro State University, Av. Mal. Rondon, 381 HLA 20950-003, Rio de Janeiro, Brazil. Tel.: +55 21 2334 2421. (e-mail: *amacosta.uerj@gmail.com*).

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