

Mechanisms of Mechanotransduction in Bone

Remodeling.

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Abstract

Mechanotransduction is the physiological process where cells sense and respond to mechanical loads. This paper reclaims the term "mechanotherapy" and presents the current scientific knowledge underpinning how load may be used therapeutically to stimulate tissue repair and remodelling in tendon, muscle, cartilage and bone. The purpose of this short article is to answer a frequently asked question "How precisely does exercise promote tissue healing?" This is a fundamental question for clinicians who prescribe exercise for tendinopathies, muscle tears, non-inflammatory arthropathies and even controlled loading after fractures. High-quality randomised controlled trials and systematic reviews show that various forms of exercise or movement prescription benefit patients with a wide range of musculoskeletal problems.¹⁽⁻⁾⁴ But what happens at the tissue level to promote repair and remodelling of tendon, muscle, articular cartilage and bone? The one-word answer is "mechanotransduction", but rather than finishing there and limiting this paper to 95 words, we provide a short illustrated introduction to this remarkable, ubiquitous, non-neural, physiological process. We also re-introduce the term "mechanotherapy" to distinguish therapeutics (exercise prescription specifically to treat injuries) from the homeostatic role of mechanotransduction. Strictly speaking, mechanotransduction maintains normal musculoskeletal structures in the absence of injury. After first outlining the process of mechanotransduction, we provide well-known clinical therapeutic examples of mechanotherapy-turning movement into tissue healing.