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The role of the tenocyte in tendon ossification: inherent plasticity or environmental cues?

Objectives and significance of the research: The injury or degeneration of tendon as a result of an accumulation of age- and exercise-related damage, has become an increasing clinical problem, and is exacerbated by the relative inability of tendon to repair itself quickly or provide renewed structural integrity. Tendon ossification (formation of bone within the tendon) and calcification (deposition of mineral calcium in tendon) is common among many human pathological conditions, and may also arise following tendon injury or post-operative complications involving tendons. Whilst some studies have investigated aspects of the biochemistry of the ossification process and the effect on the biomechanical properties of the tissues, little attention has been focused on the cell biology involved, despite the fundamental role played by tendon cells (tenocytes) in regulating the tissue matrix of tendon. Cell characteristics and phenotype are poorly defined in tendon when compared to other cells of the musculoskeletal system such as muscle or cartilage and therefore it remains unknown why tenocytes fail to fully repair degenerated tendon with a suitable matrix or how and why they are able to ossify their matrix under certain conditions. The overall objective of this study is to identify, using a well-established developmental model, the basis of the mechanism that results in the ossification of tendons and recognise the role played by the resident tenocyte population. We hypothesise that tenocytes are plastic in nature and in response to certain environmental and/or mechanical cues are capable of differentiating into cells of other related tissues. In the longer term, understanding these events may help us to treat or prevent the painful and debilitating ossification that can occur in injured or diseased tendon by manipulating cell and matrix constituents.

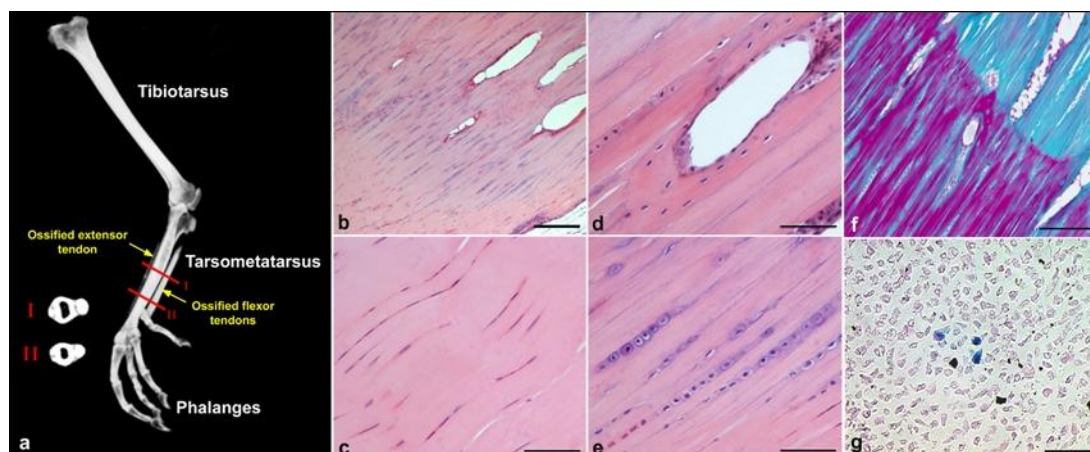


Figure a) CT scan of an adult chicken leg, demonstrating ossified flexor and extensor tendons. b) tendon-bone interface of adult chicken flexor tendon, HE, bar = 200 μm . High magnification view of b) depicting cells with a c) tenogenic, d) osteogenic and e) chondrogenic phenotype, HE, bar = 50 μm . f) tendon – bone interface of adult chicken flexor tendon, Masson's trichrome, bar = 100 μm . g) Lac Z tagged tenocytes introduced into the developing avian limb demonstrate capability of cells to differentiate into chondrocytes, bar = 50 μm .