Medical Xpress

This is why it takes so long to get over tendon injuries

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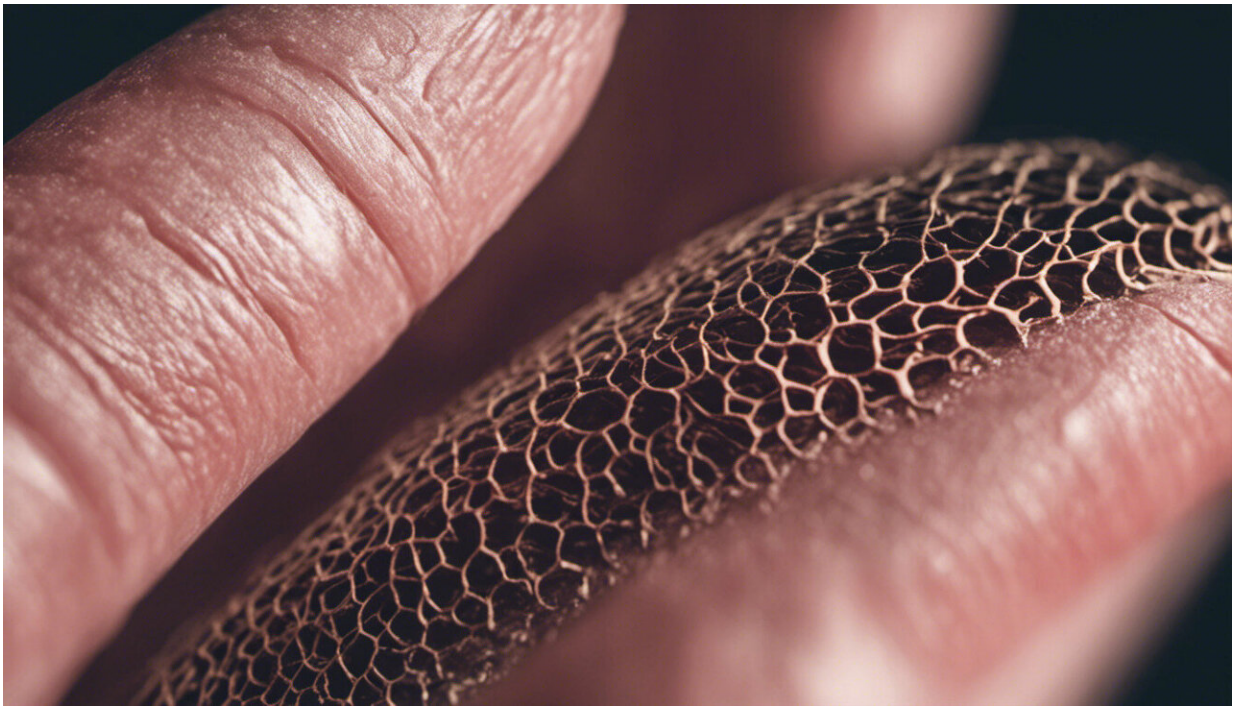

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getting over damage to tendons can be a long and painful process. By combining the nuclear tests of the 1950s with tissue samples and modern technology, a research collaboration between the Aarhus University and University of Copenhagen now reveals why the healing process is so slow.

Many people are affected by injuries caused by straining the Achilles tendon and other tendons in the body. Danish athletes alone account for up to 200,000 injuries per year. This often leads to frustration over the poor treatment options available, and it can take several years to get over tendon damage. The long healing process has always been something of a mystery to medical science because the body's regeneration normally manages to remedy most injuries to human tissue. Research results now surprisingly show that the Achilles tendon remains the same throughout adult life. This new knowledge partly reveals why healing following an injury can be a long and painful process, and it opens up for possibilities for seeking new forms of treatment.

"It's fascinating that some parts of the body are designed to last an entire lifetime. The Achilles tendon can withstand very strong forces – up to 500 kg when you're hopping, for example – and you might think that it would be exposed to minor injuries all the time, thus requiring constant repair and renewal. Not the Achilles tendon, however. Its construction is very strong – almost like a steel cable that has to last your whole life. Unfortunately, this 'tendon construction' does not last in a considerable number of cases, as can be testified by Denmark's numerous patients with strained tendons. With our new discovery, we can explain why the healing process can be difficult and take such a long time," explains Katja Heinemeier, Faculty of Health and Medical Sciences, University of Copenhagen.

Inheritance from the Cold War

To find out how quickly the Achilles tendon can regenerate, the research group used a somewhat unusual combination of competences – and adopted a positive approach to the many nuclear tests carried out during the Cold War. These nuclear tests took place during the period 1955, and led to a very strong increase in the amount of radioactive carbon-14 in the atmosphere. This increase – called the bomb pulse – reached its peak

in 1963, when the amount of carbon-14 doubled compared with the natural level. Since then, it has gradually fallen to the present level, which is almost normal. However, Aarhus physicists can actively use the 'imprint' of the bomb pulse to study the carbon-14 content of materials. This has enabled the research group to find an entry point to what can be called the inheritance from the Cold War nuclear race.

"The changes in atmospheric carbon-14 can be constantly reflected in the human body because we eat plants – and animals fed with plants – that absorb carbon-14 from the atmosphere. In doing so, a kind of history is built up in our tissue. At a later stage, this can tell us about the environment we've lived in, at the same time as precisely showing how quickly the different types of tissue were regenerated. We've studied Achilles tendons from people who lived during the bomb pulse era, and we can conclude that their tendons have retained the very high levels of carbon-14 found during the bomb pulse and for decades afterwards. This can only be explained by the fact that very little renewal takes place in the building blocks of the tendons. Our studies show that the building blocks that made up your Achilles tendons when you were seventeen years old are virtually the same when you're fifty," explains Associate Professor Jan Heinemeier. In addition to being director of the AMS 14C Dating Centre at Aarhus University, he is Katja Heinemeier's father.

Possibility for new forms of treatment

When a tissue has limited renewal of its building blocks – also called slow turnover – it means a poorer healing process in general. Very limited tendon renewal thus provides a good explanation of why tendon injuries are difficult to treat and can often persist for years.

"Based on our results, we actually think that the cells living in the tendon are in a kind of hibernation state, and therefore don't manage to wake up and repair the tendon when it's injured. The interesting results achieved

by our research collaboration cutting across different fields of study now form a much better understanding of tendon function. And now that we've found an explanation of why tendons heal so badly, we've got a better chance of developing new ways of treating tendon injuries. A new treatment strategy could involve trying to provoke the dormant tendon cells to wake up and start repairing the tendon, for example. We're about to initiate a study of this possibility," says Professor Michael Kjær, who is head of the Department of Sports Medicine, Bispebjerg Hospital, and is affiliated with the Centre for Healthy Aging, University of Copenhagen.

Provided by Aarhus University