



CAN EXERCISE HELP OUR TENDONS?

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YOUNG REVIEWERS:



LILI

AGE: 12



SHRAYYA

AGE: 14

TENDON

A tough “rope” of collagen and cells that connects our muscles to our bones, to help us move by letting our muscles pull on our bones.

Do you ever think about how people can skip, hop, run, and jump? It is largely thanks to our incredible tendons! Tendons connect muscles to bones, with the special job of transferring the muscle’s power to the attached bones to help us move. Tendons are strong and do not change shape easily. This helps ensure our bodies move efficiently. Did you know that there are thousands of tendons in the body? The largest of all is the Achilles tendon, in the ankle. Whilst tendons are strong and resilient, they can become injured. The most common injury to tendons is called tendinopathy. Exercises are commonly used to treat tendon pain. In fact, exercise makes tendons stronger and helps people return to doing the activities they love.

WHAT ARE TENDONS AND WHAT DO THEY DO?

Tendons are like bridges, but instead of connecting two pieces of land, they connect our muscles to our bones. Tendons are stiffer than muscles and can withstand massive loads without much change in their shape. Here, load refers to the stress the tendon experiences when we perform different movements. The structure of a tendon

LIGAMENTS

Thick bands of tissue that help stabilize bones to each other.

makes it capable of transferring the power produced by our muscles to the bones they connect to, without losing much energy; this allows us to move efficiently. **Ligaments**, which attach bone to bone, are different from tendons. The main job of ligaments is to help stabilize joints by holding bones together.

So how does this work when we move? Movement begins in the brain, which sends signals through the nervous system to the specific muscles responsible for the desired action. Nerves in the spinal cord send these signals to the muscles, instructing them to contract. Tendons play a pivotal role in this process, as they are the bridge between muscles and bones. When a muscle contracts, it pulls on the tendon, transmitting the force generated by the muscle to the attached bone. This action allows our joints, like our elbows and knees, to move.

Did you know that there are thousands of tendons in the body? The largest of all is the Achilles tendon. The Achilles tendon connects the calf muscle to the heel bone. This tendon attaches to two muscles that run down the back of the leg—the gastrocnemius muscle (which in Greek means the “belly” of the leg) and the soleus muscle. The two calf muscles combine to form the Achilles tendon, which attaches to the heel bone (Figure 1).

Figure 1

The two main muscles of the calf, the gastrocnemius and soleus, combine to form the Achilles tendon, which attaches to the heel bone.



Figure 1

The Achilles tendon was named after the Greek hero, Achilles. In Ancient Greek mythology, Achilles’ mother dipped him into a river, called the Styx, which made his entire body invulnerable except for the part of his foot where she held him—his Achilles heel [1]. During the battle, his enemies targeted his area of vulnerability, his Achilles, with

an arrow. This led to his downfall. Today the term “Achilles heel” is used to describe a point of weakness that could lead to one’s defeat—but do not worry, the Achilles tendon is a strong structure that is resilient to injury. In fact, during walking, the Achilles tendon withstands loads of around 3–4 times the weight of the entire body. This increases up to loads of up to eight times the body’s weight when we run!

WHAT ARE TENDONS MADE OF?

When we look at a tendon under a microscope, we can see that tendons are primarily made up of a substance called **collagen**. Collagen is a strong, white tissue. The fibers of collagen are combined closely to one another in tiny bundles, like threads in a rope. Millions of collagen bundles combine to form each tendon. A tendon’s strength is related to how thick it is and how much collagen it contains. Muscles that create powerful forces, like the quadriceps muscle on the front of the thigh, have short, thick tendons. In contrast, tendons that perform delicate movements, like the tendons in our hands, are long and thin.

Inside tendons, there are special cells called **tenocytes** that help with fixing and repairing the tendon after we exercise. Tenocytes make sure the tendon is ready the next time we use it. When we play a game like football, our tendons need time to rest and recover. The amount of time a tendon needs to recover depends on how much activity we perform. Athletes who engage in demanding training routines carefully plan their workouts to allow their muscles and tendons to rest and heal before their next training session.

TENDON PAIN

Tendons can become painful. The most common condition that impacts tendons is called **tendinopathy**. Tendinopathy is the word used to describe a condition where someone reports pain coming from a tendon when performing activities that load it. For example, someone with tendinopathy of the Achilles tendon will commonly report pain when running.

Tendinopathy can affect various regions of the body, such as the ankle, knee, hip, and shoulder. The understanding of what is happening in tendinopathy has changed over time. Scientists used to think that **inflammation** (which they called tendinitis) was a big part of tendon injuries. But now they have learned that inflammation may not be the main cause. That is why researchers have changed the name to tendinopathy.

It is largely unknown why tendinopathy develops [2]. A common theory is that tendinopathy may occur when we repeatedly place more

COLLAGEN

A thread-like structural protein crucial to maintaining the strength of a tendon.

TENOCYTES

Specialized cells that are found in tendons that play a role in maintaining and repairing tendons.

TENDINOPATHY

Describes a tendon that hurts when we perform activities that place load on it.

INFLAMMATION

A protective response in which our bodies send cells, chemicals, and extra blood to the affected area to help repair any damage, causing redness, swelling, and warmth.

load through the tendon than it is used to, without giving it enough time to repair. For example, if you are used to playing football once per week and you suddenly play 4 days per week, the tendons in your legs that help you run will have little time to adapt and strengthen to get ready for the new demands. Unfortunately, we know that this simple theory does not explain all tendon injuries... we still have a lot more to learn!

WALKING UP THE REHABILITATION LADDER

Did you know that people can recover from most tendon injuries by performing specific exercises? This is called **rehabilitation**. Rehabilitation for tendon injuries is like climbing a ladder. Different types of exercises put different amounts of weight on the tendons (Figure 2). In rehabilitation, patients start with easy exercises in which their muscles work without moving much. We call these isometric exercises, and they are gentle on the tendons. Then, patients move on to exercises in which they slowly move their joints, which puts more load on their tendons. Finally, patients can do faster movements, like skipping or sprinting, which put a lot of load on their tendons. Rehabilitation gradually makes tendons more robust.

REHABILITATION

The process of performing exercise to improve your ability to function after an injury.

Figure 2

During rehabilitation, a patient with an injury of the Achilles tendon will perform exercises that place more and more load through the tendon. The Y axis shows the amount of load in terms of body weight. For example, doing standing heel raises puts a load on the Achilles tendon equal to about three times the body's weight [3].

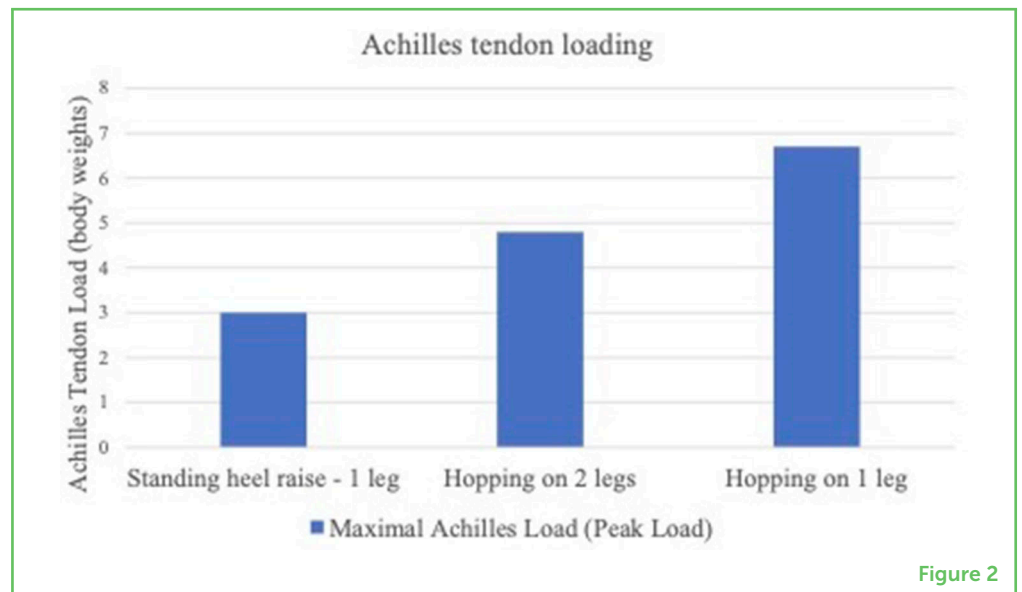


Figure 2

REHABILITATION STORY

Here is a story that helped guide how we treat tendon injuries today. Once upon a time, there was a doctor who loved to run, but he injured his Achilles tendon [4]. We will call him Dr. A. Dr. A did not want to have surgery to repair his tendon due to the long recovery required, so he sought alternative treatment.

At this time, there were whisperings of a new treatment. It was an exercise program that involved doing something called “heel drops.” This exercise required Dr. A to place his foot on the edge of a step, lift onto his toes, and then slowly lower downwards. Dr. A was skeptical of such a strange approach. However, he persisted with this exercise program. Guess what? Dr. A started feeling better. His pain started to improve, and before long, he could run again.

Dr. A’s story helped us learn how to treat tendon injuries. We now know that exercise can be a great way to help treat our tendons and get back to doing the things we enjoy—just like Dr. A with his running.

Nowadays, rehabilitation exercises have become the main treatment for tendon pain. The good news is that these exercises have become less time consuming over time. Health professionals like **physiotherapists**, who are experts in treating injuries to tendons, muscles, and joints, often prescribe these exercises.

PHYSIOTHERAPISTS

Healthcare professionals who work with people to improve their function, manage pain, and recover from injuries or disabilities.

CONCLUSION

Tendons are like strong ropes with the special job of passing on the power developed from our muscles to our bones, which helps us move. The strong structure of tendons structure means that they do not easily change their shape, which helps our bodies work efficiently.

When people have injured tendons, they often need to do exercises as part of a rehabilitation program. The goal of rehabilitation is to match the exercises to the person’s lifestyle, so that they can do all the activities they enjoy in their daily lives. Whether it is running a marathon or walking a dog, physiotherapists want to make sure people’s tendons are ready and strong enough to handle any activity they want to perform. So, spread the news: exercise strengthens our tendons! Just remember to progress slowly, to give your tendons time to adapt and keep up.

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YOUNG REVIEWERS

LILI, AGE: 12

I absolutely love cats and I have two at home. Actually, I like almost all animals and I love exploring nature. My ambition is to study veterinary medicine and then eventually create an exclusive cat surgery. I do rhythmic gymnastics as a hobby, and I paint a lot.

SHRAVYA, AGE: 14

My hobbies are music, journaling, and my favorite, reading! “A reader lives a thousand lives before he dies”—George R.R. Martin. Books are like small portals to a 1,000 different worlds. The best part is, we do not have to be ourselves while reading a book. I always wonder how we know more about our surroundings than about our own body! Learning about humans is such a beautiful thing. Feelings, thoughts, emotions, reactions are such beautiful things! I aspire to learn more about humans, our anatomy, how our body works.

AUTHORS

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I am a sports medicine researcher from the University of Technology Sydney in Australia. I am also trained as a sports and exercise physiotherapist. My research aims to advance the way that we treat tendon pain. In my work, I utilize the understanding of the way tendons function to rehabilitate athletes following injuries. *anthony.nasser@uts.edu.au

