

First glimpse of body's 'steering wheel' joint sparks hope

February 18 2020



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For the first time, scientists have found a way to reveal the mechanics of the human body's 'steering wheel'—the subtalar joint.

The bones of the foot are unique in that they need to be both extremely flexible allowing the foot to point, twist and flex, but in other positions they need to be absolutely rigid, such as pushing off or jumping so the person doesn't sprain their ankle.

The key to this ability is the subtalar joint, below the ankle, which until now, doctors couldn't see rotating while standing.

Ankle sprains are one of the commonest reasons for people to attend Accident and Emergency departments. More often than not, the subtalar joint is also injured but, because the joint is hidden, doctors find it difficult to diagnose sprains, which often leads to long-term ankle instability.

If left untreated, an injury to the subtalar joint can lead to flat feet and even arthritis.

It is hoped that being able to see the joint in action might give doctors the ability to tailor treatments to the many thousands of people with foot joint problems, in the same way it's possible to tailor treatments of the hip and knee joints.

The study, published in Nature's *Scientific Reports*, was led by Dr. Gianluca Tozzi, Reader in Bioengineering at the University of Portsmouth, in collaboration with Mr Andrew Goldberg, Consultant Orthopaedic Surgeon at UCL and the Wellington Hospital in London.

Dr. Tozzi said: "This is the first time this technique has been used in humans. It is non-invasive and gives clinicians a perfect view of a patient's subtalar joint motion under full weight-bearing, making it possible for the first time to determine the joint's centre of rotation which, in turn, opens the possibility of much-improved design of joint replacements.

"Being able to see the subtalar joint in action is made possible by a combination of 3-D imaging (computed tomography) and digital volume correlation. The technology has a huge potential to be expanded, allowing doctors to see any strain in the bone, greatly improving clinical diagnosis.

"I've always hoped for this. Everyone working in healthcare research hopes to their work will be transferable from the lab to real life, making a difference to patients."

Mr Goldberg said: "Currently, surgery for arthritis usually involves joining the bones together making them stiff in a procedure known as joint fusion. While this is a successful procedure to treat pain, it does remove a mobile joint which can lead to stiffness and long-term wear of other joints that have to pick up the slack.

"No one has ever been able to replace this complex joint. This new research helps us to better understand the complex biomechanics of the foot and could pave the way for new treatments that just aren't currently available."

The study used standing CT scans and sophisticated [image analysis](#) to better understand how the subtalar joint works in eight men and women in three different positions.

More information: Peña Fernández, M., Hoxha, D., Chan, O. et al. Centre of Rotation of the Human Subtalar Joint Using Weight-Bearing Clinical Computed Tomography. *Sci Rep* 10, 1035 (2020). doi.org/10.1038/s41598-020-57912-z

Provided by University of Portsmouth

Citation: First glimpse of body's 'steering wheel' joint sparks hope (2020, February 18) retrieved 10 April 2024 from <https://medicalxpress.com/news/2020-02-glimpse-body-wheel-joint.html>

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