Better outcomes for patients with wrist fracture

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Steve Watts is active. He plays squash and is converting a bedroom into an office. He has to wear compression gloves to do the normal work of hammering and painting because of the pain and lack of mobility that comes with osteoarthritis. His only other option is bone fusion.

Thirty years ago, Steve fractured his wrist after a fall from a horse on his father’s farm. The impact of that fall continues today. “Having just begun the process of having osteoarthritis, I know how important my hands are and having that movement,” says Steve. “Having that pain there — in the background — is the biggest negative impact to one’s life.”

Breaking a wrist is one of the most common causes of emergency visits in Canada. Wrist fractures account for 14 percent of injuries to seniors and 22 percent for adolescents. After an emergency visit for a wrist fracture, a complete recovery can take several months and in many cases patients live with chronic pain, malunion and abnormal kinematics for the rest of their lives.

A collaborative, cross-faculty team led by Principal Investigator, Emily Lalonde, PhD, Assistant Professor in Department of Mechanical & Materials Engineering, received funding from Western University’s Bone and Joint Institute (BJI) Catalyst Grant Program to study the issue. Lalonde and Dr. Joy MacDermid, professor and co-director of the Clinical Research Lab within the Roth McFarlane Hand & Upper Limb Centre, and their team are looking at diagnostic tools to characterize the effects of wrist fractures on joint mechanics early on to reduce the prevalence of post-traumatic osteoarthritis.

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Following fracture, surgeons monitor the joint alignment using static x-ray. The difficulty however is that patients experience pain when they “load” or use their hands and wrist not necessarily when their hand is lying flat on the x-ray detector. “It is regular practice to examine a fracture using an x-ray,” says Lalonde, “but 2D and even 3D imaging have limitations. Neither adequately show joint mechanics or harmful malunion.” In addition to these imaging limitations, most fractures are clinically treated with a cast, but with a wrist fracture, patients do not experience the symptoms that could indicate malunion or misalignment. Lalonde and Dr. MacDermid aim to standardize the analysis of fractures and help determine optimal treatment by obtaining functional range of motion and weight-bearing scans.

4D CT (3D CT + time) scanning to examine people after a fracture has healed can track the movement of wrists and identify hot spots of increased wear — highlighting mal-tracking and loading of the wrist during 3D and 4D scanning. The goal is to create best practice guidelines that give clinicians the ability to make informed therapeutic decisions for their patients. The goal is to reduce long-term complications such as pain, lack of mobility and quality of life.

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When combined with surveys about pain and mobility, Lalonde and team can better understand which treatments are most successful — a cast or reconstructive surgery.

So far, the team has obtained images from 110 individuals — half with no fracture and half post-fracture. This is the beginning of what will be a comprehensive database of risk injuries. They are using this database to develop protocols for positioning and loading of the wrist during 3D and 4D scanning. The goal is to create best practice guidelines that give clinicians the ability to make informed therapeutic decisions for their patients. The goal is to reduce long-term complications such as pain, lack of mobility and quality of life.

“The research may result in new ways of reducing the resources needed to treat patients over their lifetime.”

“This research offers hope for people who are having the same problems as I am,” says Steve. “It will give physicians the ability to make better decisions based on the data. Research can lead to changes and treatments for conditions that no one has ever thought of before. One day, it can improve someone’s quality of life.”

To learn more about Lalonde and Dr. MacDermid’s research please visit https://www.eng.uwo.ca/hbl/index.html and https://www.lawsonresearch.ca/hbl/clinical-research-HULC.