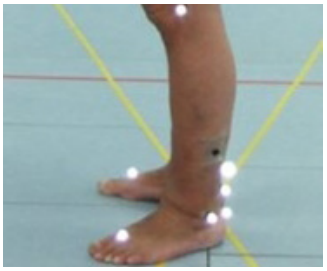
VICON

Joint wear out in Knee osteoarthritis
ORLAU and Cardiff University

"Over the years our greatest need has been improved marker tracking and the ability to track smaller markers, sited closer together and across greater distances. More recent developments in hardware have made this possible and we can do almost anything we need to with our Vicon system."
Caroline Stewart, Bioengineer at ORLAU.

VICON | Case Study

Knee osteoarthritis ORLAU and Cardiff University


Patient


ORLAU


Gait laboratory at ORLAU

ORLAU has been a Vicon customer for nearly 20 years. Their 12 camera F40 system is used for clinical gait analysis, ankle and foot orthosis (AFO) tuning and functional electrical stimulation (FES) services.

Caroline Stewart, bioengineer at ORLAU, said, "The integration of video and the facility for video vector analysis is really important for ORLAU. We make use of video vector in all our assessments, but it is particularly important in our orthotic tuning clinics. Over the years our greatest need has been improved marker tracking and the ability to track smaller markers, sited closer together and across greater volumes.

"Recent developments in hardware have made this possible and we can do almost anything we need to with our Vicon system."

More recently, the Vicon system has been used on a research project that seeks to assess and quantify the changes in walking following knee replacement.

Looking for evidence

Funded by the North West Trust, the work on knee replacement is being carried out in collaboration with Betsi Cadwaladr University Health Board, ORLAU and Cardiff University.

Andy Metcalfe, orthopedic registrar at Cardiff University, says, "Both patients and clinicians often comment that patients with knee osteoarthritis 'wear out' their other joints by changing their gait pattern and placing excessive loads on previously undamaged joints. Many people see this as obvious, without being aware that there is little evidence base for this view.

"We realized that we could not explain whether this phenomenon actually happens, how it happens or why. This information could be very valuable as it could potentially be used to slow the progression of disease in the other joint."

Metcalfe recruited 20 patients with arthritis confined to a single knee joint. The aim was to measure their gait and determine if there was any evidence for the patients' feelings' that their painful knee was causing them to walk in such a way that their other joints were being damaged.

Unexpected results

After securing a research grant from a local NHS trust, a group of patients were selected from the knee replacement waiting list who fitted the criteria of having one painful knee but no other lower limb joint pains. 3D gait analysis and EMG data was captured on 20 patients. One year after the operation 15 came back to be re-assessed.

The analysis was carried out using ORLAUs Vicon system and Nexus software.

The team hypothesised that pre-operative gait patterns would exhibit large variability, but return to normal patterns post operatively. Metcalfe comments, "In fact the reverse was true. We saw a remarkably consistent pattern pre-operatively and much more variation in recovery after arthroplasty. Pre-operative gait patterns were characterised by slow gait speeds, abnormal waveforms in the coronal plane moments with increased adduction moment impulses, and high levels of quadriceps/ hamstrings co-contraction. Post-operative, whilst subjective outcome scores normalized in a reasonably consistent manner, recovery of gait variables was very variable, and usually incomplete."

Future research

The results show that patients with single joint arthritis overload their other joints when they walk. The excessive load comes from a combination of sustained high varus moments through stance phase, combined with quadriceps and hamstring co-contraction. Not all of the issues identified resolve when the knee joint is replaced.

Metcalfe concludes, "This study has given us a fascinating insight into an aspect of knee osteoarthritis that we did not have before. It has also given us a big pile of research plans and new studies to carry these early observations on into new treatments for the future. A challenge but one we look forward to taking on."

The results from the pre-operative analysis have recently been published in the Bone and Joint Journal (2013, 95(3), p348-353). The early results from the post operative analysis have been published in Gait and Posture (2013, 37(1), p32-6).

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