Kinematic walking assessment to compare robotic assisted and conventional unicompartmental knee arthroplasty

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Unicompartmental knee arthroplasty (UKA) has been gaining popularity in recent years [1] due to its perceived benefits over total knee replacements, such as greater bone preservation [2], reduced operating-room time [3], better postoperative range of motion and improved gait [4]. However there have been failures associated with UKA caused by misalignment of the implants [5].

To improve the implant alignment a robotic guidance system called the RIO Robotic Arm has been developed by MAKO Surgical Corp (Ft. Lauderdale, FL). This robotic system provides real-time tactile feedback to the surgeon during bone cutting, designed to give improved accuracy compared to traditional UKA using cutting jigs and other manual instrumentation.

![Graph comparing the knee joint angles of the MAKO and Oxford patients during level walking.](image)

Figure 1: Graph comparing the knee joint angles of the MAKO and Oxford patients during level walking.
The University of Strathclyde in association with Glasgow Royal Infirmary has undertaken the first independent RCT trial of the MAKO system against the Oxford unicompartmental knee arthroplasty – a conventional UKA used in the UK. The trial involves 139 patients across the two groups.

At present outcomes have been evaluated for 30 patients. 14 have received the MAKO unicompartmental knee arthroplasty and 16 the Oxford unicompartmental knee arthroplasty. Both groups were seen 1 year post-operatively. Kinematic data was collected while subjects completed level walking using a Vicon Nexus motion analysis system. Three-dimensional hip, knee and ankle angles were compared between the two arthroplasty groups.

Our initial findings indicate that hip and ankle angles show no significant statistical difference, however there is a significant difference (p < 0.05) in the knee angles during the stance phase of gait. Data shows higher angles achieved by the MAKO group over the Oxford (Figure 1).

It would appear from our early findings that the MAKO RIO procedure with Restoris implants gives at least comparable functional outcome with the conventional Oxford system and may prove once our full sample is available for analysis to produce better stance phase kinematics with a more active gait pattern than the conventional Oxford procedure. Further work includes analysing the data obtained from the patients in a number of other activities. These include a full biomechanical analysis of ascending and descending a flight of stairs, sit to stand and a deep knee lunge. The high demand/high flexion tasks in particular may reveal if there's an advantage to using the MAKO procedure over the Oxford. If there is a direct correlation between alignment and patient function then this effect could be even more significant in the more demanding patient tasks.

References