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Comparison Of Gait Following Mechanically Aligned And Callipered Restricted Kinematically Aligned Total Knee Arthroplasty: A Randomized Controlled Trial

Orthopaedics / Knee & Lower Leg / Joint Replacement - Primary

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Background
Osteoarthritis of the knee significantly impairs mobility. Total knee arthroplasty (TKA) is a standard treatment, with mechanical alignment (MA) traditionally used to ensure implant longevity. However, dissatisfaction remains high. Restricted kinematic alignment (rKA) aims to recreate more physiological joint kinematics. This study compares post-operative gait mechanics between MA-TKA and callipered rKA-TKA (crKA-TKA).

Objectives
To compare dynamic gait parameters between crKA-TKA and MA-TKA by Gait lab.

Study Design & Methods
A double-blinded, randomized controlled trial was conducted on 36 patients (72 knees) undergoing bilateral TKA. Patients were randomized to receive MA-TKA or crKA-TKA using the same prosthesis. Gait was analyzed preoperatively and at six months using BTS Bioengineering gait lab. Radiological assessments and patient-reported outcome measures (PROMs) were also evaluated.

Results
Thirty-five patients completed the study. Radiographic parameters confirmed alignment differences consistent with surgical technique. Post-operative gait analysis revealed significantly higher peak knee adduction moment in the MA group compared to the crKA group (0.29 ± 0.14 vs. 0.19 ± 0.11, $p = 0.002$). rKA knees demonstrated an axial plane motion similar to normal knees. No significant difference was observed in any other gait parameter. PROMs improved in both groups with no significant inter-group difference.

Conclusions
crKA-TKA demonstrates improved replication of natural gait mechanics by reducing knee adduction moments compared to MA-TKA. No significant difference was seen in knee flexion during swing. Both alignment techniques yield comparable improvements in patient-reported outcomes and short-term function.

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