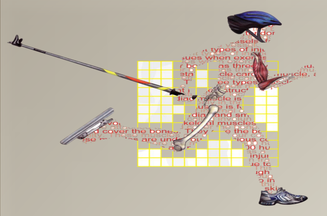

Muscle Activity in Ipsi-and Contralateral limbs in Total Knee Arthroplasty Patient during Level and Sloped Walking

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Background

- Total knee arthroplasty (TKA) patients with medial pivot (MP) implants provide more similar muscle activity patterns to healthy knees than posterior stabilized (PS) prostheses.[1,2]
- However, it is unknown how the prosthesis design would affect the muscle activity of the non-operated limb.

Objective

- The purpose of this study was to compare lower limb muscle activity in patients who underwent a total knee arthroplasty (TKA) with a medial pivot (MP) implant to healthy controls (CTRL) during a stair ascent task.

Methods

- 14 participants required a unilateral total knee arthroplasty and were randomly assigned to either a MP (MicroPort Orthopaedics Inc.) or a PS (Zimmer Biomet) implant and were compared to 9 healthy controls (CT) (Table 1)
- Muscle activities were collectured using wireless electromyography (EMG) probes on the semimembranosus and biceps femoris (hamstings); vastus medialis and vastus lateralis (quadriceps); medial and lateral heads of of the gastrocnemius (gastrocnemii) of both limbs
- EMG data was recorded as participants completed level and sloped (±9°) walking
- Total muscle activity (iEMG) was extrapolated and normalized to a maximal voluntary isometric contraction
- Significant differences between operated and non-operated limbs in TKA group and left and right limbs in the CTRL group was obtained using a paired t-test ($\alpha < 0.05$)

Medial Pivot Implant

Posterior Stabilized Implant

Wireless electromyography probe

Tables

Table 1: Participant demographics

Group	Number	Age (years)	BMI (kg/m^2)	Post-Op (months)
MP	8	59.9 ± 5.5	29.0 ± 4.5	10.8 ± 3.0
PS	6	68.3 ± 3.6	29.8 ± 3.0	9.8 ± 1.7
CT	9	65.7 ± 5.4	27.1 ± 5.0	N/A

Results

- PS group had significantly higher iEMG in the quadriceps and hamstrings of the non-operated limb during the level walking task, whereas MP group had no significant differences for the same muscles
- MP group had significantly higher iEMG in the hamstrings and gastrocnemii of the operated limb than the non-operated limb during the inclined walking task

Discussion

- Previous studies have found that TKA patients have higher and longer muscle activity in the non-operated limb compared to the operated limb during walking[3,4]
- PS group resulted in greater iEMG on non-operated limb compared to operated limb during walking as was previously found[1]
  - This may indicate a compensatory gait originating from muscle adaptations resulting of many years of waiting for the knee replacement
- MP group had better inter-limb muscle symmetry for level and declined walking, which may indicate a greater ability to load both limbs equally, reducing overload on the contralateral limb
- Differences in implant designs between the MP and PS implant may contribute to differences in muscle activation
- Reduced muscle activation on the non-operated limb may reduce joint loading, consequently limiting joint degeneration
- Conformity in implant designs showed less kinematic and kinetic variability[5], consequently lowering joint loading
- Therefore, post-surgery rehabilitation should aim to strengthen muscles in the operated limb so weight-bearing activities such as walking will result in greater symmetry between both limbs

Figures

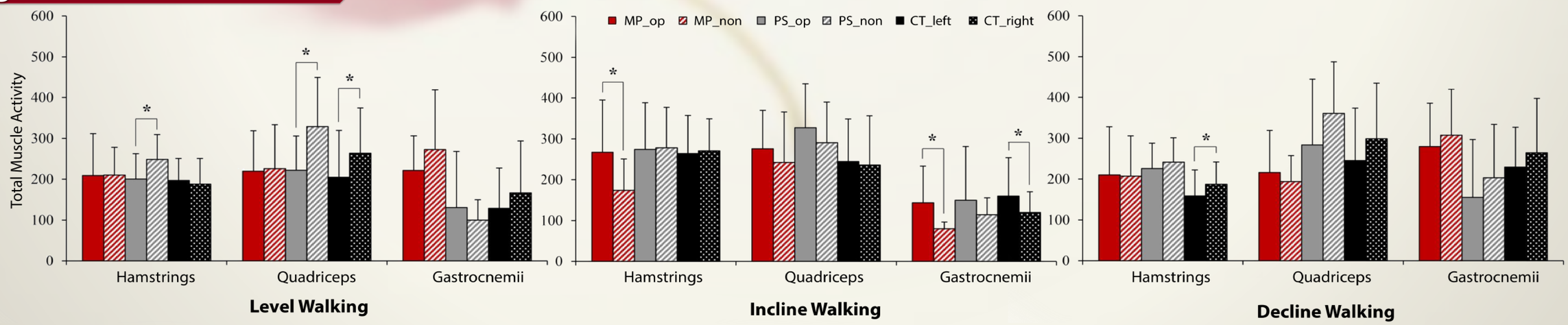

Figure : Total muscle activity for the MP, PS and CT groups during the three walking conditions. * represents significant differences between operated and non-operated limbs in the MP and PS group, or between left and right limbs of the CT group

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