

UNILATERAL TRANSFEMORAL AMPUTEES MIGHT BE AT RISK OF LATERAL COMPARTMENT DEGENERATION OF THE KNEE JOINT

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Introduction

High-functioning unilateral transfemoral amputees (UTF) are susceptible to intact knee osteoarthritis (OA) [1], which is a mechanically-mediated condition. Unilateral transtibial amputees (UTT) are known to show medial intact knee compartment overload, which might explain the risk of OA for UTT [2], but little is known for UTF. This study aims to understand the mechanical indicators of the development and progression of knee OA in the UTF population.

Methods

Gait motion capture and force plate data were collected from seven UTF with no known secondary conditions. All participants were fitted with microprocessor-controlled prosthetic knees and dynamic response feet and have been prosthesis users for a minimum of two years. Seven able-bodied people (AB) were group matched to the UTF cohort by sex, age, height, and mass. The control dataset is a subgroup of a previous dataset [3]. Musculoskeletal modelling was performed using Freebody to compute joint contact forces [4].

Results

Figure 1 and Table 1 present the knee loading characteristics for UTF and AB. Whilst the UTF lateral compartment of the knee presented higher loading rates, peaks, and impulse (area under the force curve) than AB, there were no significant differences in the medial knee loading between UTF and AB. These findings show that the higher knee loading for UTF is localized to the lateral compartment.

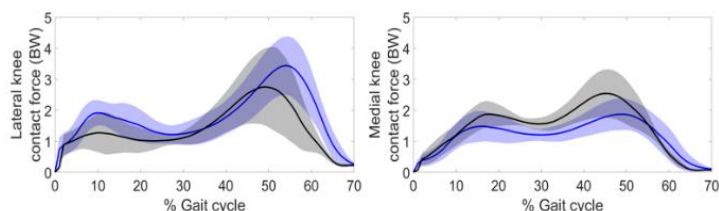


Figure 1: Lateral and medial intact knee joint contact forces. UTF – blue. AB – black.

Discussion

As high and repetitive loading might lead to joint degeneration [5], the higher knee loading rate, lateral knee contact forces and impulse observed in this study indicate that UTF might be more susceptible to lateral knee OA as opposed to medial knee OA, as is the case for UTT [2].

Conclusion

Unexpectedly, this study's results indicate that the higher functional demand of the intact limb compared to AB may increase the risk of lateral knee OA in the UTF population, as opposed to UTT who might be more susceptible to medial knee OA [2]. Mitigation strategies could be explored through prosthesis adjustments, including alignment to shift the ground reaction force vector, or muscle strengthening to ensure optimal long-term musculoskeletal health.

Acknowledgements

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References

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Table 1. Intact knee joint loading rate, contact forces and impulse.

	UTF	AB	p-value
Knee loading rate (Nm/(kg.s))	4.8 ± 1.7	3.4 ± 0.5	p = 0.045
1 st peak lateral knee force (BW)	2.1 ± 0.4	1.6 ± 0.5	p = 0.024
2 nd peak lateral knee force (BW)	3.5 ± 0.9	2.8 ± 1.3	p = 0.322
Lateral knee impulse (BW.s/m)	98.5 ± 17.0	77.1 ± 18.3	p = 0.029
1 st peak medial knee force (BW)	1.6 ± 0.5	1.9 ± 0.4	p = 0.164
2 nd peak medial knee force (BW)	2.0 ± 0.5	2.5 ± 0.7	p = 0.131
Medial knee impulse (BW.s/m)	63.7 ± 13.8	72.8 ± 14.7	p = 0.108

