

Knee crepitus does not alter sagittal plane knee biomechanics in runners with and without a history of knee surgery

Fernanda Serighelli¹, Matthew G King¹, Kay M Crossley¹, Benjamin F Mentiplay¹, Melissa Haberfield¹, Joshua Hill¹, Prasanna Sritharan¹, Richard Johnston¹, Brody McCarthy¹, Michael Girdwood¹, Paula Pappalardo¹, Thomas West¹, Gustavo Telles¹, Danilo De Oliveira Silva¹.

¹La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Melbourne, Victoria, Australia

Email: f.serighelli@latrobe.edu.au

Summary

Knee crepitus is a well-known source of concern to the general population, and attempts to avoid experiencing it may result in altered movement patterns. However, no studies have explored whether knee crepitus is related to running biomechanics. We aimed to explore whether the presence of crepitus influences knee flexion angle and external flexion moment in runners with and without a history of knee surgery. Our results suggest that in runners, with and without surgery, knee crepitus during squatting is not associated with sagittal plane knee joint moment and flexion angles during running.

Introduction

Knee crepitus is defined as audible grinding noises and/or palpable vibrations during knee movement [1]. Crepitus is highly prevalent among different populations, such as those with patellofemoral pain (47%), knee osteoarthritis (81%), and the general population (41%) [1]. Participants in qualitative studies report modifying their movement during daily life activities to avoid hearing the noise. A previous study found that women with patellofemoral pain and crepitus have a reduced knee flexion angle during stair ascent [2]. However, no studies have explored the influence of knee crepitus on running biomechanics. We aimed to explore the effect of crepitus on knee flexion angle and external flexion moment in runners with and without a history of knee surgery.

Methods

This study uses data from the TRajjectory of knee heaLth in runners (TRAIL) prospective cohort study [3]. 214 participants were included, 108 with a history of knee surgery and 106 controls. Knee crepitus was assessed by a clinical test in which the evaluator placed the palm of their hand over the patella to detect the presence of a grinding sensation during active knee flexion-extension movement (two squats until 90° of knee flexion). Biomechanical overground running data were collected at 3-3.5m/s pace using a 10-camera, 3D motion capture system (VICON Motion Systems Ltd, sampling at 200Hz) and two embedded force plates (AMTI, sampling at 1000Hz). A biomechanical model was created in OpenSim 4.3 via the API using Python 3.8. For each running trial (n = 8 per participant), inverse kinematics were used to generate sagittal plane knee angles, while inverse dynamics were used to generate knee joint moments. Comparisons of knee joint angles and moments between groups (participants with a history of knee surgery with crepitus vs without crepitus; controls with crepitus vs without crepitus) were completed using two-sample t-tests via statistical parametric mapping (SPM). Alpha was set at 0.05, and the critical value of t was

calculated based on the trajectory smoothness via temporal gradients.

Results and Discussion

One hundred and eight (49% women; mean age: 34 years old; mean body mass index: 23.3 kg/m²) surgical and 106 (50% women; mean age: 32 years old; mean body mass index: 22.7 kg/m²) control participants were included in the analysis. 82% (89 out of 108) of the surgical and 66% (70 out of 106) of the control group presented with knee crepitus. Participants with and without crepitus ran with similar knee flexion angle ($t = 2.98$, $p > 0.05$ control group and $t = 2.98$, $p > 0.05$ surgical group) (Fig. 1) and knee external flexion moment ($t = 3.20$, $p > 0.05$ control group and $t = 3.20$, $p > 0.05$ surgical group), regardless of the history of knee surgery.

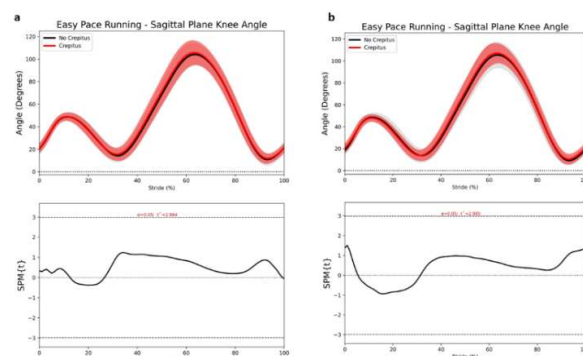


Figure 1: Comparisons of knee joint flexion angles between those with and without crepitus in a) Control and b) Surgical group.

Despite its high prevalence, having crepitus during squatting does not seem to influence sagittal plane knee angle and moment in runners. Our findings differ from those of prior findings [2]. Our results differ from the prior study, that found an association between crepitus and activity [2]. By comparison, we investigated a running task with a mixed-sex cohort of runners versus women from a general population completing stair ascents. These task and population differences may explain the divergent findings.

Conclusions

In runners, with and without surgery, knee crepitus during squatting does not influence sagittal plane knee joint moment and flexion angles during running.

References

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- [3] De Oliveira Silva D et al. (2023) *BMJ Open*, **13**:e068040.