

# PhD Opportunity

Investigating the impact of different flooring surfaces on EMG muscle activation of the knee and hip muscles during squatting and stair descending in patients with Patellofemoral Pain

## Supervisory team

### Director of Studies:

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**Research Group:** [Living Well with Long-Term Conditions](#)

## The PhD Opportunity

Patellofemoral Pain (PFP) is a prevalent musculoskeletal condition that affects a significant portion of the population, particularly athletes and physically active individuals. It is characterized by pain around the patella (kneecap) and is often exacerbated by activities that involve knee flexion, such as squatting, stair climbing, and descending (Papadopoulos et al., 2015). The aetiology of PFP is multifactorial, involving biomechanical, muscular, and structural factors (Gasibat et al., 2023). Electromyography (EMG) is a valuable tool for assessing muscle activation patterns and has been widely used in research to understand the neuromuscular control of the lower extremities during various functional tasks. Previous studies have investigated EMG muscle activation in different contexts. For instance, Bolgla and Uhl (2005) examined hip abductor muscle activation during rehabilitation exercises and highlighted the importance of hip strengthening in lower extremity rehabilitation. Similarly, Gasibat et al. (2023) compared EMG activity of the gluteus maximus and medius during different exercises, providing insights into muscle activation patterns. Despite the extensive research on muscle activation during functional tasks, there is a notable gap in the literature regarding the impact of different flooring surfaces on EMG muscle activation of the knee and hip muscles, particularly in patients with PFP. Flooring surfaces can vary significantly in terms of hardness, texture, and compliance, which may influence muscle activation and joint loading during activities such as squatting and stair descending. Understanding these effects is crucial for developing effective rehabilitation strategies and optimizing functional performance in patients with PFP.

## Rationale

The rationale for this study is based on the need to fill the existing research gap and provide evidence-based recommendations for rehabilitation practices. Patients with PFP often experience pain and discomfort during weight-bearing activities, which can limit their functional abilities and quality of life. By investigating the impact of different flooring surfaces on muscle activation, this study aims to identify surfaces that may reduce pain and improve muscle function in patients with PFP.

Previous studies have shown that surface compliance can affect muscle activation and joint mechanics. For example, softer surfaces may reduce the impact forces on the joints, potentially decreasing pain and improving muscle activation patterns (Xie et al., 2021). Conversely, harder surfaces may increase joint loading and exacerbate symptoms in patients with PFP (Price, 2017). However, there is limited research specifically examining these effects in the context of functional tasks such as squatting and stair descending.

This study will provide valuable insights into how different flooring surfaces influence EMG muscle activation of the knee and hip muscles during these tasks. The findings will have practical implications for clinicians and therapists, guiding them in selecting appropriate surfaces for rehabilitation exercises and functional training in patients with PFP.

## Aims and Objectives

**Aim:** To investigate the impact of different flooring surfaces on EMG muscle activation of the knee and hip muscles during squatting and stair descending in patients with Patellofemoral Pain.

## Objectives

1. To measure and compare EMG muscle activation of the quadriceps, hamstrings, gluteus maximus, and gluteus medius during squatting on different flooring surfaces (e.g., hardwood, carpet, rubber).
2. To measure and compare EMG muscle activation of the same muscles during stair descending on different flooring surfaces.
3. To determine if specific flooring surfaces reduce muscle activation and pain in patients with PFP.

## References

1. Papadopoulos, K.D., Stasinopoulos, D., Ganchev, D. 'A systematic review of systematic reviews of PFPS risk factors, diagnostic tests, outcome measures and exercise treatment, with an analysis of key participant and study characteristics in included primary studies' (2015)
2. Gasibat, Q., Alexe, C. I., Raveica, G., Tohänean, D. I., Vasilios, K., & Alexe, D. I. (2023). Decoding Hip Muscle Activation: A Comparative Electromyographic Analysis. *European Journal of Investigation in Health, Psychology and Education*, 13(9), 1612-1623.
3. Bolgla, L. A., & Uhl, T. L. (2005). Electromyographic Analysis of Hip Rehabilitation Exercises in a Group of Healthy Subjects. *Journal of Orthopaedic & Sports Physical Therapy*, 35(8), 487-494.

4. Xie, K., Lyu, Y., Zhang, X., & Song, R. (2021). How Compliance of Surfaces Affects Ankle Moment and Stiffness Regulation During Walking. *Frontiers in Bioengineering and Biotechnology*.
5. Price, V. (2017). Knee Joint Forces in Relation to Ground Surface Stiffness During Running. East Carolina University.

### **Application Process**

To begin the application process please go to

<https://www.worc.ac.uk/research/research-degrees/applying-for-a-phd/>.

### **The Interview**

All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Doctoral School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

### **Funding your PhD**

For information about Doctoral Loans please visit: <https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx>

During your PhD you can access the Research Conference Support Scheme to support the costs of presenting your research at an external conference.

### **Research at the University of Worcester**

Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- [Human Health and Wellbeing](#)
- [Sustainable Futures](#)
- [Digital Innovation](#)
- [Culture, Identity and Social Exclusion](#)
- [Professional Education](#)

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

### **Research Degrees at Worcester**

Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3<sup>rd</sup> for overall research student satisfaction nationally. Key to our success in this area is the Doctoral School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team
- a Research Student Study Space with both PCs and laptop docking station
- a comprehensive Researcher Development Programme for students and their supervisors
- a programme of student-led conferences and seminars

### **Living Well with Long-Term Conditions Research Group**

Approximately 15 million people in England, representing 1 in 4 adults, have one or more long-term conditions (LTCs). A LTC is an illness that cannot be cured but may be controlled with medicines or other treatments. People living with LTCs face considerable challenges around the management of their long-term physical and mental health.

The 'Living Well with Long-Term Conditions' Research Group aims to facilitate the development and implementation of high-quality research and knowledge exchange, targeted at helping people with long-term conditions and their families to live well.

### **Widening Participation**

As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

**For further information** or an informal discussion on this project, please contact Dr Konstantinos Papadopoulos (Direct of Studies) via email at [k.papadopoulos@worc.ac.uk](mailto:k.papadopoulos@worc.ac.uk)