**Title**

**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.**

**Introduction**

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**

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