# Comparison of Postural Stability Measures During Single-Leg Stance in Subjects with and without Patellofemoral Pain

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## Summary

This study compared postural stability in subjects with patellofemoral pain (PFP) and healthy controls using K-Plates during a 50-second single-leg stance. No significant differences were found between groups. The results align with studies reporting no differences in single-leg balance. The absence of differences may be attributed to the use of the objective method used in the study and the relatively good functional status of PFP subjects.

## Introduction

Patellofemoral pain is a musculoskeletal disorder frequently observed in young athletes and is associated with functional impairments. Subjects with PFP exhibit deficits in postural control measures compared to healthy subjects, and there is a need to evaluate these measures [1], particularly in different stance tasks such as single-leg stance.

## Methods

A total of 88 legs were evaluated for the study, comprising 25 subjects with PFP (6 males, 19 females; 38 legs with PFP) and 25 healthy subjects (8 males, 17 females; 50 legs). After collecting demographic data such as age and body mass index (BMI) from each subject, pain at rest and during activity was assessed using the visual analog scale (VAS), and the Kujala Patellofemoral Score (KPS) was administered to assess functional status to the subjects with PFP. K-Plates from Kinvent (Kinvent Inc., Montpellier, France) were utilized to evaluate postural stability. Each subject performed a single leg-stance for 50 seconds with three repetitions, and the mean scores were analysed for the differences. Measures collected included ellipse area in $mm^2$, anteroposterior (AP) and mediolateral (ML) amplitudes in mm, and AP, ML, and center of pressure (CoP) path lengths and velocity measures in mm and mm/s, respectively. Shapiro-Wilk test was performed to decide the normal distribution of the data and Mann-Whitney U test and Student T test were used when appropriate.

## Results and Discussion

The mean age was 23.32±3.36 years, and BMI was 22.19±2.93 $kg/cm^2$ in the PFP group, while the mean age was 22.56±2.9 years, and BMI was 22.48±3.03 $kg/cm^2$ in the healthy group. Demographic characteristics of the two groups were similar (p>0,05). Mean pain scores were 2.24±2.15 at rest and 5±2 during activity, and the mean KPS score was 78.5±8.35 in subjects with PFP. There were no differences in all postural stability measures between the two groups (p>0,05). While literature findings are conflicting [1], our results align with studies reporting no differences in single-leg balance [2]. Notably, previous studies used the SEBT for SLB assessments [3], whereas our study employed an objective evaluation system, which should be taken into consideration. Furthermore, the relatively good functional scores of the participants in our study might explain the absence of differences.

## Conclusions

Dynamic postural balance is affected by kinematic changes in the lower extremities, including the pelvis, hip, and ankle and reciprocal anatomical mechanisms might result in changes in stability measures. Future electromyography studies focusing on stabilizer muscles, such as those in the lumbar region and hips, may clarify their role in this process.

## Acknowledgments

This research project was supported by Hacettepe University Scientific Research Projects Coordination Unit (Grant Number: THD-2023-20897).

## References

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[2] Erdoganoglu Y et al. (2020) *J Orthop Surg (Hong Kong)*, **28(1)**: 2309499019900819.
[3] Song CY et al. (2017). *Clin J Sport Med*. **27(5)**: 438-443.

**Table1.** Differences in postural stability measures for single-leg stance and bipodal stance between groups.

| | SLS | | | BS | | |
|---|---|---|---|---|---|---|
| | Mean±SD | | p | Mean±SD | | p |
| | PFP | Healthy | | PFP | Healthy | |
| **Ellipse area ($mm^2$)** | 8.67±3.1 | 7.23±2.4 | 0.171 | 8.67±3.1 | 7.23±2.4 | 0.255 |
| **AP amplitude (mm)** | 43.9±9.8 | 41.5±11.6 | 0.103 | 19.3±7 | 17.4±4.3 | 0.627 |
| **ML amplitude (mm)** | 31.1±5.3 | 29.3±5.7 | 0.428 | 11.6±5.3 | 9±2.8 | 0.078 |
| **AP path length (mm)** | 285.6±81.2 | 293±54.9 | 0.205 | 337.8±83.2 | 347.6±85.7 | 0.871 |
| **ML path length (mm)** | 1043.5±245.6 | 970.1±301.1 | 0.273 | 195±49.4 | 192.2±45.9 | 0.886 |
| **CoP path length (mm)** | 383.4±110.3 | 386.7±73.7 | 0.091 | 375.3±87.2 | 387.9±90.2 | 0.913 |
| **AP velocity (mm/s)** | 20.9±4.8 | 20.7±5.8 | 0.466 | 7.14±1.6 | 7.1±1.6 | 0.808 |
| **ML velocity (mm/s)** | 21.4±3.8 | 20.8±5.2 | 0.230 | 2.35±0.5 | 2.46±0.6 | 0.453 |
| **CoP velocity (mm/s)** | 8.28±1.8 | 7.91±1.4 | 0.227 | 7.93±1.6 | 7.93±1.7 | 0.740 |