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PRONATED AND FLAT FEET: DISTINCT ENTITIES OR OVERLAPPING CONDITIONS

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Abstract: The terms pronated foot and flat foot are often used interchangeably in clinical practice, despite representing distinct biomechanical and morphological conditions. In many respects, the two conditions present with analogous clinical manifestations and may elicit similar symptomatology; however, their underlying genesis differs. Accurate differentiation between these conditions requires not only advanced expertise in biomechanics and the anatomy of the ankle–foot complex, but also comprehensive knowledge of the distinct stages of foot development from a podiatric perspective.

Misinterpretation of these entities may lead to inappropriate therapeutic strategies and suboptimal clinical outcomes, particularly in pediatric and physically active populations.

The purpose of this article is to clarify the differences between pronated foot posture and flat foot deformity, with emphasis on structural characteristics, functional behavior, and clinical relevance. The paper reviews current concepts of foot biomechanics and presents commonly used plantographic assessment methods, including Clarke's angle and footprint-based indices, to illustrate diagnostic distinctions.

Special attention is given to the clinical applicability and limitations of these assessment tools in routine physiotherapy practice.

Understanding the difference between dynamic pronation and structural flattening of the medial longitudinal arch is essential for accurate diagnosis, appropriate treatment planning, and prevention of misclassification. Clear differentiation between these conditions may improve clinical decision-making in physiotherapy and related disciplines.

Keywords: pronated foot, flat foot, physiotherapy, orthotic treatments
Field: Medical Sciences and Health

1. INTRODUCTION

In clinical practice, the terms "pronated foot" and "flat foot" are often used interchangeably, although they represent different biomechanical conditions. Excessive pronation is characterized by increased calcaneal eversion, forefoot abduction, and reduction of the medial longitudinal arch under load (Redmond et al., 2006). In most cases, it is functional in nature and associated with muscular imbalance and impaired control of the tibialis posterior and intrinsic foot musculature (Murley et al., 2009; Fraser et al., 2022).

Flat foot (pes planus), whether congenital or acquired, involves structural collapse of the medial longitudinal arch, frequently accompanied by ligamentous insufficiency and osseous adaptations (Dombek et al., 2020).

Failure to clearly differentiate these conditions may lead to inappropriate therapeutic goals and suboptimal physiotherapeutic intervention.

The aim of the present study was to compare the corrective potential of pronated and flat feet under an identical Physiotherapeutic and orthotic protocol.

2. MATERIALS AND METHODS

The study was conducted at the National Sports Academy "Vasil Levski" between September 2024 and November 2025.

Participants

Sixteen individuals aged 19–22 years were divided into:

- Pronated feet (n = 8)
- Flat feet (n = 8)

Participants with prior surgical interventions or neurological disorders were excluded.

Assessment Methods

For the definition of the pathologies and the monitoring of outcomes, we used some of the most well-established and validated methods for assessing foot condition.

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- Foot Posture Index (FPI-6) (Redmond et al., 2006)
- Navicular Drop Test (Brody, 1982)
- 3D sensor-based plantography (Multireha system)

Classification:
- FPI +6 to +9 → Pronated foot
- FPI ≥ +10 → Flat foot

Intervention

Both groups received identical intervention:
- Analytical strengthening of tibialis posterior, tibialis anterior, triceps surae
- Short-foot technique (Hashimoto et al., 2023)
- Intrinsic muscle strengthening (Fraser et al., 2022)
- Proprioceptive training
- Corrective insoles with medial arch support

Frequency: 3 times weekly
Statistical analysis: Paired t-test and Mann–Whitney U test
Significance level: $p < 0.05$

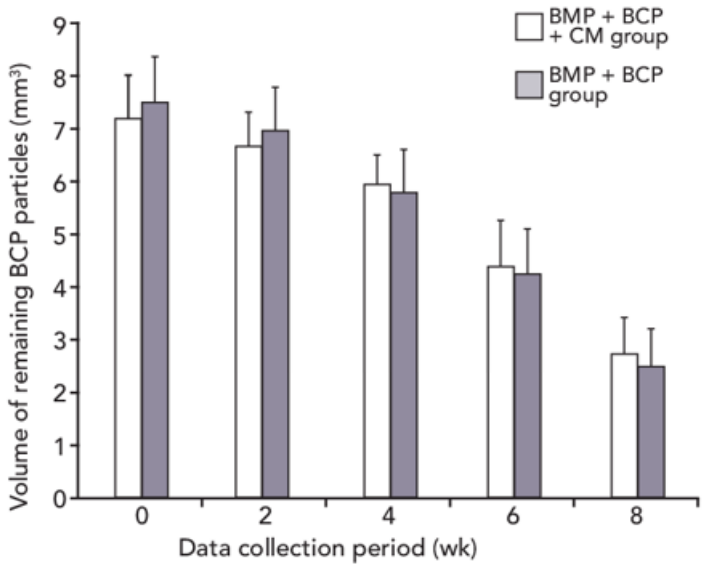
3. RESULTS

The results obtained from the different tests indicate that correction can be achieved more easily in patients with pronated feet compared to those with flat feet.

Results from the FPI-6 test demonstrate a statistically significant improvement in the pronated group.

Pronated: 8.3 ± 0.8 → 4.6 ± 1.1 (p=0.012*)
Flat: 11.4 ± 0.9 → 9.8 ± 1.2 (p=0.087)
A statistically significant reduction was observed in the pronated group only.

Figure 1. FPI-6 values (mean ± sd) before and after intervention



Source: Author's research

The results of the Navicular Drop Test also show a significant change in individuals with pronated feet.

Pronated: 9.6 ± 1.2 → 6.1 ± 1.4 (p=0.018*)
Flat: 13.2 ± 1.5 → 11.9 ± 1.6 (p=0.094)
Between-group difference in corrective potential was significant (p=0.032).

Table 1. Navicular drop (mm) before and after intervention

Parameter	Pronated	Flat	Between-group p
FPI change	−3.7	−1.6	0.032*
Navicular drop change	−3.5 mm	−1.3 mm	0.032*
% correction	65%	33%	—

Source: Author's research

Data from the plantographic assessments indicate improvement in 65% of the participants with pronated feet and a 33% correction rate in patients with flat feet.

Percentage correction toward neutral position:

- Pronated feet – 65%
- Flat feet – 33%

3D plantographic analysis demonstrated dynamic medial collapse in the pronated group and structural arch reduction in the flat foot group

4. DISCUSSION

The findings demonstrate a clear difference in adaptive potential between functional pronation and structural pes planus.

The reduction of FPI from 8.3 to 4.6 in the pronated group indicates preserved structural integrity and neuromuscular responsiveness. Improvement is likely associated with enhanced tibialis posterior activation and intrinsic muscle engagement (Kulig et al., 2004; Fraser et al., 2022).

In contrast, limited improvement in the flat foot group supports the hypothesis of structural restriction (Dombek et al., 2020). Observed changes likely reflect functional compensation rather than structural remodeling.

These results reinforce the distinction between functional pronation and structural pes planus.

Clinically, pronation should not automatically be considered pathological.

5. CONCLUSION

Pronated feet demonstrate significantly greater corrective potential (65%) compared to flat feet (33%) under identical therapeutic intervention.

Pronation represents predominantly a functional deviation, whereas flat foot constitutes structural pathology with limited reversibility.

Accurate differentiation is essential for effective physiotherapeutic planning.

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