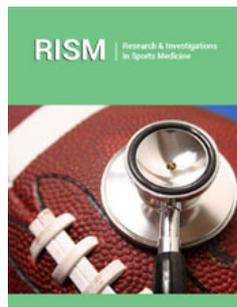


# Functional Biomechanical Analysis of Supported Body Skills

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## Editorial

Analysis of the support and biomechanical behavior of the subtalar joint in exercises with supported bodies.

## Introduction

The subtalar joint plays a central role in foot adaptation and force transmission during any skill involving supported body contacts-whether bipedal supports in athletics, unilateral dynamic supports in gymnastics, or hand-supported positions in acrobatics and dance. This editorial provides a critical analysis of support types and the biomechanical behavior of the subtalar joint in these “skills with supported bodies.” It discusses implications for practice, injury prevention and applied research.

Brief anatomical-functional context the subtalar joint, located between the talus and calcaneus, permits inversion-eversion and contributes to pronation-supination through the rearfoot complex. Its oblique axis enables multiplanar adjustments that govern longitudinal foot axis orientation, load distribution and rearfoot stiffness. Interactions with the talocrural joint, the medial longitudinal arch, the plantar fascia and the muscular chains (tibialis posterior/anterior, peroneal) ultimately determine the biomechanical response to loading.

## Support Types and Effects on the Subtalar Joint

- A. Full plantar support (standing, landing from jumps): Promotes broad load distribution; the subtalar joint modulates pronation-supination to absorb impact and prepare for propulsion. Excessive pronation or abnormal stiffness increases stress on structures such as the tibialis posterior and plantar fascia and alters proximal alignment (knee, hip, spine).
- B. Unipedal static/dynamic support (turns, single-leg landings, balance postures): Demands fine neuromuscular control. The subtalar joint stabilizes the rearfoot against sudden inversion/eversion moments; deficits in invertor/evertor control predispose to loss of balance and increased loading on the lateral or medial foot border.
- C. Manual supports and hand-bearing positions (handstands, hand-to-foot transitions, acrobatic hand balances): Although these do not directly load the subtalar joint, body transfer patterns and distal support requirements implicate kinetic chain adjustments. Ankle alignment relative to the foot axis, talocrural dorsiflexion/plantarflexion and rearfoot stiffness influence landing strategies and force dissipation when returning to plantar support.
- D. Combined or intermittent supports (partial forefoot support, mixed forefoot-rearfoot contact): Alter the Center of Pressure (CoP) and lever arms acting on the subtalar joint, changing local loading and stabilizer muscle demands.

## Biomechanical Behavior During Skills

- a) Intertarsal rotation control and talocrural-subtalar coupling: During rapid movements, the subtalar joint mediates the conversion between tibial rotation and foot orientation. Decoupling (for example, from joint stiffness or ligamentous injury) leads to proximal compensations with overload at the knee and hip.
- b) Functional stiffness modulation: The subtalar joint can increase stiffness (supination) for propulsion or decrease stiffness (pronation) for shock absorption. In skills with abrupt load changes, the capacity to rapidly switch between these states is critical for performance and safety.
- c) Force distribution and inertial moments: During jumps, landings or asymmetric supports, the subtalar joint redistributes lateral and anterior-posterior forces; altered loading patterns produce peak tensions in collateral ligaments and the rearfoot complex.
- d) Fatigue and impaired control: Muscular fatigue (peroneals, tibials) modifies activation timing and corrective magnitude at the subtalar joint, increasing risk of inversion sprains or chronic overload pathologies (tendinopathies, plantar fasciopathy).

## Practical Implications for Training and Injury Prevention

- A. Comprehensive functional assessment: Beyond passive range measures, clinicians and coaches should evaluate dynamic control (single-leg perturbation tests, CoP analysis, three-dimensional video when available) and neuromuscular responses to load changes.
- B. Targeted strengthening and neuromotor training: Exercises that enhance invertor/evertor function and proprioception (unstable balance tasks, change-of-direction plyometrics, landing drills with CoP awareness) are essential to optimize subtalar behavior.

C. Technical progression and load management: For complex skills with atypical supports (forefoot-dominant positions, hand-supported transitions), implement graded progressions to allow adaptation of subtalar control and the ascending kinetic chain, avoiding abrupt overload.

D. Protective and corrective strategies: Orthoses, footwear, and taping can modify subtalar kinematics; their use should be individualized and goal-directed (stability versus mobility).

E. Task-specific rehabilitation: Include exercises that replicate the specific mechanical demands of the skill (landings, pivots, support on unstable surfaces) to restore coordinated patterns and joint resilience.

## Applied Research Priorities

- a) Quantify the exact contribution of the subtalar joint across support conditions using validated musculoskeletal models and in vivo measures (EMG, force platforms, kinematics).
- b) Determine how interventions (orthoses, proprioceptive training, surgical procedures) alter subtalar dynamics and overall task efficiency.
- c) Investigate interindividual variability (morphological and neuromuscular) to personalize preventive and performance interventions.

## Conclusion

The subtalar joint is an essential modulator in skills involving supported body contacts: it functions as a shock absorber, adapter and regulator between the distal limb and the proximal kinetic chain. Understanding its responses to different supports- and training its ability to transition rapidly between stiffness and compliance under neuromuscular control-is critical to improve performance and reduce injury risk. Interventions should be individualized, functional and task-specific. Continued interdisciplinary research (biomechanics, physical therapy, sports science) is necessary to translate these principles into effective, evidence-based protocols.