



Search Engine

Abstract details

Title: **A NOVEL FRAMEWORK FOR THE ANALYSIS OF LINEAR ACCELERATION MECHANICS FOCUSING ON 'SHIN ROLL': HOW TO ROCK N ROLL?**

Session: OP-BM01 - BIOMECHANICS AND MOTOR CONTROL

[Enter session OP-BM01](#)

AID: 35048/3083, Presentation format: ORAL

Authors: **OEPPERT T J, ZEDLER M, GOLDMANN J P, BRAUNSTEIN B, WILLWACHER S & ALT T**

Institution: GERMAN SPORTS UNIVERSITY COLOGNE

Country: GERMANY, Topic: BIOMECHANICS

INTRODUCTION:

The generation of horizontal force is essential for sprint acceleration. It requires a precise sequence of joint kinematics and kinetics, which is elicited during swing-stance transition [1]. Thirty years ago, the effectiveness of a 'rotation-extension strategy' has been emphasized: a rotation of the centre of mass (CoM) around the foot in the early stance, followed by a delayed extension of the hip (HJ), knee (KJ) and ankle joint (AJ)[2]. As the rotational component is vital for horizontal acceleration, a deeper understanding is necessary. Therefore, this 'Method and Theoretical Perspective' article aimed to introduce a novel framework which identifies key positions and a temporal sequence of movement strategies contributing to efficient acceleration.

METHODS:

A 3D analysis using 16 infrared high-speed cameras (250 Hz, Vicon, Oxford, United Kingdom) was used to study the first three steps of nine female elite sprinters (23±5 years, 172±5 cm, 61.5±5.0 kg, 100 m-PR: 11.4±0.2 s). Combined with a review of existing evidence, this dataset led to the identification of a framework based on the shins' orientation in space [3].

RESULTS:

A continuous forward rotation of the shin towards the supporting ground (SG) ('shin roll') was observed from late swing to late stance. Three movement strategies drive the shin's downward tilt and connect four key positions. The 'shin block' defines the instance during late swing at which the shins' rotation direction changes. The athletes then reach the 'touchdown' (initial ground contact), by way of the 'shin alignment' strategy. This is followed by the 'heel lock' when the AJ reaches its lowest position through the 'ankle rocker' strategy. Finally, the 'propulsion pose', defined as the minimum shin angle in relation to the SG, is achieved via the 'shin drop' strategy.

CONCLUSION:

The 'shin roll' facilitates rotation of the CoM prior to proximal-to-distal energy transfer. The 'shin alignment' strategy, achieved through a HJ extension with a 'locked' KJ, enables an efficient interaction with the SG after touchdown. Following rapid heel stabilization, the shin continues to rotate forward through a pronounced AJ dorsiflexion ('ankle rocker'). These strategies, as supported by previous research [4] associating foot placement posterior to the vertical projection of the CoM and greater AJ dorsiflexion range of motion during early stance with improved acceleration performance, assist in quickly overcoming the braking impulse. The 'shin drop' ensures a considerable amount of maintained flexion in the AJ and KJ, decreasing excessive vertical acceleration. By combining the ankle rocker and shin roll, the cue 'Rock n Roll' offers a catchy association for practitioners. The framework helps improving the technical understanding of sprint acceleration and can be used as a template for future research.

1) Charalambous et al. (2011) JSportsSci

2) Jacobs & van Ingen Schenau (1992) JBiomech

3) Alt et al. (2022) SportsBiomech

4) King et al. (2023) JSportSci

[Back to the results list](#)

[Search Engine](#)