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Bipedal in-shoe kinetics of skateboarding – the ollie

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on an inclined surface, there is still a forefoot dominance. However, there is a clear change in the coordination pattern which appears to be in anti-phase at certain marked sections of the stance phase (Figure 2(a)).

Whilst there is a similarity in the pattern of the waveforms between level and incline walking (Figure 2(a)), they do not provide detailed information on the coordination pattern. However, as indicated in Figure 2(b), the new coordination classification technique identifies subtle changes in the segmental data. These changes provide an insight into the complexity of multi-segment foot kinematics both in level and in incline walking, which has not been observed or reported in traditional approaches. The results of the current investigation and the techniques reported within this study have the potential not only to inform functional footwear design but also a wider clinical and scientific community to understand foot function.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Bipedal in-shoe kinetics of skateboarding – the ollie

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Keywords: impact forces; footwear; skateboarding; biomechanics; bipedal

Introduction

Skateboarding is a globally participated and popular sport with a reported participation of over 11 million in the United States alone (SGMA, 2007). Published epidemiological studies have stated the significant incidence of musculoskeletal injuries associated with skateboarding (Frederick, Determan, Whittlesey, & Hamill, 2006). The inherent nature of skateboarding makes it difficult to quantify using standard laboratory methods. In-field protocols have been attempted to quantify the metabolic demands of the activity, while only partial segments of a given movement have been quantified from a biomechanics perspective (Frederick et al., 2006; Hetzler, Hunt, Stickley, & Kimura, 2011). Therefore, unique methods of testing are necessary to develop a complete understanding behind the basic movements of skateboarding.

Purpose of the study

The purpose of this pilot study was to quantify the basic skateboarding manoeuvre of the ollie using novel methods and technology in the athlete's own environment.

Methods

Four experienced male skateboarders participated in this pilot study. Each subject wore identical Vans Authentic footwear, but used their own skateboard throughout the

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data collection. Each subject was tasked with performing an ollie under three randomized conditions: (1) standing ollie (SO); (2) rolling ollie (RO); (3) ollie down (OD). The OD manoeuvre was performed utilizing a 36.0-cm platform. OpenGo (Moticon GmbH, Munich, Germany) wireless sensor insoles were utilized to continuously record underfoot forces at 50 Hz. Each insole contains 13 pressure sensors with a specified load range of 0–40 N cm^{-2} along with an accelerometer. To ensure a similar fit in the footwear, the production insoles were replaced with the OpenGo insoles during the data collection. Statistical comparisons were made using a single-factor ANOVA ($\alpha = 0.05$).

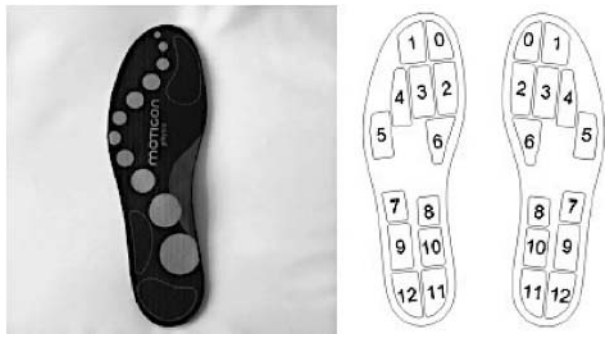

Figure 1. OpenGo wireless pressure sensing insoles with a diagram of sensor placement.

Results

The average peak take-off forces during an SO, RO and OD were 2.47 ± 0.38 BWs, 2.55 ± 0.51 BWs and 2.34 ± 0.32 BWs, respectively. Average peak landing forces of the SO, RO and OD were 2.40 ± 0.33 BWs, 2.71 ± 0.23 BWs and 3.15 ± 0.51 BWs, respectively. Pressure distribution during take-off and landing was centred around the medial forefoot in sensors 0, 2 and 3 shown in Figure 1.

Discussion and conclusion

The measured take-off forces were similar to previous studies that evaluated the impact forces from an ollie movement (Frederick et al., 2006; Nevitt, Determan, Cox, & Frederick, 2008). The landing forces in our findings were different when compared to previous literature (Nevitt et al., 2008). Nevitt et al. compared landing forces from various platform heights for the OD manoeuvre, while forces of 3.15 ± 0.51 BWs when landing from a height of 36.0 cm we found in this pilot study, they do not compare to the 4.61 ± 0.80 BWs from a platform of 22.9 cm. Previous literature on skateboarding forces utilized force plates to determine the force measurements for the whole system. It is critical to keep in mind that the board, bushings and wheels of the skateboard, as well as the footwear may provide for shock attenuation. As shown in Figure 2, the OpenGo system differentiates itself by providing for force measurements underneath each foot without the need for a tethered data logger on either the distal limb or waist of the subject (Stöggl & Mariner, 2016)

The unique methods of data collection in this pilot study allow the subject to perform in his or her given environment without external influence from testing equipment. This pilot study reveals that skaters experience significant forces underfoot while having the various factors of shock attenuation. Future investigation in the role

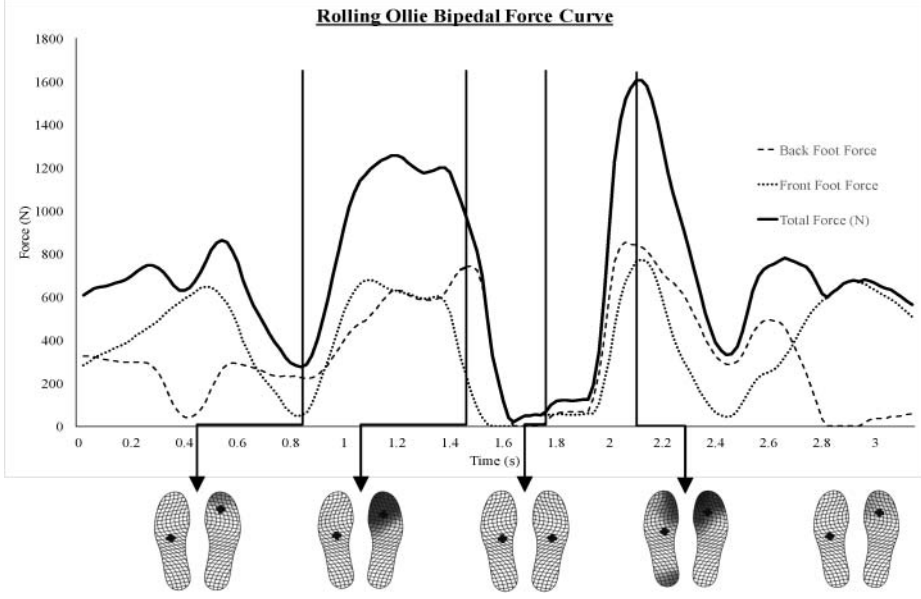

Figure 2. Forces and underfoot pressures from a rolling ollie trial.

of shock attenuation of the skateboard and footwear would be useful to footwear and skateboard manufacturers.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Effects of cleat stiffness on footwear comfort and performance in American football: A randomized control trial

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Introduction

Comfort and performance are the most desirable features that athletes consider when selecting footwear (Hennig & Sterzing, 2010). While footwear stiffness modifications aim to reduce the number of foot and ankle injuries during activity, the interaction between the foot and shoe surface can directly influence the perceived comfort, and therefore have functional performance implications (Wintana, Goonetilleke, Xiong, & Au, 2009). The effects of varying levels of shoe plate stiffness on comfort and functional performance are not well understood, particularly across an athletic season.

Purpose of the study

To determine the effects of footwear stiffness modification on subject-specific assessments in a large cohort of high school American football players prior to and during a football season.

Methods

Ninety-seven high-school-aged American football players (age 16.1 ± 1.2 years, height 175.3 ± 7.2 cm, mass 80.0 ± 21.3 kg) were fitted with two identical football specific cleats (CrazyQuick 2.0, adidas) with different magnitudes of plate stiffness measured by three-point bend testing (stiff: 61.2 N/mm, moderate stiffness: 47.3 N/mm). Subjects completed field-based performance assessments (Pro-agility test, T-test, vertical jump) during the pre-season. The order of testing for each cleat was randomized for each subject. Following the field-based assessments for each footwear condition; the athletes' perception of the footwear was assessed via a computer-based visual analogue scale (VAS), Likert questions and regions of discomfort chart. Following the field-based assessments; subjects' cleat preference was recorded. Each subject was then randomly assigned one of the two cleat conditions to wear throughout the season. A weekly questionnaire assessed player wear rate, perceived comfort and perceived performance. Logistic regression determined the primary predictors of athlete cleat preference. Linear mixed effects models determined differences throughout the 12-week season between cleats.

Results

During the pre-season testing, there were no statistical differences between cleats (stiff vs. moderately stiff) in the

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