

subjects (N= 78, mean age, 33.4y; range 19-72y) were included. The subjects participated in four tests: I. Ground walking over a 20 m distance, II. Ground jogging over a 20 m distance, III. Treadmill jogging at a constant speed of 8.5 km/hr for a 15-second interval and IV. Elliptical jogging over a 20 second period at a resistance and incline level of 10, and at a steady pace within the range of 70-95 steps/min.

Results: In walking tests, the APBW value on the entire foot value was 112% (SD=15.57), 80% (SD= 15.92) on the hind foot, and 108% (SD= 15.47) on the forefoot. In ground jogging, the APBW value on the entire foot was 201% (SD= 31.24), 101% (SD= 21.78) on the hind foot, and 174% (SD=28.52) on the forefoot. In the treadmill test, the APBW value on the entire foot was 175% (SD=25.48), 88% (SD=24.86) on the hind foot, and 146% (SD=25.59) on the forefoot. In the elliptical test, the APBW value on the entire foot value was 73% (SD=13.8), 33% (SD= 13.7) on the hind foot, and 48% (SD= 15.9) on the forefoot.

Conclusion: Elliptical training significantly reduces weight-bearing as compared to other common functional and sporting activities.

Impact:

- Elliptical training can be used in cases where weight bearing needs to be reduced
- Early rehabilitation can be commenced early on in rehabilitation to prevent muscle atrophy and maintain cardio-pulmonary function

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Influence of a nonlinear pedagogy approach on individual routes of learning when acquiring a complex weightlifting skill

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Introduction: Traditionally, reducing performance variability is synonymous with 'optimal' skill learning, however, contemporary skill acquisition approaches, such as Nonlinear Pedagogy (NLP), view variability differently. Exploration (i.e., movement variability) of alternative movement patterns, even those considered suboptimal, are thought to be important in learning, facilitating the development of adaptable and individualised movement solutions (Chow et al., 2022). This exploratory study aimed to describe the individual dynamics of performance related to the level of movement exploration when learning the power clean skill using a NLP approach.

Methods: Four healthy adults, categorised as weightlifting beginners (Everett, 2012), practiced the power clean over 7 sessions for 4-weeks. Consistent with NLP design principles, analogy-based instructions were used to avoid explicit technique prescription (Komar et al., 2014) and two task constraints (poles in front of lifter and chalk on barbell; Verhoeff et al., 2018) were introduced in sessions 2-5 to infuse practice variability and encourage movement exploration. Sessions comprised a warm-up of 1×5 repetitions (20kg barbell), followed by 3×5 repetitions (30kg barbell) recorded using 3-D motion capture to track 36 retroreflective markers to create nine time-continuous variables. Cluster analysis quantified individual movement to provide an exploration/exploitation ratio (EER). Exploration occurred when movement clusters differed between

two repetitions and exploitation occurred when movement on repetitions was the same (Komar et al., 2019). To quantify performance changes, horizontal barbell displacement was measured from start position to final catch position (B×D) (Winchester et al., 2005).

Results: Individual differences in movement exploration across sessions were apparent. Lifter A demonstrated the least exploration (EER = 0.07 – 1.8) and largest improvement in B×D early in practice (S1 to S3 = 14.40%). Lifter B explored most in S4 and S5 (EER = 2.75 – 4) and showed minimal changes in B×D across sessions (S1 to S7 = -2.39%). Lifter C demonstrated high levels of exploration across all sessions (EER = 1.14 – 3.66) and improved B×D later in practice (S5 to S7 = 9.23%). Lifter D explored most in session 4 (EER = 6.50) and displayed largest improvement in B×D between S1 to S3 (5.12%).

Discussion: NLP-designed practice had different impacts on performance dynamics and levels of exploration for lifters. All lifters demonstrated improved performance outcomes, but displayed different routes of learning (Kostrubiec et al., 2012). Some learners (i.e., Lifter C) may display more exploration to discover a functional, stable performance solution (Bifurcation route). Other learners (i.e., Lifter A) may display less exploration while gradually transitioning between movement patterns (Shift route). Practical implications include how explicitly prescribing an "ideal" technique may not be necessary to achieve optimal performance, with NLP-designed practice potentially facilitating the development of individualised movement patterns matched to individual capabilities.

Impact and application to the field: Findings challenge a "one size fits all" approach, indicating that skill development is highly individualised and movement variability is not necessarily "poor performance", but may represent a beneficial exploratory component of the learning process.

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Risk factors for the development of femoroacetabular impingement in physically demanding occupations: a systematic review

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Background: Femoroacetabular impingement (FAI) syndrome, or hip impingement, is a musculoskeletal condition affecting the hip joint. It involves motion- or position-related pain originating from an abnormal, premature contact between the femoral head-neck junction (femur) and the acetabular rim (rim around the hip socket). Cumulative and repetitive mechanical overloads at the hip joint appear to contribute to the development of FAI. However, occupational exposures to such loads in potential high-risk occupational groups (e.g., military personnel and athletes) and the relationships between these exposures and the development of FAI remain unclear. Therefore, the aim of this review was to identify and synthesise findings from studies which have reported on the occurrence rates and risk factors between occupations or occupational tasks in physically demanding occupations, and the development of FAI.

Method: This review was conducted according to the PRIMSA-P guidelines and registered on the Open Science Framework. PubMed, EBSCO, Scopus, Web of Science, CINAHL and ProQuest databases