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Opinion

Are we really "screening" movement? The role of assessing movement quality in exercise settings

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1. Introduction

The assessment of movement quality became widespread in exercise settings following the introduction of Gray Cook's Functional Movement Screen (FMS).[1] Assessing muscle and joint function during real-world movement tasks, it changed the way many coaches assessed their clients. Subsequent research explored potential applications of the tool, most of which focussed on injury prediction. But despite theoretical rationale, evidence suggests that the injury-prediction capabilities of movement-quality assessments like the FMS are limited, at best.[2] Consequently, it is now often suggested by coaches and researchers alike that movement-assessment tools offer little merit in practice.[3] However, the authors of this opinion piece offer an alternative perspective, where the assessment of movement quality plays an important role in practice, although with a primary focus of guiding safe and effective exercise prescription, rather highlighting injury risk.

2. Are we really "screening" movement?

The term *movement screen* suggests that these tools are designed to identify, or screen for, risk of injury. However, as recently articulated by Bahr,[3] exploring what determines a screen highlights why this term is misleading. Screening describes a strategy used to identify pathological conditions *prior to* an individual's showing the specific symptoms of that condition.[3] This is done to allow early intervention, thus mitigating the risk of that condition progressing further or even occurring in the first place. However, it is important to note that for this process to be effective, the condition must have an early detectable stage where a link between the indicator and the condition is well established.[4] Furthermore, there must also be clear evidence demonstrating that treatment of the indicator at this early stage offers more benefit than treating the condition at a later stage.[4] Therefore, for a movement assessment to act as an injury screen, there would need to be a clear link between low scores in movement quality and a heightened incidence of injuries. There would also need to be evidence demonstrating that improving scores of movement leads to a subsequent reduction in injury risk, neither of which is strongly supported by evidence from multiple systematic literature reviews.[2,5,6]

Although it appears logical that the way someone moves will impact injury risk, mechanisms for injury are complex and multifactorial.[7] An injury occurs when the physical load placed upon tissues of the body outweighs the capacity to tolerate that load. In the case of an acute injury, this capacity is likely to be exceeded only in a scenario where intrinsic and extrinsic risk factors overlap in such a way that they overcome the tissues' load management capabilities during a specific action and at a singular moment in time. Using a hamstring strain as an example, an injury is likely to occur if the individual has previously had a hamstring injury, has poor eccentric hamstring strength, is currently under fatigue, and is performing high-speed running. Although in isolation, these factors may have a small association with increased injury risk, it is only in combination that the risk of injury becomes more probable. It is then reasonable to suggest that if the way someone moves does contribute to an increased risk of injury, it will be only a minor factor in the overall pathway to injury occurrence (Fig. 1). It is likely that this explains why poor scores on movement-assessment tools such as the FMS have shown weak associations with injury occurrence across such a broad range of populations, sporting and otherwise.[8,9]

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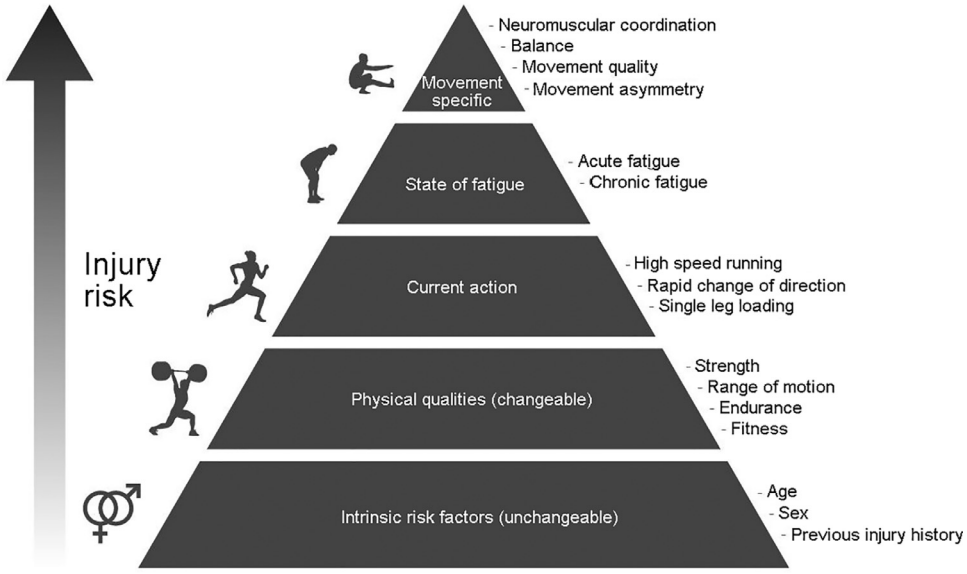

Fig. 1. Proposed hypothetical pyramid of injury risk.

This suggests that the assessment of movement has limited implication for injury prediction, but it does not mean that movement assessment is without merit—rather, that we should consider its value from other perspectives.

3. The importance of movement quality

Good-quality movement is typified by the performance of fundamental movements in a balanced and well-coordinated manner.[1] Conversely, poor movement quality presents in the inability to complete these same movement tasks in accordance with accepted theoretical norms (i.e., excessive knee valgus during a lunging movement task). This underpins the rationale for movement assessments like the FMS, which allow the evaluation of movement to produce a quantifiable measure of movement quality.[10]

It is well established that resistance training is integral to enhancing physical performance. However, the quality with which resistance training is performed has important implications. The continued performance of resistance exercise with poor technique can lead to the development of undesirable motor patterns, muscular imbalances, and postural deviations,[11] all of which may have negative implications on long-term health and performance.[12–14] Consequently, prioritising optimal technique is an important consideration among coaches when prescribing and delivering exercise programs. Well-qualified coaches aim to prescribe exercise that is suited to enhance the health, well-being, and performance of any individual client. Subsequently, the exercises selected should be prescribed based upon the best available evidence and should align accurately with clients' needs. One can draw on one's own knowledge and experience, as well as the available literature, to decide on a program of resistance exercises that manage this effectively. However, for this program to be effective, one must also assess whether the client has the capacity required to perform those exercises in a safe and acceptable manner.

4. How do movement assessments guide exercise prescription?

For resistance exercise to provide optimal benefits, it must be performed with strict technique, ensuring that the musculoskeletal system is loaded safely and that the correct muscles, joints, and motor patterns are being trained to achieve the desired outcome. However, when individuals enter a resistance-training environment, their capacities to perform resistance exercise with acceptable technique remain unknown. As such, there is a need for assessments evaluating their abilities to perform gym-based exercises. Hence, it is imperative that some level of movement assessment be undertaken to help inform this process.

All movement-assessment tools appearing within the literature share a key similarity: they assess fundamental movements to provide a measure of movement quality.[10] Considered fundamental because they underpin tasks of daily living and athletic actions, these movements also replicate many core movements trained in gym settings.[10] Therefore, at a minimum, these assessments provide a valid method of appraising an individual's current movement capabilities. In doing so, they can qualify a person for the performance of certain movement variations whilst identifying others that need to be adjusted or omitted.[15] Although this alone can enhance the safety and efficacy of an exercise program,[14] movement assessments offer further value in exercise settings.

When applied appropriately, movement assessments can identify sites of muscular dysfunction (driven by neuromuscular imbalances, muscle weakness, restrictions in joint mobility, or excessive muscle tightness) that are contributing to undesirable movement patterns.[16] Additionally, they evaluate muscular function in practically relevant movement scenarios, providing a depth of information unobtainable by the testing of individual muscles and joints. This provides a method of guiding resistance exercise to cause subsequent improvements

in movement quality which, over time, can improve training effectiveness.[17] For example, the observation of excessive knee valgus during a lunging movement task may indicate weakness of the gluteal muscle groups.[18] This muscle group could then be strengthened, causing improvements in frontal plane knee control, indicating enhanced movement quality. This example is isolated to a specific area of the body, but the principle can be applied to other movements and body regions and for different exercises.[10] Importantly, over time these improvements can increase the number of movements available to the client. These can then be trained with external resistance, enhancing performance outcomes associated with that type of exercise (Fig. 2).

It is with this methodology that new movement-assessment tools such as the Selective Functional Movement Assessment have been developed, with the primary goal of helping health care professionals choose the best possible rehabilitative and therapeutic exercises for their clients.[19]

5. Practical implications: Where does the assessment of movement offer the most value?

When used in the manner illustrated in Fig. 2, movement assessments have applications in both sporting and health-related contexts. For individuals with minimal experience in gym environments, the appraisal of movement quality identifies a starting point from which they can commence an exercise regime safely. This ensures that the resistance training program is suitable for their individual needs, while providing a foundation from which more complex resistance training methods can be introduced. Alternatively, the appraisal of the movement capabilities can highlight unidentified areas of weakness which their current exercise program may not be addressing. A suitable training program can then be developed with the intent to improve upon these weaknesses, causing a sustained improvement in movement capabilities.

Further, considering that this type of resistance exercise has been shown to enhance performance (at lower perceived exertion than traditional strength-training methods)[17] and that individuals with higher measures of movement quality experience greater improvements in athletic performance across the duration of a training season,[20] it is pertinent to consider prioritising movement quality for athletic populations.

It is important to note that coaches are likely to appraise movement during the performance of resistance exercise, either subconsciously or consciously, but in an *ad hoc* manner when prescribing and monitoring strength interventions. However, the use of well-described systematic approaches (i.e., movement assessments) offers significant advantages over these unstructured approaches because they provide a more complete assessment of baseline movement quality as well as a more reliable method for reassessment at later stages. There is evidence from medical research that further suggests the importance of a systematic assessment process, demonstrating that even expert practitioners miss key information when using unstructured methods of client assessment.[21] This approach is also important for assessing changes in movement quality over time, where previous research on the repeatability of the various tools can add

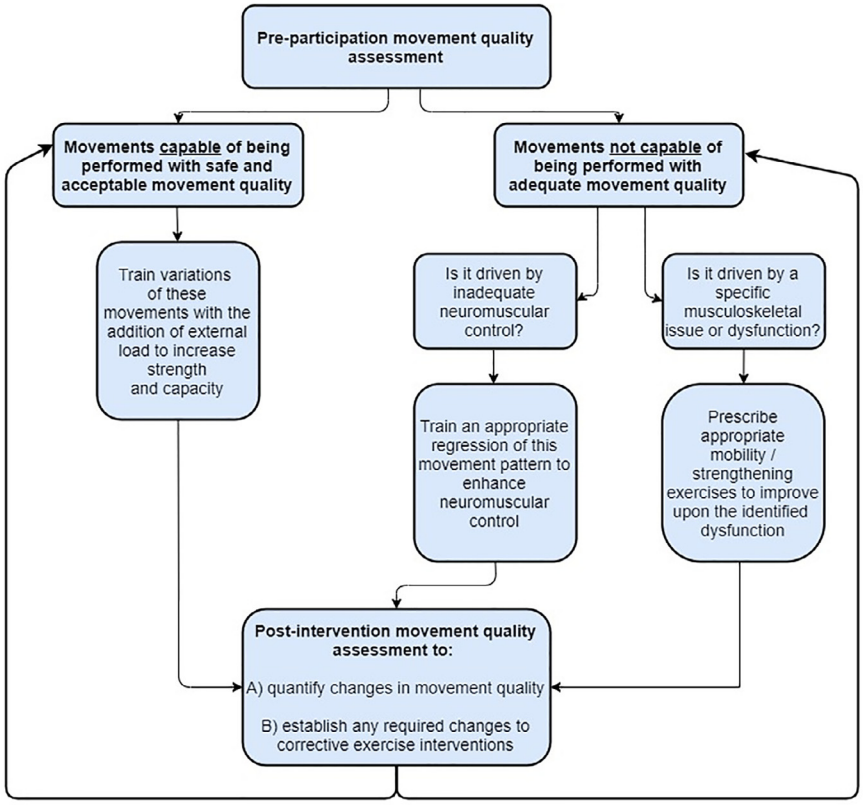

Fig. 2. Proposed hypothetical protocol for assessing movement quality to inform exercise prescription.

confidence for determining whether real change has occurred. Although most tools were not designed with this specific purpose in mind, many can be applied in this way.[17,22] Thus, using a structured and systematic movement-assessment tool is recommended to ensure that movement-quality information is gathered in a comprehensive and repeatable manner.

6. Conclusion

Although movement assessments do not appear to truly screen for injury risk, they offer valuable information to support exercise professionals in resistance-training settings. In addition to providing a systematic method of observing and quantifying movement quality in an individual for future reference, they also provide important information about task-specific movement capabilities and neurological and musculoskeletal function. This information can be used to guide exercise prescription, enhancing training safety and improving long-term functional and performance outcomes. It is apparent that these tools offer value to professionals in exercise settings.

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Authors' contributions

HB, JA, KN, and KD all played key roles in the conception, drafting, and finalisation of this manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interest

KN is a director of MovementScreen Pty Ltd., the company that developed the MovementSCREEN movement assessment tool. This job position did not interfere with the conception, direction, or completion of this article. HB, JA, and KD declare no competing interest.

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