Letter to the Editor

Concentric and Eccentric Exercise

To the Editor:

This contribution considers the use and possible misuse of the terms concentric and eccentric in several contexts: first, the origin of terms; second, different approaches; and third, the possible uses. To our knowledge, an article has been published in The Journal of Pain misusing the terms concentric/eccentric exercise. The purpose of this letter is to foster the use of the terminology positive/negative work together with concentric/eccentric contraction to ease reference search (ie, through key words) and comprehension.

When Did These Terms Initially Appear and What Do They Mean?

The history of the terms concentric and eccentric is related to muscle contraction in physiology science. Back in 1925, A.V. Hill defined 2 types of muscle contraction: isometric (muscle length does not change during contraction) and isotonic. In the latter contraction, tension remains unchanged while the muscle fibers change even if in real sporting conditions, the neuromuscular system constantly adapts to the resist load by managing the tension in order to obtain the desired movement outcome. There are 2 types of isotonic contractions: concentric and eccentric. In concentric contraction, the muscle tension rises to meet the resistance and then remains over this level as the muscle shortens. During eccentric contraction, the muscle lengthens as the resistance is greater than the force the muscle is producing.

Which Areas for the Terms Concentric/Eccentric Exercise?

The terms concentric and eccentric were much used in scientific manuscripts in different areas: physiology, biomechanics, and neuromuscular. On PubMed, a search concerning the years 1975 through 2013 (years included) found n = 190,138 articles using the words muscle contraction vs n = 2,308/1,589 articles with eccentric/concentric exercises. Several authors have misused the terms concentric/eccentric work or exercise for exercise with displacement of the body upwards to overcome gravity/acceleration of the body (positive work) or landing/deceleration of the body (negative work). Whereas the terms eccentric/concentric are linked to a muscular behavior, we believe that it cannot be used in all contexts. Is it judicious to use (only) eccentric/concentric for exercise?

From the point of view of physics, during positive work (rising/accelerating), there is positive work (lowering/decelerating),1 some muscles are in eccentric mode. For instance, during concentric elbow flexion, the biceps brachii contracts concentrically, whereas the antagonist muscle, the triceps brachii, contracts mildly eccentrically to maintain movement precision and control. In this article, considering (as showed in the article) that the human moment was performed in flexion or extension, use of the term eccentric exercise cannot be justified. Moreover, if you do not want to use flexion or extension, you should refer to either the concentric phase of the biceps or triceps or its eccentric phase.

Furthermore, the use of these terms in both exercise and muscle contraction has led to confusion.4 Considering the need to clarify this question, we propose that the terms positive work and negative work1 are more appropriate for describing some exercise. In another context, it would be more correct to use, for instance, flexion–extension or adduction–abduction for a single-joint exercise or pull–push for a multijoint exercise.6

The correct use of terms eccentric and concentric can be valuable for understanding results in a journal article and deciding whether the authors’ conclusions are justified by the data. To avoid confusion, words such as positive (concentric) and negative (eccentric) exercise are preferable. They indicate the importance of the outcome and hence what was probably intended. We believe Sports Science still presents some confusion for some other concepts and we invite all our colleagues to discuss them in letters to the editors as we did in this short letter.

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References