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Editorial OMICS International

Getting the Dosage Right in Balance Exercise Prescription: the Intensity Problem

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Editorial

As our population ages, finding effective interventions to treat balance impairments is critical. In the United States Medicare spent over $31 billion in 2015 managing fall injuries. More than 800,000 people a year were hospitalized because of a fall, most often a fractured hip or head injury. Fall injuries are among the top 20 most expensive medical conditions, with an average cost of over $30,000. Furthermore, these direct costs do not account for the long-term effects of these injuries such as disability, dependence on others, lost time from work and household duties, and reduced quality of life [1]. Thus, determining effective means of preventing falls is a significant health care need.

There have been a large number of investigations examining various aspects related to balance training and fall prevention, with more than 50 systematic reviews and meta-analyses of this research completed since 2009 [2]. Multiple types of balance interventions have been studied, with populations of varied ages as well as with differing disabilities, and in multiple types of settings [2,3]. However, there is no simple answer about the "best" exercise prescription to prevent falls because the construct of balance itself is so complicated [4]. The ability to maintain the center of mass within the base of support, or balance is a composite impairment that is influenced by strength, flexibility, sensation, cognition, and motor control.

Despite the complexity, however, developing evidence based guidelines for effective balance exercise prescription is essential. Physical therapy exercise prescription typically follows the FITT principle [5], referring to frequency, intensity, type, and time, similar to medication administration. For example, when prescribing a drug, a physician determines the correct medication [TYPE] as well as the amount [INTENSITY] and frequency [FREQUENCY] of taking the medication, and the duration to continue taking the medication [TIME]. The physical therapy profession has taken a harder look at how we prescribe exercise over the last decade across multiple domains of practice, from acute care, to orthopedics to geriatric rehabilitation [6-8]. Similar to pharmacological interventions, incorrect exercise dosage can be ineffective in targeting the problem, and therefore costly in actual dollars and/or time. In addition, it can be damaging [9].

Because balance is a multifactorial construct, exercise prescription is complex. It is for this reason that many individuals will do better with an exercise program customized by a physical therapist rather than attending a standardized group program [10,11]. There are often multiple types of exercise necessary to address different components of the balance problem. For example, it is common to use strengthening exercises in conjunction with exercises addressing motor control components of balance, such as seen in the widely used OTAGO exercise protocol [12]. We do have guidelines for determining types of exercise, based on an individualized evaluation [2], although there are newer interventions, such as perturbation training, that show excellent promise as well [13]. We also have some guidelines related to the frequency and duration needed for an exercise program to be effective in certain setting and with certain populations [14]. However, we do not have a tool or measure to quantify the intensity aspect of balance tasks [15]. To be effective, a balance exercise program must be challenging; to induce any training effect, the exercise must be performed near an individual's capacity [9]. Gold standard measures of intensity exist for aerobic exercise (heart rate) and strengthening exercise (one repetition maximum). However, with balance specific exercises, what challenges one individual is not necessarily difficult for another. Previous practice of a similar task can make a given type of balance exercise less intense. One example of a common type of balance exercise is cross over side-stepping. This activity would be less intense for an 80-year-old who practices Tai Chi regularly than a sedentary octogenarian. Likewise context matter. A given type of balance activity can be made more intense by changing the context, such as adding a dual task or decision-making demands. For example, an individual will walk more slowly in the cognitive Timed-Up-And-Go test than in the regular version of the test with no dual cognitive task [16].

Farlie and colleagues [15] completed a systematic review of measures of balance training intensity, examining 148 randomized trials. They found that intensity of balance was typically measured by some other aspect of the activity, such as exercise time, aerobic intensity, or a hierarchy of task difficulty without reference to the patient's ability. They identified only three trials with potential systems that measured balance challenge intensity, and two were not described in detail while the last was defined in terms of the limits of the patient's postural stability, but with no apparent validation.

While the profession has made strides in identifying the type, frequency and duration needed for balance exercise to be effective, we still need a way to measure balance intensity. Without validated instruments, we cannot assess dose-response relationships in balance training trails. Establishing psychometrically validated clinical and research measures of balance intensity will be difficult because the construct of balance is complex. Several groups have begun the process. Farlie and colleagues [17] examined using observation of bracing, postural reactions, and sway as non-verbal measures of balance intensity. They also noted verbal markers of intensity, such as talk during the pre-task period. Another approach is to use a self-perception scale such as Espy's Rate of Perceived Stability [18]. Measurement of balance intensity is more challenging than assessing muscle strength or aerobic intensity due to the inter-individual variation. However, this is the necessary next step for developing evidence-based guidelines for individualized balance exercise prescription.

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