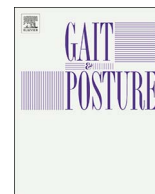




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Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Short communication

Defining instances and limbs during performance of the standing turn

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ARTICLE INFO

Keywords:

Turning
Standing
180° Turn
Step definitions
Conventions

ABSTRACT

Conventions have been reported to describe walking and turning gait. No such descriptions appear for the 180° standing turn and as such there are inconsistencies in the literature reporting on this movement. The complexity of explaining the standing turning motion, variation in number of steps when turning, and differing strategies used means conventions will make research reporting easier to comprehend and less likely for errors in interpretation. We propose definitions of the 180° standing turning motion and steps used to complete a turn for able-bodied and pathological populations to encourage consistency in reporting. It is recommended that the definitions be applied in future research on standing turns.

1. Introduction

Turning is a common yet complex manoeuvre that occurs whilst in transit and from standing, and there is a growing body of research in this area for healthy and pathological gait [1,2]. Current research on the standing turn has adopted differing approaches to quantifying and describing the turning motion [3,4]. Developing the principles outlined by Huxham et al. [5] we have devised a convention to define the limbs, features and temporal parameters for turning from standing.

2. Proposed definitions

2.1. Overall turn

The main direction of the turn defines the turn itself. Following this a turn to the right refers to a turn where the whole body moves in a clockwise direction. Conversely a turn to the left refers to a turn where the whole body moves in an anti/counter-clockwise direction.

2.2. The address & start of the turn

The initial position at the start of the turn where they are in double support (DS) shall be referred to as the address (Fig. 1), and should be considered as the period of time between the initiation of the turn and the first movement of a foot which indicates the start of the first step of the turn. This allows any movement due to a preceding task to be distinguished from the start of the turn itself. The initiation of the turn must be defined specific to any movement occurring during standing

prior to the address, the population being investigated, as well as the parameters being studied and motion analysis system used. It is anticipated that through consistent and thorough reporting over time standardised parameters and thresholds to identify the start of the address can be quantified.

2.3. Steps performed during a standing turn

A standing turn will include some or all of the following steps from the initiation to the end of the turn [4] (Fig. 1):

- Preparatory Step
- Turn Step
- Depart Step

2.4. Defining the limbs

Clearly defining the limbs being referred to during a standing turn is important to avoid confusion when interpreting research in this area. The ipsilateral limb is the limb in stance and the contralateral limb is being repositioned during the turn step. Hence, during a right turn the ipsilateral limb will be the left limb and the right limb (contralateral) will be repositioning (Table 1). The proposed definition allows for consistent definitions of the limbs when researching pathological populations or research that stratifies turns according to preference (see below).

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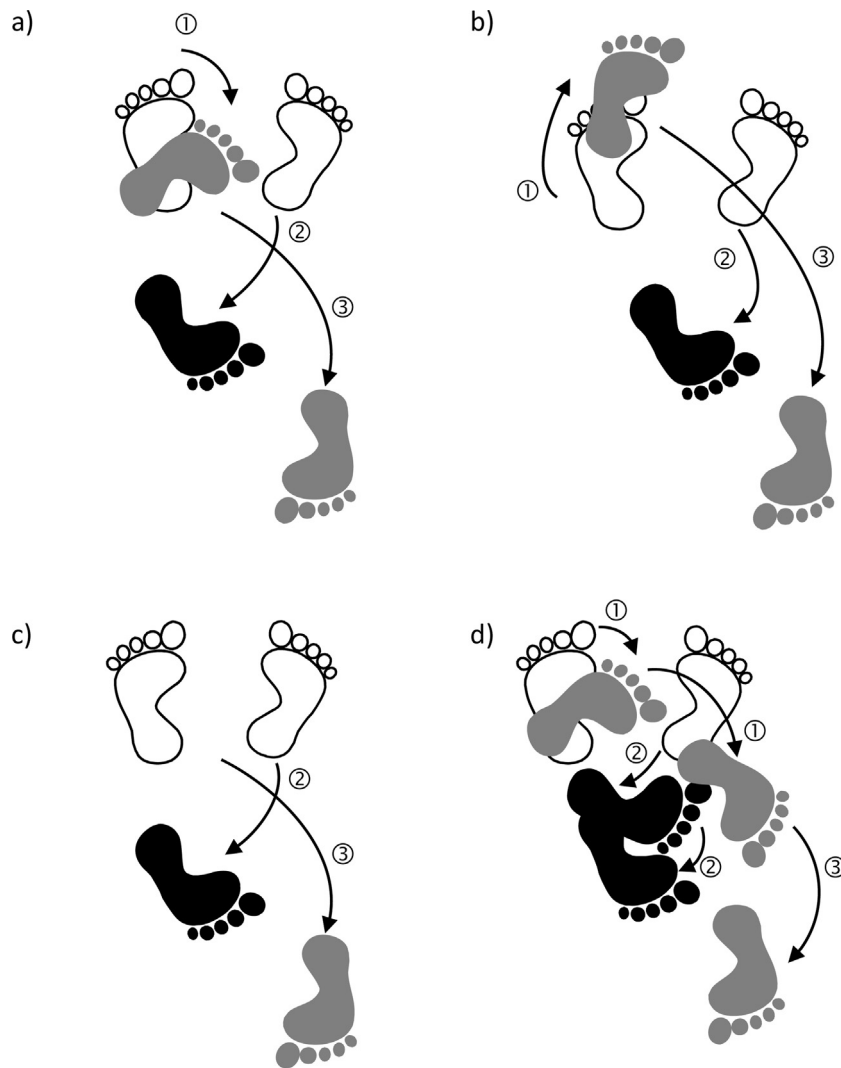


Fig. 1. A standing turn to the right from the left limb. (a) Illustrates the most common turn strategy in our lab, a turn with a preparatory step, (b) is a small modification of this turn which was relatively common, here the preparatory step involves the forward motion of the ipsilateral limb, (c) illustrates the second most common turn in our laboratory, a turn without a preparatory step, here the ipsilateral limb does not reposition prior to the turn and (d) a turn we have observed with more frail and disabled participants, a preparatory, turn, preparatory, turn, depart strategy. Key: address (white footprints), preparatory (1), turn (2) and depart (3) steps. Definitions of the step pattern for Fig. 1a are provided in Table 1.

2.5. Definition of the preparatory step

During the preparatory step the contralateral limb is in stance and the ipsilateral limb is repositioned (Fig. 2). For the turn to the right, the ipsilateral (left) foot is repositioned, and vice versa for a turn to the left.

The repositioning of the ipsilateral limb could be any angular and/or linear displacement of the foot (Fig. 1a, b). To accommodate varying strategies, we use the term repositioning to include swing when the foot leaves contact with the ground (true single support phase), a pivot where one part of the foot remains in contact with the ground while the part not in contact is reorientated, and readjusting where a shuffling movement occurs. It is therefore suggested that the definition of the preparatory step should be:

The step of the turn where the contralateral limb is in stance and the ipsilateral limb is in swing, pivoting or readjusting so that the ipsilateral limb is reorientated from its position during the address.

In some cases a person may not perform a preparatory step so their first step of the turn following the address will be the turn step (Fig. 1c).

2.6. Turn step

This is the step of the turn where the ipsilateral limb is in stance and

the contralateral limb is repositioning. For a turn to the right, the left limb would be in stance and the right limb repositioning. This is equivalent to the ‘step’ turn previously defined for steering [6]. It is therefore suggested that the definition of the turn step should be:

The step of the turn where the ipsilateral limb is in stance and the contralateral limb is in swing, pivoting or readjusting.

Prior to the start of the turn step there will be a period of double support either during the address or from initial contact of the ipsilateral limb to the initiation of repositioning of the contralateral limb. This latter situation represents the initial double support phase of the turn step and the terminal double support of the preparatory step when present (Fig. 2).

2.7. Depart step

During the depart step a person will be attempting to take the first full step in the intended direction of motion. It is therefore suggested that the definition of the depart step should be:

The first step where a person takes the first full step in the intended direction of motion following completion of the turn. During this step the ipsilateral limb will be in swing or readjusting and the contralateral limb

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