



Brief Report

The relationship between transitional motor skills and locomotion



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ABSTRACT

This study explores whether transitional skills and sitting correlate with locomotion onset. The development of eight infants was followed. Most transitional skills correlated with locomotor skills. Sitting and rolling did not. Transitional skills may resemble the control needed for locomotion more closely than sitting.

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1. Introduction

Human development is a multimodal process where babies figure out how to interpret and move through the world around them. In motor development, this first means figuring out that limbs have mass. Then, infants figure out how to move the limb through space, coordinate multiple joints, and deal with unexpected forces (Thelen, 1995). As infants complete their first year of development, they have gained so much control that they have multiple forms of locomotion such as crawling, cruising, and possibly walking. Throughout development, children interact with an ever more complex and challenging environment. These challenges often involve unexpected forces in multiple planes of movement which are an important component of pelvic and trunk control during locomotor skill development.

Locomotor skills require infants to handle rotational forces through their trunk and pelvis; suggesting that earlier motor experiences help prepare infants to deal with these forces. In addition, each locomotor pattern provides the infants information about how their bodies work and allows them to develop neuromuscular strategies to maintain positions, move between positions, and locomote. Crawling is the most stable of the early locomotor skills. Infants begin crawling with 3 limbs on the ground at all times and move to a pattern where the 2 diagonal limbs are on the ground at the same time (Adolph, Vereijken, & Denny, 1998). During both of these crawling patterns, infants have to stabilize their trunks while 1 or 2 limbs move forward underneath them. This is no small neuromuscular feat. Infant who cruise have a higher center of mass than those who are crawling but they still use their arms for support. They also show a progression similar to crawlers, decreasing the amount of extremity support over time (Haehl, Vardaxis, & Ulrich, 2000). Throughout cruising, infants display a loose coupling between the trunk and pelvis which helps mitigate uneven forces coming through the arms and legs (Haehl et al., 2000). In other words, infants use their trunk to absorb unexpected forces and maintain balance. Walkers must also manage

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forces and maintain balance. To accomplish walking, infants use whole-body patterns that emerge from the complexity of the task, the balance requirements of walking, experience, and personal characteristics (Snapp-Childs & Corbetta, 2009). Unlike cruisers, brand new walkers often have a more rigid trunk–pelvis coupling. Instead of absorbing forces in their trunk, new walkers use arm position to counter the rotational forces coming through the legs and trunk (Kubo & Ulrich, 2006).

Though independent sitting requires a requisite amount of trunk control and strength, research on postural development in sitting appears to support the fact that infants who are 6- to 9-month-old show postural sway that is tuned to their visual input not to their sitting experience (Barela, Jeka, & Clark, 1999), suggesting that the time and experience spent in sitting may not have a large influence on the development of postural control, a key parameter in locomotor skills. Additionally, quiet sitting does not require a response to outside perturbations or rotational forces. What, then, could give us important practice in dealing with unexpected forces through the trunk; forces that we must deal with in order to locomote. We would like to suggest that transitional movements, movements that allow us to move from one posture to another, help us to explore and learn to control the effects of unexpected forces during movement. The purpose of this study is to determine if transitional movements are correlated with locomotion. We hypothesize that there will be a significant correlation between the age at onset of transitional movements and the age of onset of locomotor skills. The age at onset of sitting skills will not be significantly correlated to age of onset of locomotor skills.

2. Materials and methods

2.1. Subjects

Eight children with typical development (5 males, 3 females) participated in this study from the time they were 6 months old until they had 5 months of walking experience. Participants were recruited through flyers at local day care centers and churches as well as by word of mouth. Children were included in the study if they had typical development and birth weight of greater than 5 pounds. Exclusion criteria included gestational age of less than 37 weeks or a history of major injury that required hospitalization or surgery. In total, the families of 10 children contacted researchers to participate. One child was born before 37 weeks of gestation and one family decided not to participate. This study was approved by the Institutional Review Board.

2.2. Measurement

During monthly visits, we observed the children's motor skills using the Movement Assessment of Children (MAC) as a guide for motor skill observation. The motor skills of particular interest to us were sitting, locomotor skills, and transitional skills. Locomotor skills included crawling on hands and knees, cruising quickly and easily, and walking with the ability to start stop and turn. Transitional skills included independent rolling, rotating into sitting, pulling to stand at furniture, moving from squatting to stand, and getting down to the floor by squatting. Often, children skipped skills, choosing the more advanced option. When this occurred the date was noted for the more advanced skill and not the skipped skill. Not all children have an emergence date related to all skills.

2.3. Procedures

Children participated in monthly visits, from 6 months of age until they walked independently. The parents contacted us when the child took 5 steps across the floor independently and a visit was scheduled within 1 week regardless of when in the month this occurred. Monthly visits were then resumed with the "new walker" visit as the starting point until the child had 5 months of walking experience. During the visits, we facilitated play and exploration of the environment with standardized equipment including a 2 inch mat, a 20 inch tall mat table, a 4 inch mat placed next to the mat table to facilitate climbing, therapeutic stairs with 2 steps up and 2 steps down and one railing, and a 8 inch ball. In addition to the standardized equipment, children were also allowed to play with toys they found motivating. The researchers did not touch the children with the intent of facilitating specific movements of interest. Rather, we set up the environment and observed the child's movements. The children were tested in their diapers with no additional clothes. The testing sessions were videotaped.

2.4. Data analysis

Researchers ran descriptive statistics on the sample as well as Pearson Product Moments to determine the correlation between locomotor skills and transitional skills as well as the correlation between locomotor skills and stationary sitting skills. Alpha was set at 0.05.

3. Results

The average age for onset of the skills analyzed is shown in Table 1. Of the 5 transitional movements analyzed, 4 showed significant strong correlations to all of the motor skills analyzed (Table 2). These included coming to sit with rotation, pulling to stand through ½ kneel, coming to stand through a squat, getting down to the floor with a controlled squat and maintaining the position momentarily. The transitional skill, rolling over from supine, showed

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