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Identifying the level of trunk control of healthy term infants aged from 6 to 9 months

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ABSTRACT

This study identified the level of trunk control of healthy term infants aged from six to nine months. This cross-sectional study included fifty-five infants aged from six to nine months. The levels of trunk control was investigated by using the *Segmental Assessment Trunk Control* (SATCo). The infants remained seated on a wooden bench and a neutral pelvic position was maintained. The SATCo score was considered as dependent variable. The results showed that infants aged six and seven months presented levels of trunk control in the thoracic region while infants aged from eight to nine months presented full trunk control. These results demonstrate that younger infants present less levels of trunk control while older infants present full trunk control, confirming that trunk control development takes place in a segmental way and in a cephalocaudal direction. These results also might be used as a reference to distinguish infants that show a delay in trunk control from those who have suitable motor development and, thus intervene at an early stage to minimize later delays in these infantś global motor development.

1. Introduction

Postural control is an important and complex motor milestone acquired progressively during the first year, as it ensures adequate body positioning in space, maintaining stability and body alignment from maintaining the center of gravity projection within the base of support (Dusing & Harbourne, 2010; Prieto, Myklebust, Hoffmann, Lovett, & Myklebust, 1996; Westcott, Lowes, & Richardson, 1997). This requires proper functioning of sensory and motor systems, which work together to maintain alignment and vertical control to explore the environment and carry out functional activities (Rachwani et al., 2013).

Different authors consider that postural control development takes place in a cephalocaudal direction (Graaf-Peters, Bakker, Van Eykern, Otten, & Hadders-Algra, 2007; Woollacott, Debu, & Mowatt, 1987), it means, there is a direction-specific recruitment of postural muscles that takes place in a descending order (Graaf-Peters et al., 2007; Van Balen, Dijkstra, & Hadders-Algra, 2012). For example, over the months, as the infant grows and develops the ability to sit, postural muscle recruitment increases, so that there is an increase in the control of the trunk segments (Butler, Saavedra, Sofranac, Jarvis, & Woollacott, 2010; Rachwani et al., 2013; Rachwani, Santamaria, Saavedra, & Woollacott, 2015; Saavedra, Van Donkelaar, & Woollacott, 2012), beginning by activating the cervical muscles (Graaf-Peters et al., 2007; Van der Fits, Klip, Van Eykern, & Hadders-Algra, 1999). Thus, initially, infants acquire head control to subsequently acquire the upper, middle and inferior trunk control. Taking this into account, understanding changes in the trunk control across multiple muscular and skeletal subunits is important as there is a gain of trunk control gradual and in a segmental way over the months.

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Recent studies have highlighted the relevance of trunk control segments, since they can influence carrying out functional activities, such as manual reaching (Rachwani et al., 2013, 2015; Silva, Santos, Greco, & Tudella, 2016) and independent sitting posture (Saavedra et al., 2012). However, these studies do not provided information regarding the exact level of trunk control in the studied age group, neither identified and/or described the level of trunk control for each age, from acquiring independent sitting. Researchers and clinical therapists should know that trunk control development in typical healthy infants occurs over months, as this understanding could serve as a reference to identify early on if there are deviations in the development of trunk control of infants at risk or infants with neuromotor disability. Therefore, studies on trunk control development that consider it multi-segmental are necessary.

Given the above, it is understood that there is a lack of information about identifying the exact level of trunk control of healthy infants, especially from the emergence of independent sitting, because it is an important milestone in the first year of life, which enables the infant to use the upper limb to explore objects and the environment. Thus, identifying the level of trunk control at each age is important to establish appropriate patterns of postural responses, considering the progressive development of trunk control. By identifying the level, clinical therapists can assess early delays and disabilities in the development of trunk control in infants at risk.

The data obtained could help early identification of deficient levels of trunk control in infants with neuro-sensory motor disorders, and infants at risk for developmental disabilities. Indeed, clinical therapists can develop targeted intervention strategies, maximizing trunk control and functionality of these infants. Thus, the aim of this study is to identify the level of trunk control of healthy term infants aged from 6 to 9 months.

2. Materials and methods

2.1. Design

This cross-sectional study using a convenience sample was approved by the Ethics Committee of the University (protocol no.205.501/2013). The sample size was calculated based on a previous study by Saavedra et al. (2012) considering an effect size of 0.3 and power of 0.80 with a value of $p = 0.05$. Therefore, the minimum number of infants considered in each age group (six, seven, eight and nine months) was 10. However, there was a sample loss for the group of infants aged from eight to nine months.

2.2. Participants

This study included 55 healthy term infants that were selected based on medical records of the municipal daycare centers and creches, from January 2015 to November 2015. Afterwards, their parents/guardians were contacted. The inclusion criteria considered were: full-term infants (37–41 weeks and gestational age of six days), with birth weight appropriate to gestational age, i.e., birth weight between the 10th and 90th percentiles on the growth curve (WHO, 2006a,b) and an Apgar score between 7 and 10 in the first and fifth minutes, attending public day care centers or not. The infants were subdivided into 4 groups: infants aged six months (G6, n = 25); infants aged seven months (G7, n = 13); infants aged eight months (G8, n = 9); infants aged nine months (G9, n = 8). Infants that presented any type of sensory or motor disorder were excluded.

2.3. Procedure and materials

After accepting to take part in the studies, the parents/guardians signed the Informed Consent form and a date and time were previously scheduled to carry out the assessments.

Each infant participated in an assessment session of approximately 15 min in the laboratory or in rooms at the daycare centers. In order to define the level of trunk control, the infants were evaluated using the Segmental Assessment of Trunk Control (SATCo) (Butler et al., 2010). SATCo is the only valid instrument that can assess the level of trunk control by segments, and assess the ability of the typical or neuromotor deficient infant to maintain or recover a vertical position while sitting.

The infant was positioned in a sitting posture on a wooden bench (Fig. 1) with the pelvis maintained in a neutral position using a belt system in relation to the vertical axis and with the head upright to identify the level of trunk control (Butler et al., 2010). When the tester felt it was necessary, he/she could watch the footage to review the movement strategies in the frontal and sagittal planes. Each evaluation of the infant was filmed and used to review movement strategies in the frontal and lateral planes when the evaluator thought it was necessary.

The tester was positioned behind the infant to provide manual support to the shoulders to evaluate the cervical control; axillae (upper thoracic control); inferior scapula (mid thoracic control); lower ribs (lower thoracic control); below ribs (upper lumbar control), pelvis (lower lumbar control) and no support, to measure full trunk control. The tester applied firm manual support horizontally around the trunk at each of the different levels.

A second tester sat in front of the infant presenting him/her with attractive objects in order to maintain the infanťs upper limbs high, and so that there would be no contact with their body or the bench, thus avoiding the influence of the infanťs manual contact on the trunk control. At each level of manual support provided, balance tests were carried out: a) static, the infant should remain seated without losing balance for 5 s; b) active, the infant should visually follow the object shown on the left and right sides without losing balance; c) reactive, the infant should remain stable during nudges. The second tester applied the nudge in the reactive test in the sagittal (manubrium/sternum and high thoracic) and frontal (right and left acromion) planes using their fingertips. If the infant presented trunk control in the three balance tests at the assessed level, the test continued with lowering of manual support level until