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Arm Positioning and Walking Styles of Children During First 5 Months of Independent Walking

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INTRODUCTION

At the onset of independent walking (IW), new walkers must learn how to integrate and respond to the gravitational forces and biomechanic moments placed on the body. To do this, infants must first learn dynamic postural control in states of disequilibrium and then must refine their locomotor control of gait.[1] Adults manage equilibrium and energy expenditure during gait by utilizing reciprocal arm swing.[2] Reciprocal arm swing develops during childhood from a sequence of early arm positions first described by Ledebt in 2000.[3] Previous research has not established percentages of time spent in each early arm position as IW progresses in typically developing infants.

Purpose: To describe arm positioning across the initial 5 months of IW in typically developing infants.

Hypotheses:

1)High to middle guard positioning would be dominant during early visits with a progression to low guard by later visits

2) During the initial 5 months of IW arm movements would be limited to high, middle, and low guard, without consistent flexed arm movement or reciprocal arm swing.

METHOD

Subjects: Eight typically-developing children

Inclusion criteria: Typically developing infants with birth weight of greater than 5 lbs.

Procedure: In this secondary analysis, researchers evaluated and coded video from trials at 1–5 months of IW. Researchers coded three trials per visit using arm positioning descriptions adapted from Ledebt (2000), including reciprocal arm swing (RAS), flexed movement (FM), high guard (HG), middle guard (MG), and low guard (LG) (see figure one).[3] Time in each arm position for each arm in seconds is the dependent variable. Researchers performed descriptive statistics on the dependent variable for each visit. Other statistics performed include a 2(hand)x5(visit) ANOVA with repeated measures and post hoc analysis with Bonferonni correction.

Figure 1. Arm position examples, left to right: HG, MG, LG, FM, RAS

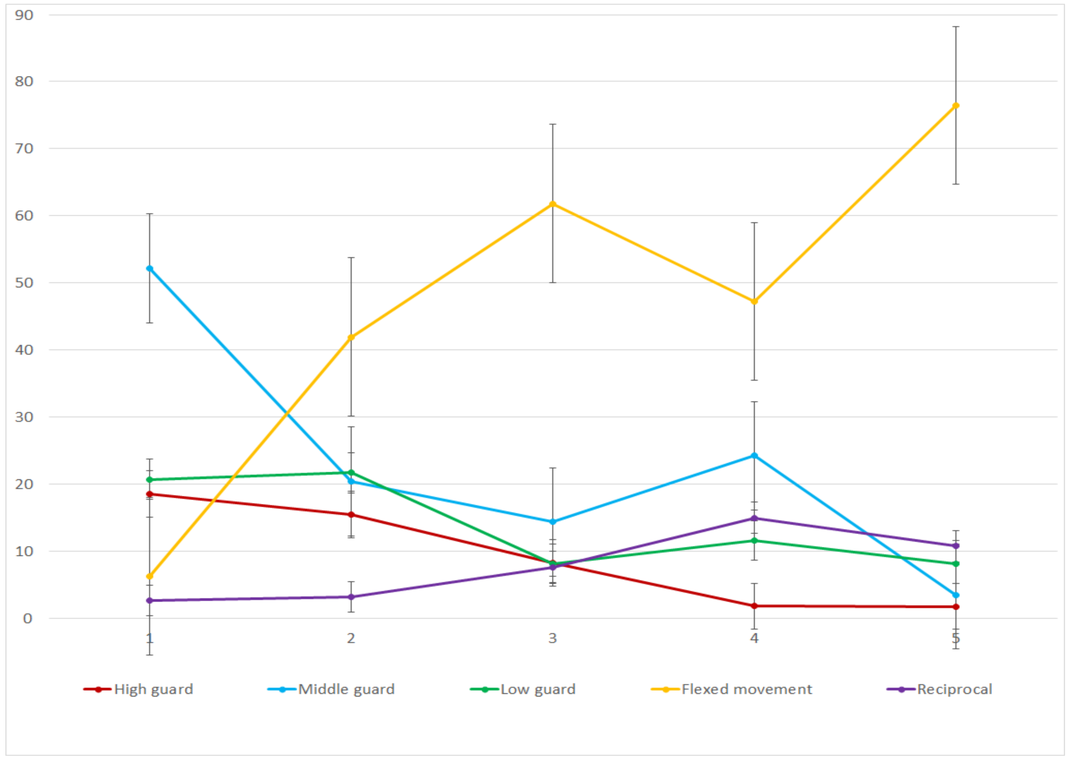

Figure 2. Mean percentage of time in each arm position across subjects by visit

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2. Meyns P, Bruijn SM, Duysens J. The how and why of arm swing during human walking. *Gait Posture.* 2013;38:555-562.

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RESULTS

The mean percentage of time in each arm position during the first visit was 2.6% RAS, 6.3% FM, 20.7% LG, 52.2% MG, and 18.5% HG. During the fifth visit, the mean percentages were 10.7% RAS, 76.4% FM, 8.1% LG, 3.5% MG, and 1.7% HG. For the fifth visit, the means were 1.7% high guard, 3.5% middle guard, 8.1% low guard, 76.4% flex movement, and 10.7% reciprocal arm swing (see figure two). A 5 (visits) x 2 (sides) ANOVA with repeated measures revealed a left-to-right difference for HG (p=.035) as well as a significant side-by-visit interaction for HG (p=.023) and MG (p=.018). There was also a significant visit effect between visits 1 and 3 and between visits 1 and 5 for MG (p=.024, .003, respectively) and FM (p=.015, .005, respectively) with a trend toward significance for low guard (p=.055).

DISCUSSION

Infants transitioned to utilizing FM as the dominant arm positioning sooner than anticipated with a quick decline in reliance on guarded arm positions. As expected, there was a trend toward emergence of RAS but more experience is needed for the infant to exhibit consistent mature upper extremity mechanics. Although it was not statistically significant for all arm positions, asymmetry between sides was common, suggesting that infants had not yet established an effective solution for equilibrium. Despite the primary use of FM, infants continued to utilize other arm positions during latter trials suggesting that the infants reverted to reducing the degrees of freedom when necessary to maintain balance.

CONCLUSION

This study describes changes in arm position over time – from stable upper extremity strategies to more mobile, exploration-facilitating strategies. Therapists should, therefore, monitor the transition from guarding to dynamic strategies during the first few months of IW for typically developing infants. If the transition does not occur, closer observation may be needed in order to facilitate early intervention.