How Do Babies Roll?

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Understanding How Babies 3-7 Months Achieve a Roll

BACKGROUND

- **Achieving a roll is a crucial developmental milestone for babies, understanding the mechanics gives insight into development.**
- **Only one previous study has established different coordinated movements that a baby may use to achieve a roll.** [1]
    1. **Contralateral Arm & Leg with Ipsilateral Leg**
    2. **Contralateral Arm**
    3. **Contralateral Arm & Leg**
    4. **All Limbs**
    5. **Contralateral Arm with Ipsilateral Leg**
- **No studies have explored how these coordinated movements are related to muscle activation.**

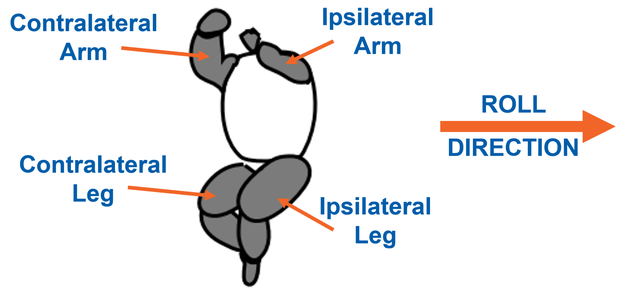

Figure 1: Naming convention for coordinated movements as roll types

PURPOSE: To develop a quantifiable method characterizing the muscle activation and the coordinate movements of infant rolling.

METHODS

Five healthy infants (4M, 1F, 6.7 ± 0.8 months) participated in this ongoing IRB-approved study where eight half rolls were analyzed.

Motion Capture System (Vicon, 100Hz)

- Tracks movement with reflective markers and specialized cameras

Electromyography (EMG) Sensors (Delsys, 2000Hz)

- Records muscle activity with specialized sensors

RESULTS

Motion Capture System

- The data collected determined the different coordinated movement types using visual inspection techniques.

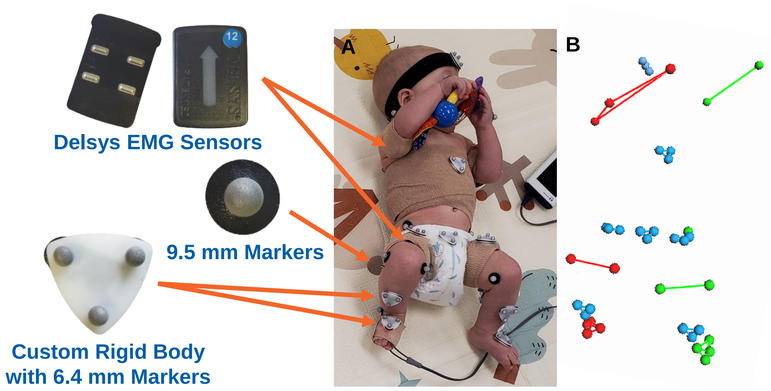

Figure 2: (A) EMG and reflective marker placement (B) Motion Capture View of roll initiation

EMG Sensors

- Data was filtered and normalized as a percentage of the ipsilateral limb (100%) of the roll direction for each muscle.[2] The contralateral muscles were then used for comparison for each movement type.

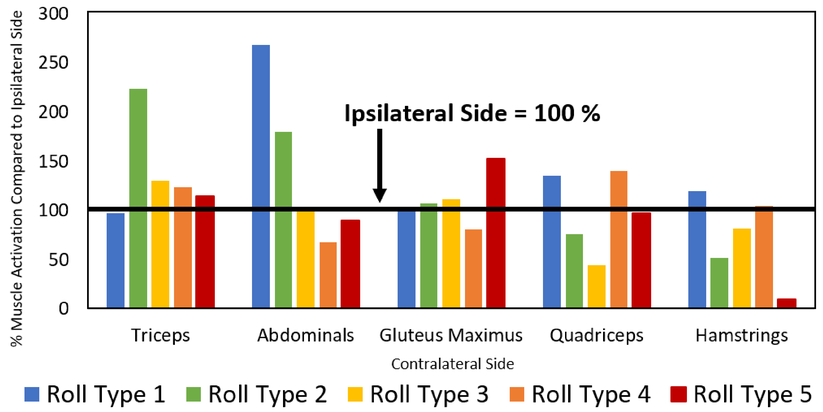

Figure 3: Muscle activation comparison for different roll types

CONCLUSION

- **Preliminary results indicate similar muscle patterns that would be expected for each coordinated movement.**
- **Muscle activation of the contralateral side compared to the ipsilateral side for each roll type observed:**
    1. **Higher abdominals and quadriceps with both triceps being used about equally**
    2. **Higher triceps and abdominals with lower hamstring and quadriceps**
    3. **Higher triceps and gluteus maximus with lower hamstring and quadriceps**
    4. **Higher triceps and quadriceps with lower abdominals and gluteus maximus**
    5. **Higher triceps and gluteus maximus with lower abdominals and hamstrings**
- **Promising approach towards quantifying the movement patterns of roll initiation using a combination of motion capture and EMG analysis.**

IMPACT: Understanding how babies achieve a roll will help determine how rolling changes as a healthy baby ages. A rolling standard can then be created that shows when a baby's rolling is not progressing as expected, indicating developmental concerns.

FUTURE WORK

- **Develop methodology that would allow us to understand the different coordinated movements of a roll from home video.**
- **Allowing us to complete a longitudinal study from the comfort of a baby's home in a more realistic rolling environment.**

REFERENCES: [1] Kobyashi Y, et al. Exp Brain Res, 2016. [2] Siddicky S, et al. J. Biomech, 2020.