

How much hip motion occurs in 3 degrees of freedom during activities of daily living?

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Disclosures

Consultant/Speaker

Medtronic

Convatec

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Depuy

Microport

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Think Surgical

Research Support

Zimmer

Microport

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Introduction

- Hip range of motion precautions are often considered a requirement for patients after total hip replacement.
- Few studies have estimated hip motion during activities of daily living, and have been limited to measuring hip flexion / extension only.
- These studies are also limited by bulky equipment, outdated technology, or testing in a lab environment.



Objective

- The purpose of this study is to evaluate hip range of motion in 3 planes (flex / ext, abd / add, IR / ER) during real-life activities in healthy individuals with a novel tracking wearable sensor.



Methods

- Eight healthy subjects used a hip motion tracking device during a series of tested activities.
- Healthy volunteers were selected, and subjects were excluded if they reported symptoms in the limb or known deviation in their gait.
- Activities recorded in the real-world environment included walking, stair ascent/descent, squatting, sitting to standing, getting on/off toilet, getting in/out of car, tying shoes, and getting in/out of bed.



Results

- Activities with over 90 degrees hip flexion and about 25 degrees abduction arc include sit to stand and on/off toilet.
- Getting in/out of bed and car averaged 100 degrees hip flexion with over 26 degree abduction arc, with additional over 20 degrees of hip rotation.
- Tying shoes while sitting had the highest hip flexion angle of 120 degrees, combined with 27 degrees abduction arc and 13 degrees rotation.
- Stairs and level walking had the narrowest motion arcs.

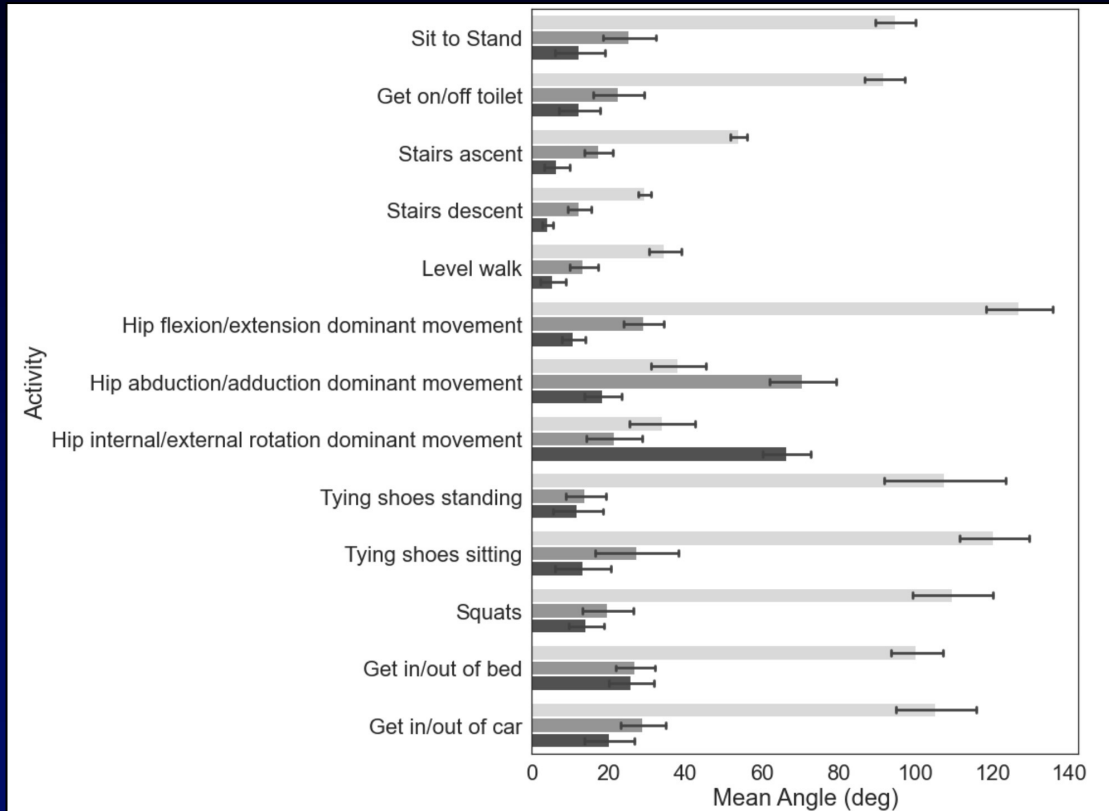


Results

	Mean Hip Flexion Extension Angle across 8 participants (deg)	Mean Hip Abduction Adduction Angle across 8 participants (deg)	Mean Hip Internal External Rotation across 8 participants (deg)
Sit to Stand	94.76	25.37	12.48
Get on/off toilet	91.84	22.72	12.36
Stairs ascent	53.91	17.44	6.53
Stairs descent	29.39	12.47	4.15
Level walk	34.72	13.51	5.59
Hip flexion/extension dominant movement	126.98	29.15	10.85
Hip abduction/adduction dominant movement	38.24	70.64	18.48
Hip internal/external rotation dominant movement	34.09	21.50	66.40
Tying shoes standing	107.50	14.07	11.97
Tying shoes sitting	120.45	27.42	13.32
Squats	109.59	19.83	14.12
Get in/out of bed	100.31	26.97	26.01
Get in/out of car	105.30	29.04	20.27



Results



Discussion

- ✓ Hip precautions are often enforced after total hip arthroplasty without knowing normal arcs of motion during real-life activities.
- ✓ Knowledge of hip motion during activities of daily living in healthy individuals is useful information in setting goals and in educating THA patients.
- ✓ At-risk activities such as:
 - sit to stand,
 - on/off toilet,
 - in/out bed and chair,
 - and shoe tying

have the greatest combinations of flexion, abduction, and rotation arcs leading to positions of potentially greatest hip instability risk

