

# Lower Extremity Sagittal Plane Motion during Different Squat Types in Patients with Femoroacetabular Impingement

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## INTRODUCTION

- Femoroacetabular impingement (FAI) is due to the repetitive interaction of abnormal structural anatomy of the hip
- Daily tasks, such as squatting, place the hip into a position that can cause pain<sup>1</sup>
- The purpose of this study was to evaluate the kinematic changes that occur in the hip during the descent phase of a squat prior to and following an osteochondroplasty for idiopathic FAI

## METHODS

**Inclusion Criteria:** Undergoing hip preservation surgery for FAI (surgical hip dislocation or arthroscopic)

### Squatting Techniques

- **Hold Squat:** maintained the squat at the lowest position for 3 seconds
- **Standard Squat:** reached their lowest position and immediately returned to standing
- **Target Squat:** a 15.5 cm platform was placed behind the participant who was instructed to attempt to touch the platform<sup>2</sup>
- Overall range-of-motion (ROM), maximum squat depth, as well as peak trunk, pelvis, and hip sagittal motion of the affected limb were compared across squat types



	AFFECTED LIMB	Group Comparison mean (SD)			Hold vs Standard	Target vs Hold	Target vs Standard
		Hold	Standard	Target	p-value	p-value	p-value
DESCENT PHASE	Trunk Tilt ROM (°)	29.6 (9.2)	34.1 (9.6)	39.7 (9.1)	0.001	<0.001	0.001
	Max Trunk Tilt (°)	25.9 (12.4)	30.2 (12.8)	36.5 (12.0)	0.001	<0.001	<0.001
	Pelvic Tilt ROM (°)	17.8 (5.7)	18.5 (5.7)	23.0 (6.5)	0.831	0.001	0.008
	Max Pelvic Tilt (°)	30.6 (5.1)	30.4 (5.1)	32.7 (5.1)	0.332	0.004	0.002
	Hip Flexion ROM (°)	76.8 (17.7)	85.5 (14.5)	93.4 (12.4)	<0.001	<0.001	0.003
	Max Hip Flexion (°)	84.4 (17.1)	92.6 (14.7)	100.9 (11.5)	<0.001	<0.001	0.002
	Max Squat Depth (%)	34 (12)	42 (12)	50 (14)	<0.001	<0.001	0.002

## RESULTS

- N = 17 patients who underwent hip preservation surgery for FAI were included (mean age 16.7 years, range 13.5 – 24.0 years, 13 females)
- 15 underwent arthroscopic surgery
- 2 had a surgical hip dislocation approach

### Kinematic Comparison

- Sagittal plane of the trunk, pelvis, and hip were significantly different between the squatting techniques
- Maximum trunk tilt was greatest during the target squat and lowest during the hold squat
- The target squat showed increased ROM of trunk tilt, pelvic tilt, and hip flexion compared to the standard squat
- Greater peak hip flexion and maximum squat depth was achieved during the target squat
- Hold squat showed the least amount of ROM in the sagittal plane

## CONCLUSIONS

- Patients may have restricted the depth of the hold squat to assure comfort and ability as they held the squatting position
- Using a target maximizes squat depth which may elicit different mechanics and compensations which might not be present during an untargeted standard or hold squat
- Based on squatting pattern, there are varying levels of joint motion that occur
- Therefore, if biomechanical testing is used as a functional assessment or outcomes measure, a target squat may be used to achieve the deepest squat and the greatest amount of hip flexion

## REFERENCES

1. Hemmerich, A. et al., (2006). *J Ortho Research*, 24(4), 770-781.
2. Lamontagne, M. et al., (2009). *Clin Orthop Relat Res*, 467, 645-650