Effects of machine squats on muscle strength, balance and gait in patients who underwent total hip replacement

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Introduction

The aim of this study was to examine the effects of machine squats on the strength of hip flexor, hip extensor, and hip abductor muscles, balance, and gait in patients who underwent total hip replacement (THR).

Methods

Thirty-three patients who underwent THR were randomly allocated into three groups: slide (n=12), reformer (n=12), and control (n=9). Each group underwent their respective squat regimens for thirty minutes, seven times a week for two weeks (Figure 1). Before and after the exercise intervention, hip flexor, extensor, and abductor strength, balance, and gait were measured in all groups. Muscle strength changes were assessed using the manual muscle test (MMT), balance was evaluated using the Berg balance scale (BBS), and gait analysis was performed using the 10-meter walk test (10MWT). The Wilcoxon signed-rank test and the Kruskal-Wallis test were used for statistical analysis, and post-hoc comparisons were made using the Mann-Whitney U test.

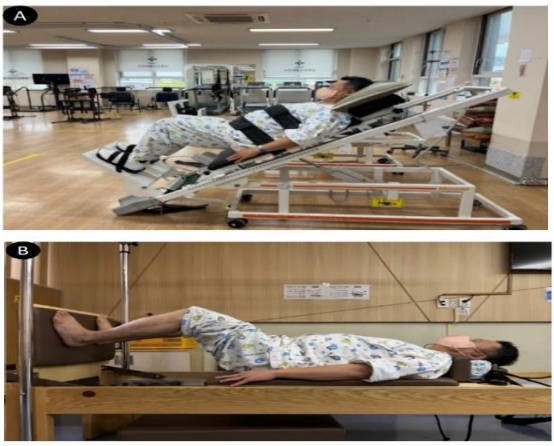

Figure 1. Machine squatting. A:Slide group, B:Reformer group.

Results

The results are depicted in Table 1. Significant changes in hip flexor and abductor strength were observed in the slide and reformer groups within each group ($p<.05$). The reformer group showed significant changes in hip extensor strength ($p<.05$).Significant improvements in BBS were observed in all three groups ($p<.05$). There were significant changes in 10MWT in the slide and reformer groups ($p<.05$). A significant difference in hip extensor strength was found between the reformer and control groups after the intervention ($p<.00167$). Significant differences in BBS were observed between the slide and reformer groups and between the reformer and control groups after the intervention ($p<.00167$). No significant differences in 10MWT were found among the three groups after the intervention

Conclusion

Our findings suggest that machine squat regimens can be effective for early rehabilitation after THR to improve hip flexor, abductor, and extensor muscle strength, balance, and gait. This study provides valuable information for healthcare professionals in the physical therapy field and patients who have undergone THR and seek to enhance their physical function. Further research is warranted to explore the long-term effects of machine squats on these outcomes.

Table 1. Within-Group and Between-Group Comparisons of Hip Flexion, Extension, Muscle Strength, Balance, and Gait

Variable		Group	Pre	Post	Change	P (Within)	P (Between)	Post-hoc
Hip MMT (grade)	Flexion	Sliding[a]	3.18±0.60	3.81±.60	0.63±0.67	0.020*	0.087	
		Reformer[b]	3.27±0.64	3.63±0.50	0.36±0.50	0.046*		
		Control[c]	2.81±0.75	3.00±0.77	0.18±0.40	0.157		
	Extension	Sliding[a]	3.09±0.70	3.63±0.92	0.54±0.82	0.058	0.044*	b>c
		Reformer[b]	3.00±0.44	3.45±0.52	0.45±0.52	0.025*		
		Control[c]	2.72±0.64	2.72±0.64	0.00±0.00	1.00		
	Abduction	Sliding[a]	3.27±0.64	3.81±0.60	0.54±0.68	0.034*	0.087	
		Reformer[b]	3.09±0.53	3.45±0.52	0.36±0.50	0.046*		
		Control[c]	2.90±0.30	3.00±0.00	0.91±0.30	0.317		
BBS (score)		Sliding[a]	37.72±4.14	43.72±4.01	6.00±1.40	0.003*	0.001*	b>a,c
		Reformer[b]	28.09±4.09	47.09±1.73	19.00±3.66	0.003*		
		Control[c]	19.54±4.12	23.90±4.77	4.36±1.87	0.035*		
10MWT (sec)		Sliding[a]	17.22±2.14	11.14±1.16	6.08±1.31	0.003*	0.479	
		Reformer[b]	25.42±7.75	13.23±2.22	12.19±5.72	0.005*		
		Control[c]	21.56±3.79	17.46±3.53	4.10±2.51	0.110		

MMT: Manual muscle test, BBS: Berg balance scale, 10MWT: 10-meter walk test, Values are means ± standard deviation, *: P<.05.