The Effects of Combined Balance and Strengthening Exercise Program in Patients with Different Grades of Primary Knee Osteoarthritis

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Introduction

The knee is one of the most commonly affected joint in (osteoarthritis) OA, as it is exposed to high stress and use of the joint. Around 250 million people are affected by knee OA (KOA) worldwide. KOA affects patient's physical function, dynamic balance and stability. Several factors believed to have a role in affecting balance in patients with KOA such as muscle weakness, knee pain, decreased proprioception, limitation of joint range of motion and knee joint laxity. Physical exercise is the most recommended conservative treatment for patients with KOA. In patients with mild to moderate KOA, pain, physical function and dynamic balance have shown significant improvement after fulfilling an exercise program. There is lack of data regarding the effect of combined strengthening and balance exercise on patients with different severity grades of KOA. Previous studies either assessed the effict of exercise on a specific severity grade of KOA or assessed the effict of exercise on KOA patients regardless of their radiographic severity.

Aim of the work

The aim of this study was to assess the effect of combined balance and strengthening exercise program in patients with different grades of primary KOA.

Subject and methods

The study was conducted on eighty patients diagnosed with primary KOA according to the 2010 (EULAR) evidence-based recommendations for the diagnosis of knee OA. Patients were divided into four groups (20 patients each) according to knee severity based on Kellgren and Lawrence (KL) grading scale of KOA.All patients underwent an exercise program; including balance and strengthening training 3 times a week for 6 weeks. Patients were assessed before and after fulfilling the exercise program by: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for Pain and physical function evaluation, timed up and go test for physical function evaluation and modified star excursion balance test (MSEBT) for dynamic balance evaluation.

Results

All the studied patients groups showed significant improvement in all directions of MSEBT (anterior, posteromedial, posterolateral) at the end of the exercise program. In the anterior direction, group 1 showed statistically significant improvement compared to group 4 in the mean difference and percentage of change. In the posteromedial direction of MSEBT, the mean difference and percentage of change for groups 1, 2, 3 showed significant improvement compared to that of group 4. (Table 1)All the four studied groups showed significant improvement in the total WOMAC score and in its 3 subscales pain, stiffness and physical function after fulfilling the exercise program. For the percentage of change in pain, physical function and total WOMAC score, groups 1 and 2 showed significant improvement as compared to group 4.Group 1 showed significant improvement as compared to group 3 regarding the percentage of change in physical function and total WOMAC score.(Table 2a,b)All the studied patients groups showed significant improvement in total score and all 5 intervals of the timed up and go test with no statistical significant difference between groups.

Table (1):Comparison between the different studied groups according toTotal WOMAC scoure

WOMAC	Group 1 (n = 20)		Group 2 (n = 20)		Group 3 (n = 20)		Group 4 (n = 20)		H	p
	Before	After	Before	After	Before	After	Before	After		
Total score (Mean ± SD)	40.8±12.94	15.95±5.63	43.70±9.73	18.05±6.41	48.45±13.7	24.70±11.0	55.35±8.90	31.15±11.7		
t (p_0)	9.270* (<0.001*)		13.428* (<0.001*)		13.678* (<0.001*)		12.375* (<0.001*)			
Mean difference (Mean ± SD)	24.85 ± 11.99		25.65 ± 8.54		23.75 ± 7.77		24.20 ± 8.75		0.765	0.858
Percentage of change (Mean ± SD)	24.85 ± 11.99		25.65 ± 8.54		23.75 ± 7.77		24.20 ± 8.75		13.586*	0.004*
Sig. bet. Grps	p_1=0.688,p_2=0.025*,p_3=0.002*,p_4=0.067,p_5=0.006* p_6=0.348									

Table (2):Comparison between the different studied groups according to MSEBT

MSEBT	Group 1 (n = 20)		Group 2 (n = 20)		Group 3 (n = 20)		Group 4 (n = 20)		H	p
	Before	After	Before	After	Before	After	Before	After		
Anterior (Mean ± SD)	65.74 ± 7.91	76.02 ± 10.14	68.91 ± 9.52	75.70 ± 8.0	65.91 ± 8.89	72.25 ± 8.58	69.10 ± 6.75	73.40 ± 5.81		
t (p_0)	7.779* (<0.001*)		4.894* (<0.001*)		4.322* (<0.001*)		3.253* (0.004*)			
Mean difference (Mean ± SD)	10.28 ± 5.91		6.79 ± 6.20		6.34 ± 6.54		4.31 ± 5.92		8.023*	0.046*
Sig. bet. Grps	p_1=0.086,p_2=0.069,p_3=0.005*,p_4=0.916,p_5=0.287 p_6=0.337									
Percentage of change (Mean ± SD)	15.73 ± 8.99		10.72 ± 10.47		10.30 ± 10.54		6.75 ± 8.89		8.831*	0.032*
Sig. bet. Grps	p_1=0.059,p_2=0.081,p_3=0.003*,p_4=0.886,p_5=0.299 p_6=0.238									
Posteromedial (Mean ± SD)	79.24 ± 10.08	95.69 ± 7.90	79.09 ± 9.51	94.95 ± 7.84	75.67 ± 8.51	90.61 ± 9.13	77.52 ± 11.51	85.52 ± 11.74		
t (p_0)	10.937* (<0.001*)		13.456* (<0.001*)		8.768* (<0.001*)		4.870* (<0.001*)			
Mean difference (Mean ± SD)	16.45 ± 6.72		15.86 ± 5.27		14.95 ± 7.62		8.01 ± 7.35		15.748*	0.001*
Sig. bet. Grps	p_1=0.809,p_2=0.600,p_3=0.001*,p_4=0.778,p_5= 0.001*p_6=0.003*									
Percentage of change (Mean ± SD)	21.79 ± 10.83		20.82 ± 8.81		20.35 ± 11.01		10.87 ± 10.26		13.382*	0.004*
Sig. bet. Grps	p_1=0.884,p_2=0.809,p_3=0.002*,p_4=0.924,p_5=0.003*, p_6=0.004*									
Posterolateral (Mean ± SD)	75.65 ± 7.16	91.99 ± 9.24	72.85 ± 6.25	88.32 ± 8.11	73.81 ± 7.56	89.44 ± 7.50	68.17 ± 8.87	80.12 ± 9.93		
t (p_0)	9.008* (<0.001*)		10.651* (<0.001*)		9.066* (<0.001*)		6.937* (<0.001*)			
Mean difference (Mean ± SD)	16.34 ± 8.11		15.47 ± 6.50		15.63 ± 7.71		11.95 ± 7.70		4.775	0.189
Percentage of change (Mean ± SD)	22.10 ± 11.88		21.55 ± 9.99		21.89 ± 12.03		18.19 ± 12.70		2.661	0.447

Conclusion

All four studied groups of KOA regardless of the OA grading showed improvement in the degree of pain, physical function and dynamic balance. Patients with mild KOA might benefit more from early exercise program that includes both strengthening and balance training.