

Figure 1: CONSORT chart for patient's flow in this study

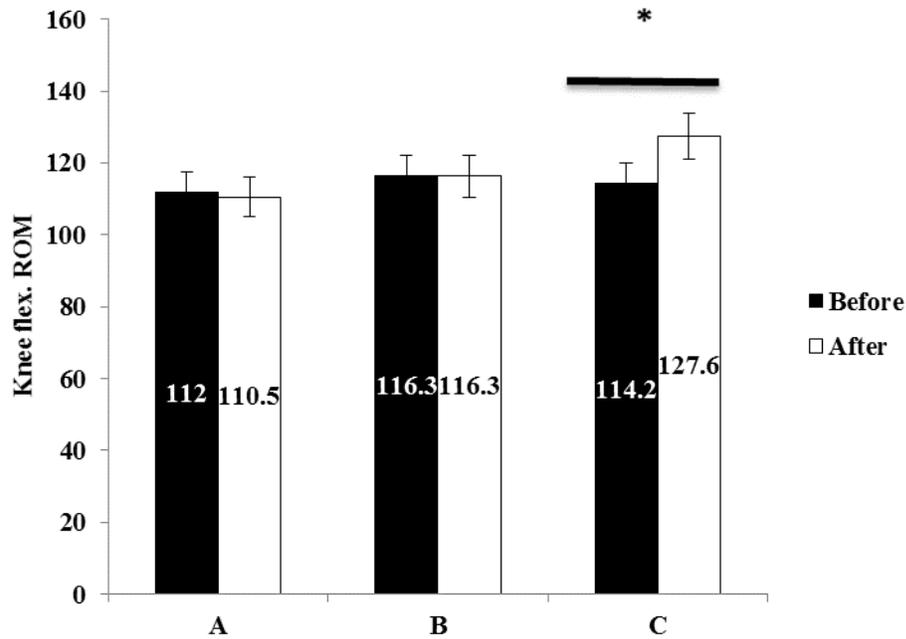


Figure 2. ANOVA results for knee ROM showed that there were no significant differences ($P > .05$) in group A and group B between pre-test and post-test. While, there was a significant difference for knee ROM ($P < .05$) between pre-test and post-test results for group C.

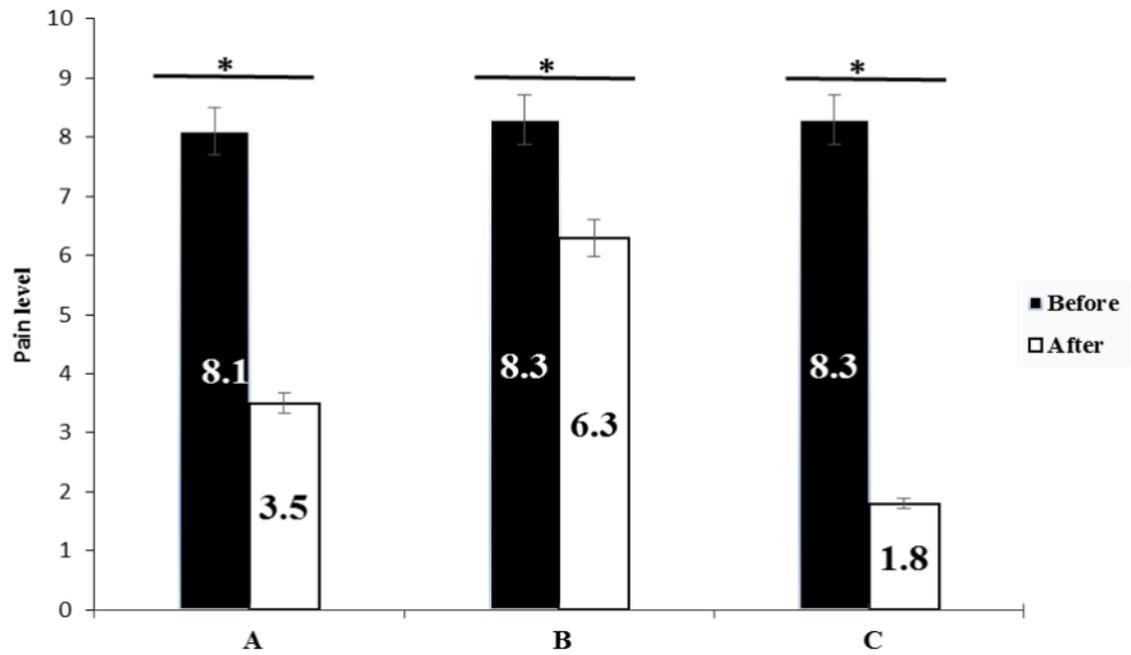


Figure 3. ANOVA results of knee pain showed that there were significant differences ($P < .05$) for the VAS scale between the pre-test and post-test within the three groups.

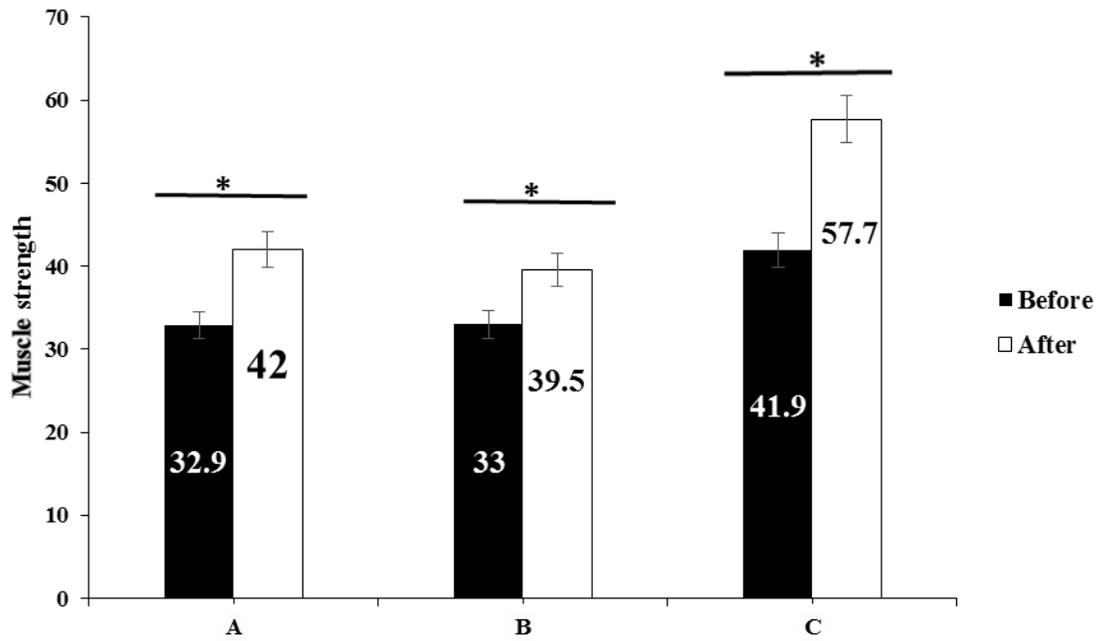


Figure 4 .ANOVA results of quadriceps strength showed that there were significant differences ($P < .05$) in the three groups for the quadriceps strength between the pre-test and post-test.

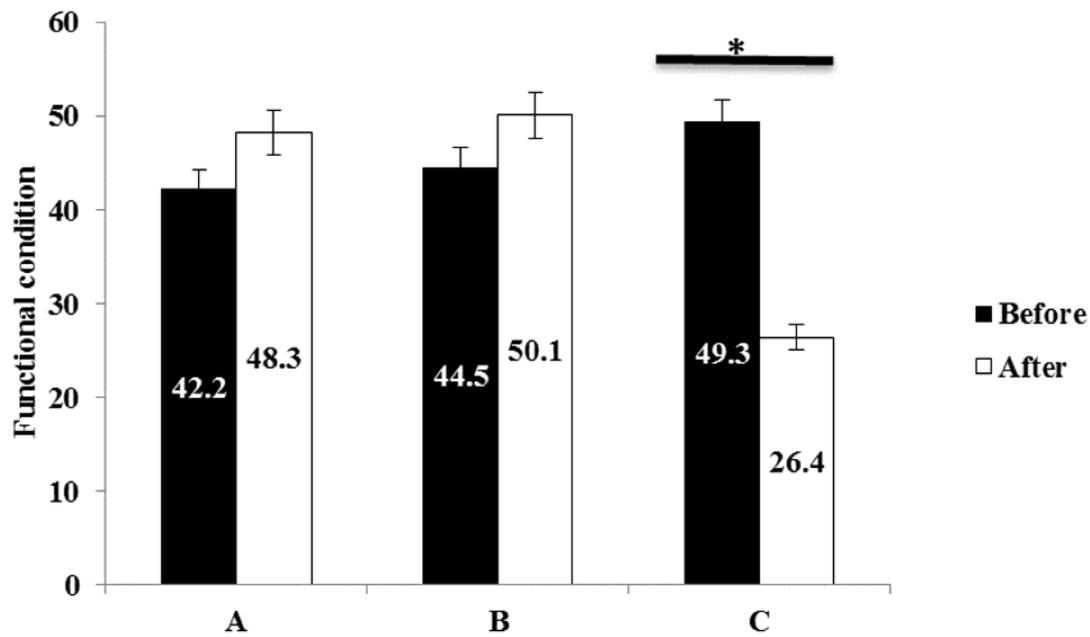


Figure 5. ANOVA results of WOMAC scale results showed that there were no significant differences ($P > .05$) in group A and B between pre-test and post-test. While, there was a significant difference ($P < .05$) of WOMAC scale results in group C between pre-test and post-test.

Table 1. Three training program exercises.

Exercise	Description
Isometric quadriceps exercises	It is performed by using a standard variable resistance leg extension machine (Cybex VR2) and using a strain gauge which placed in tension strap to give a resistance against isometric quadriceps contraction, with signal displayed on computer screen in front of patients to give them visual feedback for each contraction. Patients were asked to perform an isometric quadriceps strength from three different angles of knee flexion (50°, 70° and 90°). The patients completed three sets of 10 repetitions, with one set being completed at each of three angles of knee flexion (50°, 70°, 90°). There was 2 second rest between contractions and 2 min rest between each set. In each session, the sets of all angles were completed in a different random order
OKC exercises	
First OKC exercise	First OKC exercise performed with the knee joint in 30° flexion from full extension. The resistance was provided by a 10 cm-wide brace clasped around the ankle joint proximal to the malleolus. Patients were instructed to resist the motion as possible by applying force upward into the ankle brace in response to an auditory signal, the patients were asked to make a moderate and approximately equal effort for each repetition. They were given visual feedback of the force on a data screen. Three sets of 10 repetitions were performed for each task. With a 5–15 seconds rest between repetitions and 2–3 minutes rest between sets
Second OKC exercise	It was performed with knee in 90° flexion from full extension with the same consideration in position and performance during using isokinetic device as first exercise in OKC
Third OKC exercise	It was performed by position the patient in a side-lying position. The patient was asked to adduct the affected leg. The leg that is not affected was in the upward position with flexion of the knee while affected leg placed against the bed. The leg was then lifted up to adduction for about 10 seconds before being lowered gently back
CKC exercises	
First CKC exercise	It was performed from sitting position with the knee in 30° flexion from full extension. The resistance was provided by a plate placed under the whole foot. The dynamometer maintained the joint configuration in the CKC task like to the OKC task. Patients were instructed to respond as possible by pushing down against the resistance exerting pressure with the whole foot in response to an auditory signal, the patients were asked to make moderate and approximately equal effort for each repetition and were given visual feedback of the force on a data screen. Three sets of 10 repetitions were performed for each task. A 5–15 seconds rest between repetitions and 2–3 minutes rest between sets were used.
Second CKC exercise	It was performed from in sitting position with the knee in 90° flexion from full extension. The same OKC exercise consideration in position and performance during using isokinetic device were used as in first exercise in CKC
Third CKC exercise	It was performed from standing then the patient was asked to perform a step-up and down. The patient performed forward, backward and lateral step-ups and step-downs using a 5cm – high sturdy wooden box. The patient's trunk was kept upright and he/she ensured that his/her heel was the last to leave the floor and the last to return in order to emphasize the activities of the quadriceps muscle.

Table 2. Physical characteristics of patients in three groups.

Items	Group A (n=24) M ±SD	Group B (n=24) M ±SD	Group C (n=24) M ±SD	P value
Age (yrs.)	47.5 ±5.87	48.5±6	48±6.16	0.270
BMI(kg/m ²)	37.5±3.24	37.3±3.24	37.1±3.24	0.320
Sex (%)				
Male	10(40 %)	11(45 %)	9(36 %)	0.460
Female	14(60 %)	13(55 %)	15(64 %)	
Pain history (%)				
Present	16 (68 %)	17 (73 %)	18 (77 %)	0.690
Absent	8 (32 %)	7 (27 %)	6 (23 %)	
Level of Activity (%)				
Active	9 (36 %)	8(32 %)	7 (27 %)	0.530
Sedentary	15 (64 %)	16 (68 %)	17 (73 %)	

M: Mean, SD: Standard deviation and P: Probability at .05

Table 3. Between the three groups analysis between before and after treatment.

	Before treatment								After treatment							
	ANOVA		Post hoc tests						ANOVA		Post hoc tests					
	F	P	A vs B		A vs C		B vs C		F	P	A vs B		A vs C		B vs C	
			MD	P	MD	P	MD	P			MD	P	MD	P	MD	P
FC(scores)	0.099	0.906	-1.8	0.660	-1	0.807	.8	0.845	17.424	0.001*	-2.3	0.497	15.8	0.001*	18.1	0.001*
QMS(N)	0.710	0.500	2.5	0.302	.1	0.967	-2.4	0.321	30.536	0.001*	2.5	0.331	-	0.001*	-	0.001*
Knee flex. ROM (degrees)	0.979	0.389	-5.8	0.178	-3.7	0.386	2.1	0.621	9.483	0.001*	-4.3	0.255	-	0.001*	-	0.005*
Knee pain(scores)	0.133	0.876	-2	0.659	-2	0.659	.000*	1.000	18.788	0.001*	-2.8	0.001*	1.7	0.030*	4.5	0.001*

FC: Functional condition, QMS: Quadriceps muscle strength, A: group A, B: group B, C: group C, Vs: Versus, M: Mean, SD: standard deviation, P: probability at 0.05, and *: Significant

Table 4. Within the three groups analysis between pre-test and post-test.

Table 4: Within the three groups analysis between pre-test and post-test							
		Pre-test		Post-test		ANOVA	
		M	SD	M	SD	F	P-value
FC(scores)	Group A	42.2	6.61312	48.3	9.74166	2.684	0.099
	Group B	44.5	8.00347	50.1	8.21178	2.385	0.140
	Group C	49.3	9.16576	26.4	7.70570	36.573	0.001 *
QMS(N)	Group A	32.9	6.47130	42	5.37484	11.702	0.003 *
	Group B	33	6.32456	39.5	5.98609	5.571	0.030 *
	Group C	41.9	5.55878	57.7	4.45845	49.163	0.001 *
Knee flex. ROM (degrees)	Group A	112	10.05540	110.5	9.84604	0.114	0.740
	Group B	116.3	8.08359	116.3	8.08359	0.000	1.000
	Group C	114.2	10.09730	127.6	6.23966	12.745	0.002 *
Pain level (scores)	Group A	8.1	.99443	3.5	1.08012	98.165	0.001 *
	Group B	8.3	.94868	6.3	1.94651	8.531	0.009*
	Group C	8.3	.451	1.8	1.05935	95.781	0.001 *

FC: Functional condition, QMS: Quadriceps muscle strength M: Mean, SD: standard deviation, P: probability at 0.05, and *: Significant