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Add-on Effect of Aerobic Exercise in Patients with Ankylosing Spondylitis

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Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease involving axial skeletal system, peripheral joints, and non-articular structures. Unlike stretching exercise, the effect of aerobic exercise in patients with AS is not well known, and there is a lack of detailed protocols of aerobic exercise. We aimed to identify the additional benefits of aerobic exercise for stretching exercise in patients with AS.

Methods

1) Patients This prospective study recruited 34 patients classified as AS according to the 1984 modified NY criteria or the ASAS classification criteria between the age of 20 and 60 years. 16 patients were allocated for stretching and aerobic exercise (Group A), and 18 patients for stretching only (Group B). 2) Exercise Education To educate precisely, we developed an exercise protocol of written instruction with photographic guides. The AS school was held twice inviting each group in different day. After informing the general disease concepts by a rheumatologist, the instruction of the exercise prescription was done by a physiatrist and a physical therapist. The precise exercise protocol is described in Table 1. 3) Functional Outcome As functional outcomes, 11 scales are surveyed or examined before and after 12 weeks of home exercise; total and nocturnal pain with Visual Analogue Scale (VAStotal and VASnocturnal), Ankylosing Spondylitis Disease Activity Score (ASDAS), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Routine Assessment of Patient Index Data (RAPID3), Bath Ankylosing Spondylitis Functional Index (BASFI), Ankylosing Spondylitis Quality of Life Questionnaire (ASQoL), Fatigue Severity Scale (FSS), Jenkins Sleep Evaluation Questionnaire (JSEQ), and The Brief Illness Perception Questionnaire (BIPQ). Bath Ankylosing Spondylitis Metrology index (BASMI) was examined before (0), and 30 minutes and 3 months after exercise. 4) Statistical Analysis Basic characteristics were analyzed using T test or Fisher's exact test. The changes in functional scales at 12 weeks compared to initial point were analyzed by T test and repeated-measures ANOVA.

Results

Basic characteristics showed no significant differences between two groups (Table 2). The changes of all 11 scales at 12th weeks did not show significant difference between the groups; ΔVAStotal (P=0.59), ΔVASnocturnal (P=0.95), ΔASDAS (P=0.86), ΔBASDAI (P=0.84), ΔRAPID3 (P=0.61), ΔBASFI (P=0.49), ΔASQoL (P=0.82), ΔFSS (P=0.17), ΔJSEQ (P=0.86), ΔBIPQ (P=0.50), ΔBASMI (P=0.19). However, ΔBASMI and sub-scores of lateral lumbar

flexion (P<0.01), tragus-to-wall distance (P=0.02), modified Schober test (P=0.03) had significant cumulative exercise effects (Table 3).

Conclusion

Aerobic exercise in patients with AS did not show a significant add-on effect to stretching alone. However, with limitations of small sample size and not considering the cardiopulmonary effects, further study with larger data would be required.

Table 1. Exercise prescriptions of the two groups.

		Group A	Group B
Exercise prescription		Stretching exercise	
1	Mode	Chest expansion exercise 1. Horizontal abduction 2. Chest stretching 3. Arm raising	Chest expansion exercise 1. Horizontal abduction 2. Chest stretching 3. Arm raising
	Intensity	Mild stretch without sever pain	Mild stretch without sever pain
	Duration	5 min (keep 8 sec/motion following 8 sec of rest)	5 min (keep 8 sec/motion following 8 sec of rest)
	Frequency	5 times/set, 3 sets/day, 3 days/wk	5 times/set, 3 sets/day, 3 days/wk
2	Mode	Neck stretching exercise 1. Forward flexion 2. Posterior Extension 3. Rt. lateral flexion 4. Lt. lateral flexion 5. Rt. anterolateral 45°flexion 6. Lt. anterolateral 45°flexion 7. Rt. rotation 8. Lt. rotation	Neck stretching exercise 1. Forward flexion 2. Posterior Extension 3. Rt. lateral flexion 4. Lt. lateral flexion 5. Rt. anterolateral 45°flexion 6. Lt. anterolateral 45°flexion 7. Rt. rotation 8. Lt. rotation
	Intensity	Mild stretch without sever pain	Mild stretch without sever pain
	Duration	10 min (keep 8 sec/motion following 8 sec of rest)	10 min (keep 8 sec/motion following 8 sec of rest)
	Frequency	5 times/set, 3 sets/day, 3 days/wk	5 times/set, 3 sets/day, 3 days/wk
3	Mode	Chin tuck	Chin tuck
	Intensity	Mild stretch without sever pain	Mild stretch without sever pain
	Duration	2 min (keep 8 sec/motion following 8 sec of rest)	2 min (keep 8 sec/motion following 8 sec of rest)
	Frequency	5 times/set, 3 sets/day, 3 days/wk	5 times/set, 3 sets/day, 3 days/wk
4	Mode	Back stretching exercise 1. Forward flexion 2. Posterior extension 3. Rt. lateral flexion 4. Lt. lateral flexion 5. Rt. trunk rotation 6. Lt. trunk rotation	Back stretching Exercise 1. Forward flexion 2. Posterior extension 3. Rt. lateral flexion 4. Lt. lateral flexion 5. Rt. trunk rotation 6. Lt. trunk rotation
	Intensity	Mild stretch without sever pain	Mild stretch without sever pain
	Duration	8 min (keep 8 sec/motion following 8 sec of rest)	8 min (keep 8 sec/motion following 8 sec of rest)
	Frequency	5 times/set, 3 sets/day, 3 days/wk	5 times/set, 3 sets/day, 3 days/wk
5	Mode	Hip joint stretching exercise 1. Rt. hip flexor stretching 2. Lt. hip flexor stretching 3. Rt. hip adductor stretching 4. Lt. hip adductor stretching	Hip joint stretching exercise 1. Rt. hip flexor stretching 2. Lt. hip flexor stretching 3. Rt. hip adductor stretching 4. Lt. hip adductor stretching
	Intensity	Mild stretch without sever pain	Mild stretch without sever pain
	Duration	5 min (keep 8 sec/motion following 8 sec of rest)	5 min (keep 8 sec/motion following 8 sec of rest)
	Frequency	5 times/set, 3 sets/day, 3 days/wk	5 times/set, 3 sets/day, 3 days/wk
Exercise prescription		Aerobic exercise	
6	Mode	Run in place	
	Intensity	Borg Rating of PRE: 13	
	Duration	6 min	
	Frequency	3 sets/day, 3 days/wk	
7	Mode	Jumping Jacks	
	Intensity	Borg Rating of PRE: 13	
	Duration	12 min	
	Frequency	5 sets/day, 3 days/wk	
8	Mode	Jump rope	
	Intensity	Borg Rating of PRE: 13	
	Duration	12 min	
	Frequency	5 sets/day, 3 days/wk	

PRE; Perceived Exertion Scale

Table 2. Basic characteristics of the two groups.

		Group A	Group B	Group differences (*P*-value)
Age (year)		37.22 ± 9.69	35.72 ± 7.90	0.71
Sex				0.64
	Male	7	7	
	Female	2	5	
Uveitis				0.50
	Present	5	7	
	Absent	0	3	
Surgery history		0	0	1.00
Height (cm)		173.02 ± 7.03	170.05 ± 12.68	0.50
Weight (kg)		76.61 ± 10.06	68.89 ± 21.61	0.34
BMI (kg/cm^2)		25.67 ± 3.59	23.45 ± 4.53	0.24
ESR (mm/hr)		20.67 ± 16.93	19.42 ± 17.14	0.87
CRP (mg/L)		2.87 ± 3.13	4.73 ± 7.54	0.50
HLA-B27				1.00
	Negative	0	1	
	Positive	5	6	
Exercise days by survey		16.00 ± 12.39	28.36 ± 22.94	0.24
Exercise days by self-checklist		21.33 ± 10.60	26.00 ± 13.70	0.60
Total Pain (VAS_{total})		0.28 ± 3.06	-0.33 ± 2.07	0.59
Nocturnal Pain ($VAS_{nocturnal}$)		-0.44 ± 3.10	-0.38 ± 1.61	0.95
ASDAS		-1.72 ± 6.01	-1.29 ± 5.16	0.86
BASDAI		-4.39 ± 11.40	-3.54 ± 7.33	0.84
RAPID3		-1.99 ± 3.51	-1.03 ± 4.67	0.61
BASFI		-8.22 ± 25.46	-2.17 ± 13.14	0.49
ASQoL		-0.33 ± 2.74	-0.08 ± 2.27	0.82
FSS		-5.78 ± 12.36	1.17 ± 9.79	0.17
JSEQ		-0.89 ± 2.37	-0.67 ± 3.23	0.86
BIPQ		-4.56 ± 3.36	-6.92 ± 9.84	0.50

Table 3. Bath Ankylosing Spondylitis Metrology Index (BASMI) of the two groups.

	Cumulative effect (*P*-value)	Group A	Group B	Group differences (*P*-value)
BASMI (mean of 5 scores)	0.00			0.19
0		1.60 ± 0.82	1.53 ± 1.17	0.89
30min		1.38 ± 0.76	1.57 ± 1.08	0.66
3mo		1.22 ± 0.97	1.13 ± 0.87	0.83
0-30min	0.69			
30min-3mo	0.01*			
0-3mo	< 0.01*			
Lateral lumbar flexion (cm)	< 0.01*			0.69
0		14.49 ± 5.00	13.78 ± 6.58	0.79
30min		15.10 ± 4.59	15.07 ± 6.82	0.99
3mo		17.52 ± 4.81	17.56 ± 7.08	0.99
0-30min	0.11			
30min-3mo	< 0.01*			
0-3mo	< 0.01*			
Tragus-to-wall distance (cm)	0.02*			0.68
0		14.13 ± 2.79	14.20 ± 6.63	0.98
30min		13.27 ± 2.64	13.20 ± 5.48	0.97
3mo		12.39 ± 3.27	11.72 ± 2.95	0.64
0-30min	0.01*			
30min-3mo	0.20			
0-3mo	0.36			
Lumbar flexion (modified Schober) (cm)	0.03*			0.08
0		14.17 ± 1.53	14.63 ± 1.56	0.50
30min		13.66 ± 1.65	14.67 ± 1.73	0.19
3mo		13.78 ± 1.32	13.68 ± 1.03	0.86
0-30min	0.89			
30min-3mo	0.37			
0-3mo	0.02*			
Maximal intermalleolar distance (cm)	0.43			0.39
0		141.29 ± 12.20	129.88 ± 20.73	0.16
30min		143.50 ± 14.14	127.83 ± 22.31	0.08
3mo		135.72 ± 15.24	128.63 ± 20.86	0.40
0-30min	1.00			
30min-3mo	0.99			
0-3mo	1.00			
Cervical rotation (degree)	0.69			0.24
0		66.16 ± 12.83	73.13 ± 12.25	0.22
30min		71.03 ± 9.00	71.54 ± 11.63	0.91
3mo		68.11 ± 11.67	73.58 ± 11.46	0.30
0-30min	1.00			
30min-3mo	1.00			
0-3mo	1.00			