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The Effects of Antigravity Treadmil on Pain, Function, and Muscle Strength in Spine disease patients

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Objective
The lower-body positive pressure (LBPP) treadmill exercise (AlterG Anti-Gravity Treadmill) is designed to allow normal treadmill walking with reduced lower extremity weight bearing. It has recognized value during rehabilitation of lower extremity injuries, such as anterior cruciate ligament reconstruction, microfracture, total knee arthroplasty. Therefore, we aimed to report to determine the effects of an anti-gravity treadmill exercise program on pain, function, and lower limb muscle strength in spine disease patients.

Methods
We assessed spine disease patients referred for rehabilitation after either operation or conservative treatment at orthopedics department. Patients received strengthening lower extremity and gait training using a lower-body positive pressure (LBPP) treadmill (AlterG Anti-Gravity Treadmill). Before and at 3 weeks after rehabilitation, back pain (visual analog scale(VAS)), functional ambulation categories (FAC), 6-minute walk test (6MWT), 10 meter walk test (10MWT), Berg balance scale (BBS), timed up-and-go test (TUG), and one repetitive maximum (1RM) of leg press incline, leg press, leg extension, leg curl, hip abduction and hip adduction were conducted.

Results
Twenty patients (8 male/12 female, mean age 68.80 ± 14.45) were included. The Results shows significant improvements in VAS ($p<0.001$), FAC ($p<0.001$), 6MWT ($p<0.001$), 10MWT ($p=0.002$), BBS ($p<0.001$) and TUG ($p<0.001$) after treatment. Also, 1 RM of leg press incline ($p=0.001$), 1 RM of right leg press ($p=0.004$), 1 RM of left leg press ($p=0.006$), 1 RM of right leg extension ($p=0.001$), 1 RM of left leg extension ($p<0.001$), 1 RM of right leg curl ($p<0.001$), 1 RM of left leg curl ($p=0.007$), 1 RM of hip abduction ($p=0.001$) and 1 RM of hip adduction ($p=0.001$) increased significantly after treatment. All participants completed the training and testing, and there were no serious adverse events during the study period.

Conclusion
This Results suggest that 3 weeks of an anti-gravity treadmill exercise program is safe, and leads to significant improvements in pain, function, and lower limb muscle strength in spine disease patients. These findings have important implications for the development of treatment strategies that can be used in the management of spine disease. Further randomized controlled trials are needed to confirm these findings.

Table 1. Demographic and Disease-Related Characteristics of the Subjects (N=20)

variable	Value (%)
Age (years)	68.8 ± 14.5
Gender	
Male	8 (40)
Female	12 (60)
Height (cm)	158.6 ± 7.5
Weight (kg)	60.7 ± 13.9
BMI (kg/m^2)	24.0 ± 4.5
Comorbidities	
Hypertension	12 (60.0)
Diabetes mellitus	5 (25.0)
Osteoporosis	8 (40.0)

Values represent mean ± standard deviation or number (%) of cases

Abbreviations: BMI, body mass index;

Table 2. Disease Characteristics of the Patients (N=20)

variable	Value (%)
Diagnosis	
Compression fracture	11 (55.0)
HIVD	1 (5.0)
Spinal stenosis	6 (30.0)
Spondylolisthesis	2 (10.0)
Operation	
Yes	14 (70.0)
No	6 (30.0)
Level	
Thoracic spine	2 (10.0)
Lumbar spine	18 (90.0)

Values represent mean ± standard deviation

HIVD, Herniated Intervertebral Disk;

Table 3. Changes in Pain, Function, Muscle Strength, before and after treatment

variable	Before	After	P-value
VAS	4.4 ± 1.0	2.2 ± 0.8	<0.001
FAC	1.1 ± 0.3	2.4 ± 0.7	<0.001
6MWT (m)	135.4 ± 62.9	205.1 ± 85.7	<0.001
10MWT (sec)	38.6 ± 25.9	28.1 ± 21.0	0.002
BBS	28.7 ± 11.2	36.2 ± 10.3	0.001
TUG (sec)	45.1 ± 27.2	31.9 ± 21.8	<0.001
Strength paremeters			
MVIC of leg incline (Nm)	205.3 ± 96.3	262.2 ± 113.3	0.001
Rt. MVIC of leg press (Nm)	132.5 ± 63.4	166.9 ± 65.1	0.004
Lt. MVIC of leg press (Nm)	139.4 ± 70.8	171.0 ± 73.2	0.006
Rt. MVIC of leg extension (Nm)	33.6 ± 16.5	42.4 ± 20.8	0.001
Lt. MVIC of leg extension (Nm)	31.4 ± 18.9	43.0 ± 23.2	<0.001
Rt. MVIC of leg curl (Nm)	11.7 ± 6.1	16.8 ± 8.3	<0.001
Lt. MVIC of leg curl (Nm)	13.4 ± 5.4	16.3 ± 5.2	0.007
MVIC of leg abduction (Nm)	34.1 ± 16.6	43.9 ± 20.1	0.001
MVIC of leg adduction (Nm)	42.3 ± 13.2	55.5 ± 24.4	0.002

Values represent mean ± standard deviation

VAS, visual analog scale; FAC, functional ambulation category ; 6MWT, **6** minutes walk test;10MWT, 10 meters walk test; BBS, berg balance scale; TUG, timed up and go; MVIC, maximum voluntary isometric contraction;