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INFLUENCE OF PHYSICAL EFFORT ON GAIT KINEMATICS IN LUMBAR SPINAL STENOSIS

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SUMMARY

This paper contains information about the influence of physical effort in the perception of pain and overall function of gait in patients with lumbar spinal stenosis. We observed significant changes in the gait cycle as well as the inclination of the trunk, probably as a defense strategy against the significant increase in pain.

INTRODUCTION

Back pain is a common complaint in primary care practice, especially among older patients. The spinal stenosis term is based on the fact that a minimum space of the spinal canal is necessary for normal functioning of the nervous structures, and when this space becomes narrow, results in nerve compression symptoms such as pain, numbness, weakness and neurogenic claudication, which increase with stress and decreases with rest [1,2].

The aim of this study is evaluate the relationship between functional gait and pain perception in patients with lumbar spinal stenosis before and after physical activity. Several studies were published about the pathophysiology and treatment of neurogenic claudication, but few relating to pain perception and gait abnormalities.

METHODS

Ten subjects were evaluated with diagnostic of vertebral canal stenosis with a mean age of 76.4 (±7.0) years.

The Vicon MX 40 system was used for the data acquisition during gait kinematic which consists of 10 infrared cameras (2000 fps). The exam consisted of three phases: 1) Capture of six gait cycles after a rest period without pain or symptoms; 2) Walk on treadmill for a maximum of 20 minutes or forced interruption by the effect of pain or fatigue; 3) New capture of other 6 gait cycles was performed immediately after the exercise on the treadmill.

From these data, a gait deviation index [5] (GDI) was extracted and analyzed individually and then compared to the pain perception of each patient obtained by visual analogue scale (VAS).

RESULTS AND DISCUSSION

We observed significant decrease in time of single support of 32.1(4.7) to 31.4(4,1) (p=0.023) and balance of 32.0(5.5) to 31.5(4,3) (p=0.048), and an increase in double support of 35.9(9.2) to 37.3(8.1) (p=0.012).

Table 1 - Average (SD) spatial-temporal parameters before and after physical effort.

	Average (n=10)		
Parameters	Pre Effort	Pos Effort	p-valor
Gait Speed (m/s)	0,78 (0,29)	0,77 (0,27)	n.s.
Gait Cycle (s)	1,82 (2,95)	1,16 (0,17)	n.s.
Cadence (step/min)	104,15 (10,56)	105,31 (14,44)	n.s.
Stride Length (cm)	89,58 (31,67)	88,40 (28,11)	n.s.
Single Support (%)	32,08 (4,76)	31,35 (4,16)	p=0,023*
Double Support (%)	35,86 (8,88)	37,27 (8,00)	p=0,012*
Balance (%)	32,06 (4,80)	31,38 (4,09)	p=0,048*

Wilcoxon Signed Ranks Test; p≤0,05.

In the comparison between the GDI pre and post physical activity, a functional decrease of 78.1(20.1) to 76.3(17.7) at the left side and of 76.8(18.4) to 75.2(16.8) at the right side were found, but no significant difference were found between patients (p>0.05).

Table 2 - Average (SD) of GDI and the kinematics of pelvis and trunk segments in the sagittal plane before and after physical effort.

	Average (n=10)		
Parameters	Pre effort	Post Effort	p-valor
GDI Left Side	78,11 (20,07)	76,28 (17,74)	n.s.
GDI Right Side	76,79 (18,45)	75,24 (16,86)	n.s.
Pelvic Tilt Avg.	13,37 (7,18)	12,11 (7,83)	n.s.
Trunk Tilt Avg.	11,95 (10,01)	12,92 (10,41)	P=0,019*

Wilcoxon Signed Ranks Test; p≤0,05.

On the other hand the trunk tilt average increased significantly from 11.9(10) to 12.9(10.4) (p=0.019). The perception of pain increased from 0.7(1.2) to 4.0(3.4) (p=0.011) and, when correlated with the kinematic data based on the negative correlation value (r=-0.81; p=0.05) on both sides, the results show significant correlation with pain score after physical activity.

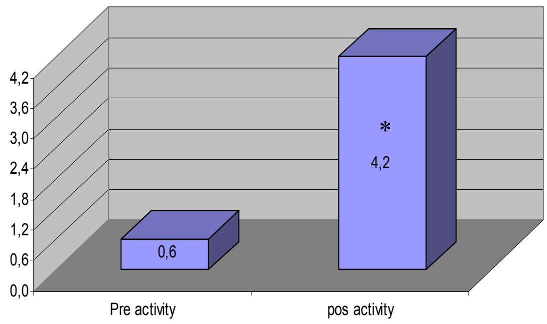

Figure 1 – Pain perception pre- and post physical activity (*p<0,05).

The significant variations of pain and time of the gait cycle periods pre-and post-exercise suggest that subjects were able to develop a strategy to compensate for the changing balance [1,2,3]. And the increase of the trunk tilt suggests an effective control strategy to ease the pain [4].

CONCLUSIONS

Physical effort duration changes periods of support and balance as well as increase the inclination of the trunk as a strategy to compensate the pain and imbalance.

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