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INFLUENCE OF ATTENTIONAL FOCUS ON THE MID-LATERAL OSCILLATION OF THE CENTER OF MASS IN SUBJECTS WITH LOW BACK PAIN

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SUMMARY

Spontaneous changes in muscle activation and its influence on the dynamic equilibrium of the gait in order to reduce and/or avoid low back pain (LBP) may be related to attentional focus target to pain. This study aimed to analyze the influence of attentional focus on the mid-lateral oscillation of the center of mass in people with chronic LBP.

10 young adults, aged between 20 and 45 years were analyzed. Three walks were performed in a straight line, with a length of six meters, which consisted of at least two full gait cycles. The results were compared using ANOVA where the task that was performed simultaneously to walk was the comparison factor, using a significance level of 0.05.

There were no significant differences in the behavior of the analyzed variable among the different attentional focus during gait thus concluding that they were not capable to produce significant changes in the dynamic balance of individuals with LBP in this study.

INTRODUCTION

Due to its fundamental importance in human gait, muscles and ligaments of the lower back when suffering an injury, may affect directly and deeply the kinematic characteristics of gait, which may impair the functionality of this feature. Low back pain is associated with abnormal movement strategies due to changes in the neuromuscular control in order to reduce and/or prevent pain. One factor that likely contributes to the low back pain is lessened control of the trunk muscles [1].

Spontaneous changes in muscle activation and its influence on postural coordination of gait in order to reduce and/or prevent lower back pain may be related to attentional focus toward the pain, promoted by individual with LBP [2]. The individual's attentional focus when directed to some external factor may change his perception of pain and decrease the changes in their movement patterns during gait [2].

The present study aimed to analyze the influence of attentional focus on the dynamic balance of people with back pain and seek different movement patterns under different attentional focus and describe the effects of them on kinematic gait patterns in subjects with low back pain.

METHODS

Study Group

Participated in the study 10 young adults, aged between 20 and 45 years, with low back pain clinically proved. Were excluded from the study subjects with vestibular or cerebellar alterations, or any type of motor deficit. The subjects should not have a history with lower limb or column injuries in the last 2 years.

Instruments

The kinematic parameters of gait were obtained using VICON system (model 624, Oxford, UK). In this study were used seven infrared cameras operating at 100 Hz. For the evaluation of dynamic balance during gait was used the amplitude of the mediolateral (ML) displacement of the subject's COM [3].

Procedures

Low back pain was assessed on the day of data collection by Visual Analogue Scale (VAS), which grades the pain of 0 to 10, where 0 represents "no pain" and 10 representing "unbearable pain". The pain can be graded as "mild pain" when referred from 0 to 2, "mild to moderate" 3-5 "moderate to severe" 6-7 and "strong or intolerable" from 8 to 10 [4].

Experimental Protocol
The subjects were instructed to perform three walks in his preferred speed in the longitudinal direction of the walking track, according to the following order of distraction tasks:
• Without any specific guidance to the attentional focus;

• Quote the weekdays in reverse order;
• Quote the months in reverse order;
• Quote the letters of the alphabet in reverse order;
• Focus all your attention on the low back pain [5].

These tasks were selected because they promote a moderate cognitive load, similar to that required in functional situations (e.g. walking while talking), and was used to reverse the relations of days, months and letters of the alphabet, in order to minimize the effect of automatic recite [6]. The subjects played barefoot and the averages of three attempts were used.

Variable Analyzed
The stability in the frontal plane was evaluated by averaging the amplitude of the ML displacement of the three valid attempts of each subject. The ML displacement of COM was defined as the maximum value minus the minimum value of the COM in the frontal plane during an attempt [6].

Statistical Analysis
The normality of the data was confirmed by the Shapiro-Wilk's test. The results were compared using ANOVA where the task performed concurrently to walk was the comparison factor. We used the statistical package SPSS for Windows version 14.0 with a significance level of 0.05.

RESULTS AND DISCUSSION

Results
The subjects had a mean age of 30.7 ± 9.09 years, mass of 72.7 ± 12 kg, height of 1.74 ± 0.07 m and graduate VAS 4.5 ± 2. The ANOVA showed no significant differences between each task performed simultaneously with gait ($p > 0.9$). The average mediolateral displacements of the COM (mm) of the subjects under each situation of directing attentional focus were: No direction: 58.95 ± 14.94 mm, weekdays: 68.45 ± 39.32 mm , months : 64.41 ± 16.10 mm, alphabet: 62.11 ± 13.80 mm and low back pain: 62.52 ± 14.83 mm.

Discussion
The main objective of this study was to evaluate the instability of gait in subjects with low back pain. To do this the amplitude of the mediolateral displacement of the subject's COM was quantified.

As the results showed, there were no significant differences in the variable behavior under different distraction tasks. These results agree with the findings of Henry et al. [1], who claim that the instability of the subject suffering from low back pain is not significantly higher than subjects without low back pain and does not change significantly under different situations of balance disorder.

One possible explanation for the low instability gait of subjects suffering from chronic back pain should be the adaptation of the subjects of this research to chronic pain due the long time of tolerance to the low back pain. The subjects adapted its gait to prevent/reduce pain sensation. However, these adaptations would already be well assimilated by the research participants, which reduced the ML oscillation of the COM.

The adaptation model for pain proposed by Lund et al. [7] states that the pain decreases activation of the muscles when they are agonists of motion and increases when these are antagonists. The effects of such control strategy is that the speed of movement is reduced and the excursion of movement is limited.

It is believed that this kinematic effect occurs to prevent the incidence of pain. It is suggested that comparative studies are conducted with individuals with different times of living with the symptom of interest and, therefore, different times of adaptation to low back pain and its effects on the instability of gait.

CONCLUSIONS

Based on the results of this study, it is concluded that the different attentional foci used in this study were not able to cause significant changes in the dynamic balance of individuals with chronic low back pain that volunteered for this study.

REFERENCES

1 - Henry SM, Hitt JR, Jones SL, Bunn JY. Decreased limits of stability in response to postural perturbations in subjects with low back pain. *Clin. Biomech.* 2006;**21**,881-892.

2 - Van Dieen JH, Selen LP, Cholewicki J. Trunk muscle activation in low-back pain patients, an analysis of the literature. *J. Electromyogr. Kinesiol.* 2003;**13**,333–351.

3 - Krebs DE, Goldvasser D, Lockert JD. Is base of support greater in unsteady gait? *Phys. Ther.* 2002;**82(2)**:138-147.

4 - Bird SB, Dickson EW, Clinically significant changes in pain along the visual analogue scale. *Ann. Emerg. Med.* 2001;**38(6)**,639-643.

5 - Mizelle C, Rodgers M, Forrester L. Bilateral foot center of pressure measures predict hemiparetic gait velocity. *Gait Posture.* 2006;**24**,356–363.

6 - Kelly VE, Schrager MA, Price R, Ferrucci L, Shumway-Cook A. Age-Associated Effects of a Concurrent Cognitive Task on Gait Speed and Stability During Narrow-Base Walking. *Journal of Gerontology: Medical Sciences.* 2008;**63A,12**,1329-1334.

7 - Lund JP, Donga R, Widmer CG, Stohler CS. The pain-adaptation model: a discussion of the relationship between chronic musculoskeletal pain and motor activity. *Can. J. Physiol. Pharmacol.* 1991;**69**,683–694.