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Original Research Article

Lumbar flexion relaxation phenomenon in the patients with acute and subacute mechanical low back pain and normal subjects

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ABSTRACT

Background: The purpose is to examine the myoelectrical activity of erector spinae muscle in patients with acute and sub-acute mechanical low back pain (MLBP) and normal subjects.
Methods: A total of 30 patients 15 with MLBP and 15 normal subjects of both genders participated in the study with convenient sampling; all were aged between 20-50 years. The participants were asked to perform movement which was paced by computer running a program and the myoelectrical activity of erector spinae muscle in patients with acute and sub-acute mechanical low back pain and normal subjects were examined.
Results: This study stated that patients with MLBP has increased or over activity of erector spinae muscle during complete lumbar flexion when the muscle should be electrically silent. This was observed with help of EMG graph where increase in activity was observed with increase in amplitude, duration and time in graph.
Conclusions: There is increase in the amplitude, duration and time in flexion relaxation phenomenon (FRP) in mechanical low back pain patients when compared to normal subjects.

Keywords: FRP, MLBP

INTRODUCTION

Low back pain (LBP) is an extremely common health problem.[1-4] Until 10 years ago, it was largely thought of as a problem confined to Western countries; however, since that time an increasing amount of research has demonstrated that low back pain is also a major problem in low- and middle income countries.[5-9]

Low back pain is the leading cause of activity limitation and work absence throughout much of the world, and it causes a great economic burden on individuals, communities and governments.[10-13] The point prevalence of LBP is 28.5% found in an Asian country.[14] The lifetime prevalence of low back pain is reported to be over 70%.[15] But globally, the annual prevalence of LBP has been estimated at 38%. In general, LBP resolves within weeks, but may recur in 24-50% of cases within 1 year.[16,17] The prevalence of LBP increases rapidly (18%-50%) in the adolescent population.[18-20]

Mechanical low back pain is the general term that refers to any type of back pain caused by strain on muscles of the vertebral column and abnormal stress.[21] It can be caused by Lifting heavy objects, levered postures (bending forward), Static loading of the spine (prolonged sitting or standing).[22] Based on duration, low back pain can be acute which persist for <4 weeks, Sub acute between 4-12 weeks, Chronic when >12 weeks. Low back pain is typically classified as 'specific' and 'non-

specific'. Specific LBP is caused by specific pathophysiological mechanism whereas nonspecific LBP is defined as symptoms due to non-specific cause, i.e. LBP of unknown origin.

Different anatomical structures and pathophysiological functions can be responsible for lumbar pain, each producing a distinctive clinical profile. Pain can arise from the intervertebral disc in which pain will provocate due to movement, lumbar pain can also arise from afflictions within the zygapophyseal joint mechanism, which will produce provocation during three-dimensional movements, stress to either the synovium or joint cartilage. Finally, patients can experience pain associated with irritation to the dural sleeve, dorsal root ganglion, or chemically irritated lumbar nerve root. Pain can also arise from muscle.[23]

A wide range of work-related mechanical risk factors for LBP have therefore been reported in prospective studies. They include bending or twisting, kneeling or squatting, prolonged standing, heavy physical work, and nursing tasks (e.g., manually moving patients).[24-31] Overall, however, the evidence showing works postures, manual handling and carrying to be risk factors for LBP remains inconclusive.[32] During normal trunk flexion in standing the trunk extensor muscles act eccentrically and are considered myoelectrically active until a distinct point in flexion range of motion (ROM) here the lumbar paraspinals relax. During this time of relaxation, the paraspinal muscles of trunk are considered myoelectrically quiet or electrically reduced. This is described as the Flexion relaxation phenomenon.[33]

Floyd et al first described the term Flexion-Relaxation of the lumbar extensor musculature using EMG and suggested that the passive lumbar posterior elements, namely, the posterior spinal ligaments and intervertebral discs, supplied the needed moment during full flexion in the absence of erector spinae muscle activity.[34] The mechanism for the silencing of the erector spinae muscles during trunk flexion has been proposed to result from stimulation of stretch receptors in the posterior discoligamentous tissues during the flexed posture, acting to reflexogenically inhibit erector spinae activity.[35, 36]

The FRP is an appealing quantitative test for adding objectivity to a movement in which pain inhibition and voluntary effort limitations may confound the examiners ability to assess actual lumbar flexibility.[37] EMG is the recording of the electrical activity of the muscle and in essence, the study of motor unit activity.

The tool used is the non-invasive technique that allows the evaluation of muscle activity and the output may be in form of audio (Sounds) or digital (Graphs). Electrodes used to record the EMG signal like: surface electrode (recording electrode), Reference electrode. Surface Electrodes are used frequently as they generally are considered adequate for monitoring large superficial muscles or muscle groups.[38]

METHODS

The undertaken study design was experimental. Total 30 in which 15 MLBP patients and 15 subjects were selected for the study by convenient sampling. Study was done at Smt. Kashibai Navale General Hospital, EMG Department, Pune-15, Maharashtra, India. Patients fulfilling following inclusion criteria were selected for the study which included MLBP patients, those who have registered in physiotherapy OPD before any PT treatment or any other treatment for MLBP, subjects between ages of 20-50 years, both genders. Subjects with following criteria were excluded-Infective condition of spine, spinal surgery, disc herniation, and prolapsed disc condition and cauda equine syndrome, pregnant women. Permission was taken from the ethical committee.

All participants were given information about the study and a written consent was taken before participation. Steps to perform the movements were taught. The EMG Electrodes were placed approx. 2.5 cm lateral to the spinous processes of T12 and L5 and reference electrode – below wrist. Participants were asked to flex their trunk forward as far as they were able without bending their knees for a count of 6, hold the final position for count of one second and return to upright stance for a count of 6.[39] This movement was paced by a computer running a program that produced a series of audible beeps. First trial done and then 3 times were performed and best of it was taken.

The changes were compared by determining the changes in MLBP and normal subject's parameters on EMG graph.

RESULTS

With Independent Sample T-Test (Table 2), it showed that Patients with MLBP has increased or over activity of muscle when it should be electrically silent.

This was observed with help of EMG graph where increase in activity was observed with increase in amplitude, duration and time in graph which is statistically highly significant.

Table 1: Statistical analysis.

Parameter	Degree of freedom	T - value	Significance
Amplitude (N vs MLBP)	14	3.92	P<0.05
Duration (N vs MLBP)	14	2.22	P<0.05
Time (N vs MLBP)	14	0.41	----

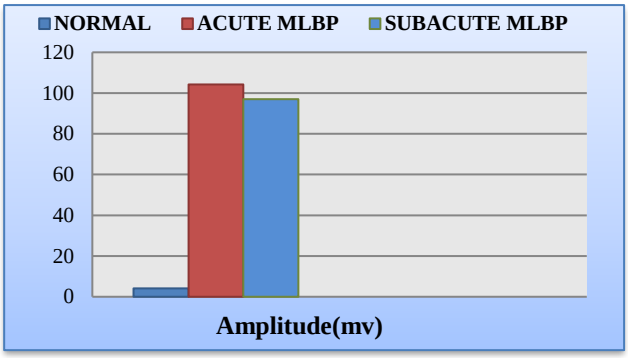

Figure 1: Comparison between amplitude in MLBP patients and normal subjects.

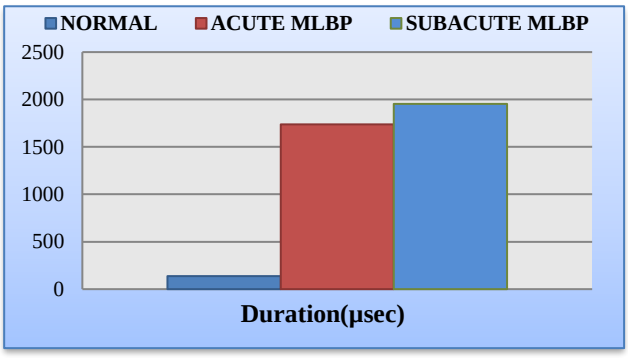

Figure 2: Comparison between duration in MLBP patients and normal subjects.

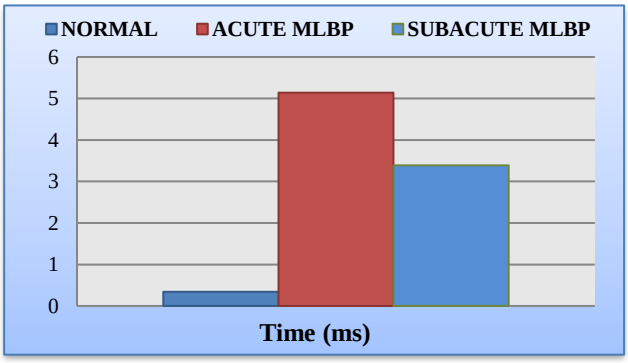

Figure 3: Comparison between time in MLBP patients and normal subjects.

DISCUSSION

In normal individuals, the amplitude, duration and time should be at relax or resting state, that is at base level (i.e. amplitude between 0 - 9 micro volts, duration between 0 412 micro second, and time between 0 - 0.8 milli seconds in normal individual). With the present study, it was found that there was increase in activity of the muscle, which was observed by the increase in the amplitude, time and duration value on the EMG graph. This is because the lumbar paraspinal muscle activity is increased when the muscle should be silent electrically. One theory proposes that LBP may be the result of muscle asymmetries. Literature suggests that the paraspinal muscles of patients with LBP act sub maximally and there is reduced activity during trunk movements.[40,41] Also, Hides et al suggest that arthrogenic muscle inhibition is likely in the paraspinal muscles in the presence of LBP.[41,42] Such changes can potentially affect the EMGs measured in these subjects and patients. In this study, our findings did support changes in muscle activation in the presence of muscular low back pain.

CONCLUSION

There is increase in the amplitude, duration and time in flexion relaxation phenomenon in mechanical low back pain patients when compared to normal subjects.

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