

Case Study

# Effect of Resting in a Chair, Resting with Range of Motion Exercises, and Back Strengthening Exercises on Pain and the Flexion-relaxation Ratio of Computer Workers with Low Back Pain

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**Abstract.** [Purpose] This study examined the effects of a relaxation chair and resting with simple range of motion exercises during computer work and low back muscle strengthening exercises after computer work on pain and the flexion-relaxation (FR) ratio of one computer worker with LBP. [Subjects] The subject of this study was a 37 year-old male who complained of severe LBP pain at the L4 level. [Methods] In the study, the subject worked on a computer for 5 h each day for 3 days and followed a different program each day. [Results] In Session 1, the FR ratios before and after work were 19% and 38% (+19%), respectively. The respective VAS scores before and after work were 5 and 8 (+3). In Session 2, the FR ratios before and after work were 18% and 21% (+3%), respectively. The respective VAS scores were 5 and 6 (+1). In session 3, the FR ratios before and work were 22% and 29% (+7%), respectively, and the VAS scores were 5 and 6 (+1). [Conclusion] This study suggests that it is more effective to perform regular, passive exercises to prevent LBP in computer users.

**Key words:** Flexion-relaxation Ratio, LBP, Resting

(This article was submitted Jul. 24, 2013, and was accepted Sep. 22, 2013)

## INTRODUCTION

In modern society, more people spend long periods working at computers, and experience increased work-related neck and back discomfort<sup>1)</sup>. Remaining seated for long periods can cause problems for the spine, circulation, muscles, and joints<sup>2)</sup>. Prolonged sitting is a risk factor for low back pain (LBP)<sup>2)</sup>. O'Sullivan et al.<sup>2)</sup> showed that decreased trunk muscle endurance is associated with habitually adopting a passive sitting posture and reduced activity levels. Dynamic changes in the sitting position with frequent posture changes are beneficial<sup>3)</sup>. According to recent findings, the form of resting and the work configuration are important to muscle activation and recovery of the circulation<sup>4, 5)</sup>. Consequently, clinicians recommend rest or exercises to help computer users prevent LBP<sup>5-7)</sup>. The purpose of this study was to examine the effects of a relaxation chair and resting with simple range of motion (ROM) exercises during computer work, and low back muscle strengthening exercises after computer work on pain and the flexion-re-

laxation (FR) ratio of one computer worker with LBP.

## SUBJECTS AND METHODS

The subject of this study was a 37-year-old male who complained of severe LBP pain at the L4 level. Ethics approval was obtained from the Yonsei University Faculty of Health Science Human Ethics Committee. The subject provided written informed consent before commencing the study. He had complained of continuous LBP for 6 months. He did not have back pain in the morning but did have it in the evening after working on a computer all day. When he performed forward flexion in the standing position with his knees fully extended, he experienced pain in his lower back with a visual analogue scale (VAS) score of 7. He had not undergone any specific treatment for this condition. He had mechanical LBP without radiating pain. He worked on a computer for 5 h each day. During this period, he rested three times for approximately 10 min each at irregular intervals. The rest of the time, he was performing Internet searches or shopping on a computer. In the study, he worked on a computer for 5 h each day for 3 days and followed a different program each day. The first day (Session 1), he spent 10 min in a relaxation chair resting after each hour of computer work. The second day (Session 2), he spent 10 min performing simple trunk ROM exercises (trunk flexion, extension, lateral bending, and rotation) while standing after

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each hour of computer work. The third day (Session 3), he performed low back muscle strengthening exercises for 20 min after 5 h of using the computer. The exercises consisted of a bridging exercise in the supine position (three sets of ten repetitions) and hip extension exercises in the quadruped position with knee extension (left and right leg, five sets each of ten repetitions). The programs or exercises and measurements were performed before he got home. There was no schedule for the different programs after he got home. This study measured the FR ratio and VAS score when he performed forward flexion in the standing position with his knees fully extended, before and after each 5-h work session. Electromyography (EMG) signals were pre-amplified by a preamplifier placed close to the electrodes, and sent to the data acquisition unit of an MP150 system (BIOPAC Systems, Santa Barbara, CA, USA), which amplified and sampled the EMG input at 1000 Hz. The EMG signals were band-stop filtered at 60 Hz, and the root mean square (RMS) values were calculated. The EMG data were analyzed using a program created with AcqKnowledge ver. 3.9.1. The subject was required to stand comfortably, bend forward slowly with his arms dangling freely (bending period), and then hold this position for 3 s (hanging period). The FR ratio (%) was calculated as the ratio of the RMS activity in the hanging period to that in the bending period.

## RESULTS

In Session 1, the FR ratios before and after work were 19% and 38% (+19%), respectively. The respective VAS scores before and after work were 5 and 8 (+3). In Session 2, the FR ratios before and after work were 18% and 21% (+3%), respectively. The respective VAS scores were 5 and 6 (+1). In session 3, the FR ratios before and after work were 22% and 29% (+7%), respectively, and the VAS scores were 5 and 6 (+1).

## DISCUSSION

The FR response is reported to occur in the lumbar region of more than 90% of healthy people who do not have LBP<sup>8</sup>. In individuals with LBP, the trunk muscle activation pattern is altered, and the lower back muscles are strongly activated over a long period<sup>8</sup>. It is necessary to evaluate the FR response for LBP. Mathieu and Forin<sup>9</sup> suggested that if the erector spinae (ES) muscle activity during the hanging period is less than 10% of the muscle activity during the bending period, it indicates the presence of FR. In Session 1, the FR ratio (+19%) and VAS score (+3) increased to the greatest degree. Therefore, the relaxation chair was not effective for muscle activation and recovery of the circula-

tion. In Session 2, the FR ratio increased by 3% and the VAS score increased by +1. In Session 3, the FR ratio was increased by 7% and the VAS score increased by +1. Therefore, after computer work, the back muscles require exercises to prevent LBP. There was no difference in pain between Sessions 2 and 3. However, difference in FR ratio was the lower in Session 2 than Session 3. The FR ratio is known to be the more sensitive indicator for prediction of LBP<sup>8,9</sup>. Also, Session 3 required additional time after work, and it also required exercise with a high load when compared with Session 2. So, this study suggests that Session 2 (regular trunk ROM exercises after each hour of computer work) was more effective than Session 3 (strengthening exercises after work). However, this report has a limitation. The carryover effects could have an influence on the results. This study suggests that it is more effective to perform regular, passive exercises to prevent LBP in computer users. It also suggests that poor resting is a risk factor for a change in the muscle pattern.

## ACKNOWLEDGEMENTS

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (No. 2012R1A1B4001058).

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