# MUSCLE COMPARISON OF MEDX LUMBAR EXTENSION TO A 45-DEGREE ROMAN CHAIR

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**TIME: Thursday, October 24, 1996, 3:46-3:52 PM**
**PLACE: Ballroom B**

## Introduction

Recent studies show that LBP responds well to intense specific resistance training. Isolated lumbar exercise has demonstrated effectiveness in 80% of patients. This is accomplished with proper lumbar stabilization. Magnetic Resonance Imaging (MRI) has been shown to identify active muscles immediately following exercise by the fluid shift out of the vascular bed into active muscle mass. The primary purpose of the study was to use MRI to determine the active muscles during two lumbar exercises. The second purpose was to compare the primary muscles involved in these exercises.

## Methods

Twenty normal healthy subjects, 10 males and 10 females, completed one set of exercise to volitional fatigue on the MedX Lumbar Extension Machine (MedX) and a 45-degree Roman Chair (RC) using slow controlled repetitions (7 to 10 sec). Exercise duration averaged 2:44 minutes on the MedX and 3:03 on the RC. MRI was used to analyze exercise response of four muscles; multifidus, erector spinae, quadratus, and psoas. T2 scans were performed prior to and immediately following exercise in a GE Signa l.5T MRI using a 3000/160/36 (TR/TI/TE) STIR sequence with two excitations and 0.95 x 0.95 x 10 mm voxels. Post exercise interval was 2:46 minutes and scan time was 3:18 minutes. Each muscle image was outlined using *Windows Advantage* for further analysis. Pre-to-post exercise signal intensity (SI) changes were calculated for each muscle and then statistically analyzed. Statistical significance was set at p ¾ 0.05.

## Results

Overall SI increase in active muscles for MedX was 41.9% and RC was 29.6% (See **Table 1**). MedX was significantly greater then RC ($p < 0.0001$). MedX increases were significant for the multifidus, erector spinae, and quadratus. RC changes were only significant for multifidus and erector spinae. The psoas major was not significant during either exercise.

**Table 1**
**Muscle Order of SI Change**

| MedX | 45-Degree Roman Chair |
|---|---|

| | | | |
|---|---|---|---|
| **All Muscles** | **24.0 ± 14.5* (26%)** | **All Muscles** | **20.8 ± 19.2* (17%)** |
| **Multifidus** | **24.6 ± 14.8* (44%)** | **Erector Spinae** | **20.9 ± 19.2* (29%)** |
| **Erector Spinae** | **23.4 ± 14.3* (40%)** | **Multifidus** | **20.8 ± 19.2* (30%)** |
| **Quadratus** | **9.0 ± 17.8 (17%)** | **Quadratus** | **3.0 ± 21.4 (6%)** |
| **Psoas** | **2.6 ± 23.5 (4%)** | **Psoas** | **0.4 ± 22.6* (2%)** |
| *** = p less than 0.0001, = p less than 0.05** | | | |

The erector spinae and multifidus were not statistically different from each other, but were significantly greater than the quadratus and psoas ($p < 0.0001$). The difference between the two exercises was significant at $p < 0.0001$ for the multifidus and erector spinae and $p = 0.0053$ for the quadratus. Males displayed a significantly greater SI increase than females (43% vs 29%). This represented an increase of 49% for males on MedX and 36% on the RC. Females increased 34% on MedX and 24% on the RC. Only females showed a significant difference between exercises ($p < 0.0001$). Bilateral comparisons showed muscles on the right were significantly more active than the left (39% vs 33%).

**Discussion & Conclusion**
Based on activation patterns, the RC uses the same muscles as MedX, but to a lesser degree. Therefore, both machines are appropriate for specific training of the lumbar extensors. However, when available, MedX is still the preferred exercise because of the greater lumbar muscle activation.

Send your questions and comments about this abstract to Ms. Vie at the following email address: mclachlan@aaos.com

## STRENGTH TESTING OF THE ISOLATED CERVICAL SPINE: A FIVE-YEAR FOLLOW-UP

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## Introduction

There have been few reports in the literature objectively measuring changes in strength and range-of-motion (ROM) in patients with non-spinal-cord injuries to the cervical spine. In 1992, we published objective testing and training data on 90 patients with varying diagnoses using a testing device which isolated the cervical extensors. The purpose of this study was to see what long-term effects, if any, remained from the cervical strength training.

## Methods

Twenty-one patients were able to return for follow-up examination and testing at an average of five years (range: 4 to 6 years) following initial cervical testing and training. Six males (mean age: 37 ± 11) and 15 females (mean age: 43 ± 12 years) were evaluated. Seventeen patients had remained at work levels previous to initial strength training (same job: 10; different job: 4; homemaker: 3), whereas four had not returned to work. Each patient's strength was measured isometrically in a MedX Cervical Extension Machine at multiple positions while restrained by a seatbelt, torso restraint and shoulder harness. The cervical ROM of the testing system was 126 degrees. Cervical pain was also rated on a 10-point analog scale.

## Results

The five-year follow-up showed that patients had lost cervical extension strength from the initial training. Even after five years, however, peak torque had remained significantly greater than the initial strength test (See **Table 1**):

**Table 1**
**Values Compared to Initial Strength Test**

| | Initial | Discharge | 5 Year Follow-Up |
|---|---|---|---|
| **Peak Torque (in/lb)** | **251** | **325*** | **275** |
| **Range of Motion (Degrees)** | **105°** | **112°*** | **110°** |
| **Pain (Analog Scale)** | **2.1** | **2.6** | **1.6** |

*** = p less than 0.01, = p less than 0.05**

Pain values were lower at five years, but not significantly different when all of the subjects were compared. For those patients, however, who had returned to previous work activity, pain was significantly reduced at five years ($p < 0.05$). All patients who did not return to work showed increases in pain over both initial and discharge levels, although not statistically significant (possibly due to the small number of subjects).

**Discussion & Conclusion**

Those patients who remained active following testing and training had the best five-year result. This data suggests that cervical strength training has some residual effects in patients who undergo this training and that physical activity contributes to the maintenance of these effects.

Send your questions and comments about this abstract to Dr. Highland at the following email address: mclachlan@aaos.com