# Comparing Muscle Activity and Spine Shape in Various Sitting Styles

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***"Stacksitting has been shockingly effective in resolving a nagging sciatic pain that was resistant to cortisone shots and medication. The effects and the underlying logic are deeply moving to me and keep me wanting to research and explore further."***
-Julie Southern, President, Spiralinks Corporation

## Background and Purpose

Lower back pain is experienced by approximately 70% of the world's population, contributing to the worldwide burden of disease. Back pain is the largest single factor in the decline in worker productivity with economic cost estimates ranging between $200 to $600 billion per year in the United States. Posture modification appears to be an effective intervention to reduce back pain. In a randomized controlled trial with 579 patients with chronic or recurrent low back pain, Little et al (2008) observed that those who were taught back exercises using the Alexander Technique (a postural modification approach) experienced significant reduction in back pain, and improved quality of life while the massage group reported no benefits (Little et al, 2008). The purpose of this poster is to explore a 'stacksitting' position (Gokhale, 2013) that appears to reduce experiences of back discomfort and low back pain.

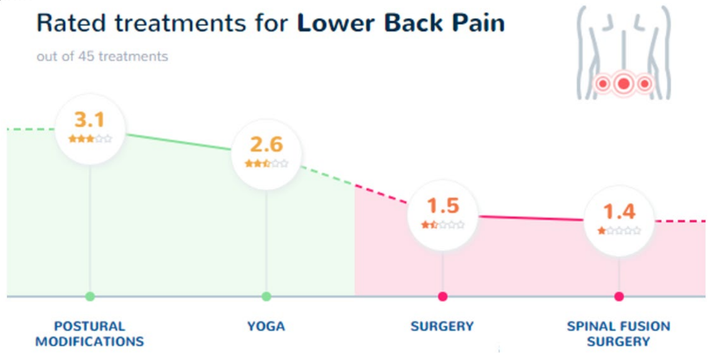


Figure 1. Crowd sourcing data from 64,520 patients' reports. Reproduced from: https://www.healthoutcome.org/condition/43/lower-back-pain-treatment

## METHOD

***Subjects***

Two female volunteers (average age 25 years) who served as pilot participants to model a stacksitting technique (Gokhale, 2013).

***Equipment and Sensor Location***

SEMG was recorded with standard biofeedback equipment (Thought Technology, Ltd. Myoscan Pro sensors) using software bandpass filter set at 100-200 Hz (Procomp Infinity). The triode electrodes were placed on the right and left upper trapezius muscle, and on the mid-back over the erector spinae muscles, one inch from the spine in a parallel configuration (see Figure 2).
Spine curvature was captured and characterized with additional biofeedback equipment (Gokhale SpineTracker, Stollenwerk et al, 2018) consisting of five sensor units, attached to the subject's back, capturing the angle of each sensor on the spine. The sensors were placed on the back with even spacing, with the lowest sensor on the sacrum at a fixed distance of 0.5" above the intergluteal cleft. The dynamic spine shape is displayed on a digital screen.

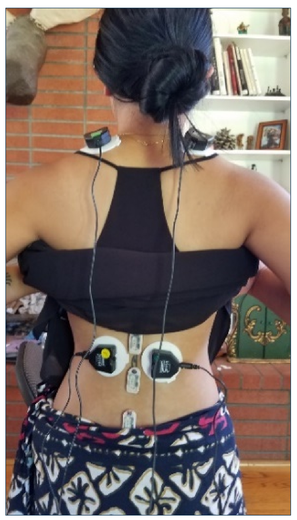

Figure 2: Sensor placement for Spine Tracker and EMG.

***Procedure***

The models sat in three positions: slouched (forward bent), arched upright, and in a stacksitting position as shown in Figure 5 (Gokhale, 2013).

## RESULTS

The spinal shape and SEMG recordings were similar for both models. There was no significant difference in trapezius SEMG activity between each of the three positions. There was a slight increase in SEMG activity of the mid-back for the stacksitting position (1.1 µV) as compared to the slouched position (0.64 µV), and a significant increase in SEMG activity when sitting in the arched position (4.9 µV) as shown in Figure 3 and 4.

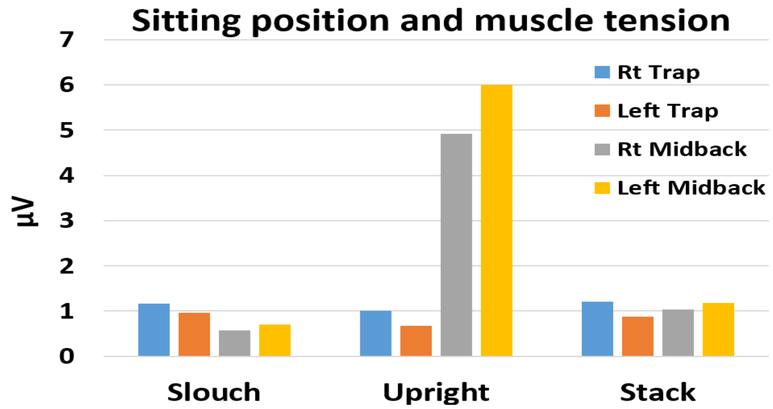


Figure 3: Average muscle tension depending sitting posture

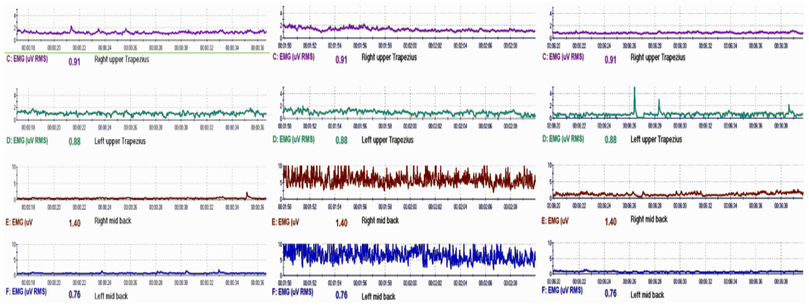

Figure 4: Comparison of the SEMG signals for slouch, upright and stack sitting positions.

The spinal tracker showed significant straightening of the lower spine in stacksitting as compared to the slouched and arched positions, as shown in Table 1 and Figure 5.

| Position | Slouched | Arched | Stacked |
|---|---|---|---|
| angle d | -3 deg | 12 deg | 4 deg |
| angle c | -2 deg | 19 deg | 6 deg |
| angle b | -9 deg | 10 deg | 0 deg |
| angle a | 2 deg | -7 deg | -1 deg |
| total curvature | 16 deg | 47 deg | 11 deg |
| #curves | 2 | 2 | 2 |

Table 1. Angle change of spinal curves for sitting positions.

## DISCUSSION


Figure 5: Comparison of the three sitting positions and the corresponding spine curves.

Stacksitting reduces the back muscle tension and intra disk pressure significantly as compared to the common technique of "sitting up straight" (arching).
The spine tracker device can dynamically plot the spinal curve and may be used by practitioners to monitor the appropriate spinal posture position that would optimize spinal alignment to reduce asymmetrical disk pressure. SEMG devices can be used to monitor and teach the participants to sit upright in a stacksitting position that minimizes back muscle tension. With correct training in stacksitting positions, the back muscles tighten only minimally, reducing the compressive force on the lower back. Hundreds of students and patients have reported recovering from back discomfort after they learned and used stacksitting at home and at work.

Figure 8. Sitting slouched.

**Recommendations on how to sit:**

When sitting on a chair, scoot your bottom far back in the chair while hinging forward at the hip. Gently straighten your spine by thinking of the back of the head reaching upward to the ceiling. Keep the head level as you make yourself tall and avoid tilting your head back, which raises the eyes and compresses the neck. Roll your shoulders a little forward, a little up, and back. Avoid letting the lower border of the ribcage extend outward. Drop the shoulders and feel the weight of gravity in your elbows while feeling the shoulders drop. Use SEMG feedback from the mid-back and trapezius muscles to monitor muscle tension. Feel your spine lengthening during inhalation (without the chest lifting) and feel the spine settling or stacking during exhalation. Periodically perform an internal 'proprioceptive body scan' of your back, shoulders and body for any unnecessary muscle tension that you can release. Be sure to change position frequently to reduce inter-disk pressure and covert static muscle tension.

## REFERENCES

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