Seats Padded With Gel Reduce The Activity Of Back Muscles During Sitting

DELSYS®
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INTRODUCTION:

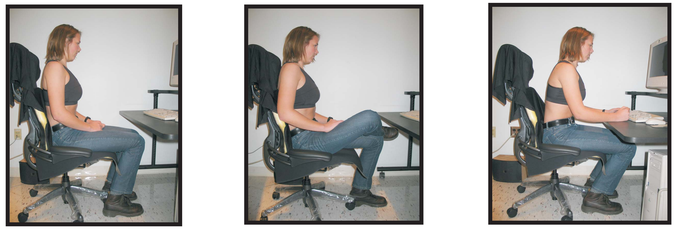
Foam is commonly used for padding surfaces that come in contact with the body for extended periods of time. The foam surface is compliant in the direction of the force and consequently conforms to the shape of the body surface, increasing the contact surface and reducing pressure points on the body surface. This distribution of pressure provides a more comfortable sensation and potentially modifies the activity level of muscles that maintain the body surface in the required posture. Gels, unlike foams, have the property of displacing in three dimensions; in the direction of the force and in the orthogonal directions. Thus, gels have the potential of providing a more conformable interface between the body surface and the support surface. This study was designed to investigate the hypothesis that a more conformable interface has the potential of reducing the necessary muscle activity, and therefore the force, required for stabilizing the back during seating.

METHODS:

- Twelve healthy subjects, 7 females and 5 males (age range 20-34, weight 51-87 kg., height 158-182 cm) were tested. Four of the subjects were tested twice for reliability assessment.
- Two identical office chairs (Freedom(TM) task chair, Humanscale Corp.) were used. One was equipped with a padding of standard polyurethane foam (36 mm thick); the other with padding of Technogel®) plasticizer-free gel, 24 mm thick fused to 12 mm of foam. (See Figure 1A)
- Subjects were required to sit quietly during a sequence of 3 sitting positions: (Figure 2)
  A) no back support, both feet on the ground;
  B) no back support, one leg crossed over the other;
  C) leaning forward with both arms supported on a table.
- Six surface EMG electrodes on bilateral Longissimus-L1, Iliocostalis-L2, and Multifidus-L5 muscles. (Figure 1B)
- Average Rectified Value (ARV) for overall muscle activity.
- Coefficient of Variation (COV) for muscle activity variation.
- A repeated measures ANOVA was performed to compare mean differences in these EMG parameters for the two test conditions (foam vs. gel)

A B

Figure 1. A. Two identical chairs with different seat padding (Gel on the left and Foam on the right). B. Surface EMG sensors locations.



No Back Support / Feet on the ground | No Back Support / Feet crosses | No Back Support / Arms on the desk

Figure 2. Three different seating positions.

METHODS:

- Average Rectified Value (ARV) for overall muscle activity.
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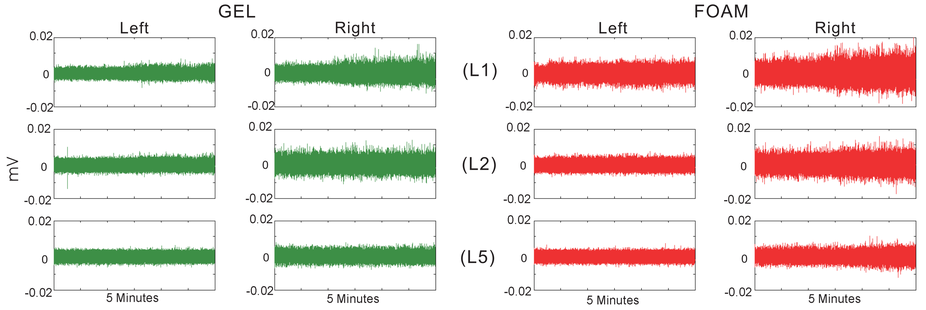

Figure 3. Sample EMG raw data for no back support/legs crossed task. The gel cushion data are in green and the foam cushion data are in red.

RESULTS:

- In all three seating positions with no back support, all three muscles tested were activated to a lesser level when the subjects sat on the gel cushion as compared to the foam cushion. (In two of these positions, the Longissimus and Iliocostalis muscles were activated at a significantly ($p<0.07$) lesser level.)
- The COV was not different for the two cushion conditions.
- Reliability results for ARV and COV demonstrated no significant difference between the test and re-test conditions.

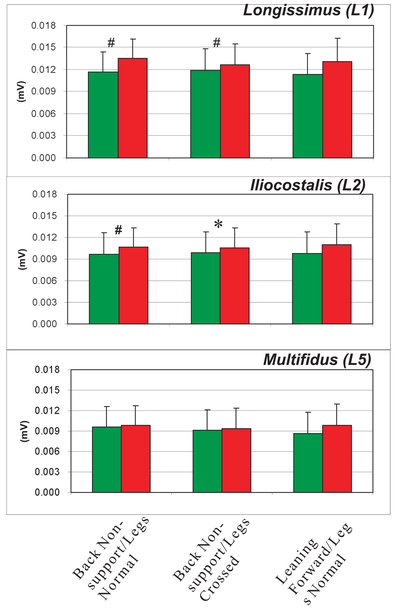

*Figure 4: Comparison of the mean and standard error of the mean of the ARV of the EMG signal recorded during the various sitting positions on both cushions. The signal from the right and left sides were summed prior to averaging across subjects. The gel cushion data are in green and the foam cushion data are in red. The significance level is * $P<0.05$ and # $P<0.07$.*

Gel Cushion
Foam Cushion

DISCUSSION AND CONCLUSION:

Preliminary results indicate that when subjects are seated with no back support, the lower back muscles are less active with the gel cushion than with the foam cushion. (The unsupported back position is the normal sitting position). One possible explanation is that the greater conformity of the gel cushion provides a more stable support for the pelvis which, in turn, requires less activity from the back muscles for stability.

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