PREDICTED ACCEPTABLE LOAD TRANSFER THROUGH THE RIBCAGE WHILE LEANING ON THE DYNAMIC TRUNK SUPPORT

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INTRODUCTION

The Dynamic Trunk Support (DTS) is a forward placed support designed to reduce postural muscle activity when standing with the trunk bent forward. Weight is transferred by leaning through the support plate that fits to the upper half of the sternum and anterior portion of the upper 4-6 ribs (Figure 1, A). To date, laboratory testing has demonstrated the effectiveness of the DTS in reducing lumbar spine compression loading(1,2). In preparation for field studies, we need to predict weight tolerance through the ribcage in order to determine support parameters (i.e. amount of support provided by the mechanism at the base of the device). So far, participants have used a 10-point visual analog scale (VAS) anchored by no compression and extreme compression to rate the sensation of compression through the upper rib cage. While this value has been a valuable indicator for use in preliminary investigations of the trade-off between compression through the ribcage and gains in reduced discomfort, reduced muscle activity and reduced spine loading; the scale does not help with setting mechanical parameters. To do this, a revised 10-point VAS was used based on Borg descriptors with 10 set as the maximal accepted value (MAV).

METHODS

Ten females participants rated their preference for support plates with different combinations of shapes (heart, round and square), vertical size (115mm, 152.5mm) and width normalized to the 5th, 50th and 95th percentile female[4]. The XSENSOR (Sensor technology, CA) was used to map pressure. The padding thickness was unchanged. To determine the MAVs, a harness was placed around the ribcage and attached to a hand-held dynamometer in front (Figure 1-B). After several practice pulls, the MAV for short term use defined as less than 1 minute was recorded followed by 3 repetitions, in random order, in increments equal to 15% MAV were tested for subjective ranking. A second session, on a separate day, was completed with the MAV, defined as an 8-hour shift for full day.

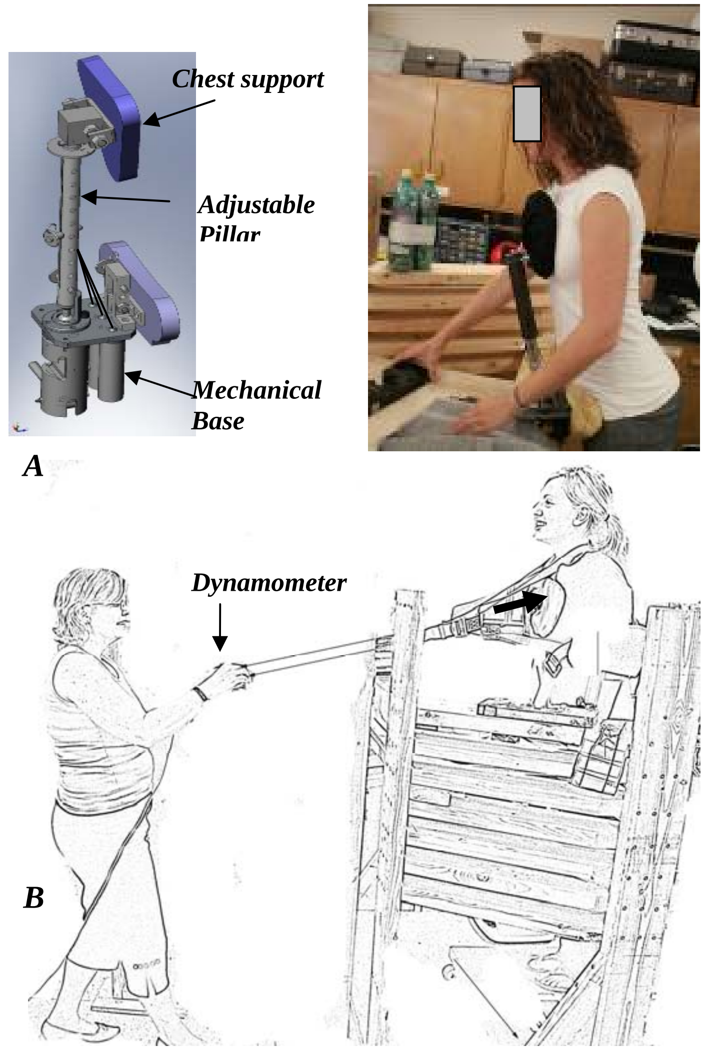

Figure 1. Subjective rating of actual compression in reference tolerance for short term (top) and full work shift (bottom).

RESULTS:

Eighty percent preferred the round shape but dimension preference varied. The anticipated MAV for full day is approximately 33% of the short term MAV. Both scales present with a similar linear relationship (Figure 2).

DISCUSSION:

The results indicate that a larger sample group is needed to determine aggregate preferences for size and shape of support plates. The VAS anchored by MAV and using Borg descriptors appears to correlate with actual compressive loading and therefore could be used in field studies as an indicator for compression loading. A limitation is that this homogenous group may not represent the workplace and full day MAVs are based on predicted values regardless of previous work experience.

REFERENCES:

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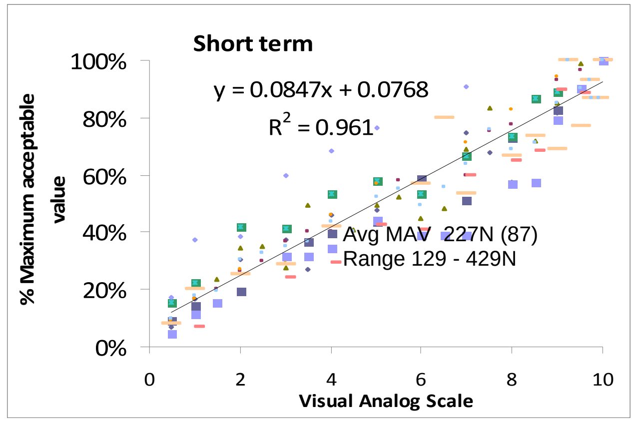

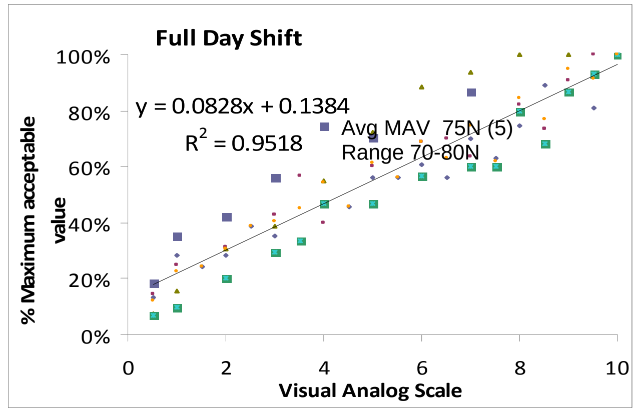

Figure 2. Subjective rating of actual compression in reference tolerance for short term (top) and full work shift (bottom).