

Effectiveness Of A Drywall Sanding Machine (DSM) In Reducing Forceful Exertions And Repetitive Motion

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Introduction

- Workers who perform drywall sanding tasks risk of injury due to drywall dust exposure and forceful repetitive motions.
- One method to reduce musculoskeletal exertion and exposure to drywall dust is the use of a mechanical drywall sanding machine (DSM) – see Photo 1.
- The purpose of this study is to verify the effectiveness of the drywall sanding machine in reducing musculoskeletal exertion and repetitive motion in actual field condition.

Study

1. Fourteen drywall-finishing workers participated. They were divided into 1) a control group to perform the sanding task using a pole sanding tool; and 2) an intervention group to use the DSM.
2. Electromyography (EMG) signals were collected on the bilateral middle deltoid muscles. All EMG data were normalized to the maximal voluntary contractions (MVC), rectified, low-pass filtered at 4 Hz and then analyzed using the amplitude probability distribution functions (APDF). Three muscle load levels (i.e. static, median and peak levels) were obtained from the 10th, 50th and 90th percentiles of the APDF.
3. Two Xsens sensors were used to quantify continuous trunk and upper arm postures. One of the Xsens was attached to the mid scapula to collect the posture of the trunk. The other Xsens was attached to the dominate arm above the posterior elbow joint.
4. While the participants performed the rough drywall sanding task, all dependent variables were measured. The same procedure was used for both groups.
5. Before starting the data collection for the intervention group, participants were given one half hour to practice using the DSM.

Results

Kinematics data:

- Significantly higher levels of mean and peak trunk acceleration were found in the flexion/extension (f/e) plane when participants used the sanding pole.
- The upper arm acceleration in the f/e plane and in the lateral plane was found to be significantly ($p < 0.05$) lower in the DSM group versus the pole sanding group.

Electromyography:

- Significantly ($p < 0.05$) higher middle deltoid muscle activities were found when participants used the pole sanding tool versus the DSM.
- For the pole sanding group, the static, median, and peak APDF levels were significantly ($p < 0.05$) higher on the right middle deltoid muscles when compared to the left muscles. For the DSM group, no significant difference was found between the right and left middle deltoid activities.

Discussions

- Despite the large difference in weight between the DSM (8 lbs) and the pole sanding tool (2 lbs), working with the DSM required significantly less shoulder muscle activities. This lower muscle activity may be due to the lower acceleration of the upper arm when using the DSM (i.e. Force = mass X acceleration). Similar findings were also found for the trunk.

- Due to the mechanical design of the DSM, the worker does not need to perform high energy consuming activities when sanding. The worker is only required to grip and direct the DSM handle. The DSM also promotes equal generation of forces on the left and right shoulders, while use of the pole sanding tool generate significantly higher forces on the side of the dominant hand.
- When working with the DSM, a reduction in dust exposure was observed. These results will be published in future publication.
- In conclusion, this study recommends the use of the drywall sanding machine for rough sanding tasks because of its ability to reduce musculoskeletal exertion, repetitive motions, and drywall dust exposure.