

# **Effectiveness of an On-Body Personal Lift Assistive Device**

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## **Background**

Lifting aids are used in industry to help alleviate the demands on workers in repetitive manual materials handling (MMH) jobs. However, mechanical lift assists are often too slow and cumbersome especially for loads within workers' capability. Therefore, there is a tendency to not use them for loads that are within the lifting capability of workers.

## **Objective**

The goal of this research program is to develop an on-body personal lift assist device (PLAD) that workers could wear for particular MMH jobs where repetitive lifting or static holding occurs (e.g., forestry, gardening, warehouse, moving industry, etc). The PLAD is designed with elastic elements acting parallel to the erector spinae that are anchored at the shoulders, knees and pivot at the pelvis. The elastic elements are stretched during the down phase and assist the erector spinae during the up phase of the lift.

## **Methods**

The objectives of this research were to compare the situations where there was no assistive device versus wearing the PLAD. Two research experiments were conducted. The first experiment involved lifting loads of 5, 15, and 25 kg for men and 5, 10 and 15 kg for women from symmetrical stoop, squat and freestyle postures. The second experiment involved a repetitive lifting task of 45 minutes (6 lifts and 6 lowers per minute) from floor to waist height. Participants were instrumented with either four or eight Fastrak sensors to calculate postures and L4/L5 moments respectively. In addition, eight pairs of electrodes were placed on muscles of importance to lifting loads. All data were synchronized by a switch on the box.

## **Results**

For men the PLAD significantly reduced the integrated moments by 28.6%, 22.6% and 17% and for women by 15.4%, 14.5% and 13.2% for light medium and heavy lifts respectively. For L4 erector spinae activity was reduced in men by 15%, 25% and 11% whereas in women, erector spinae activity was reduced by 14.8%, 40% and 21.7% respectively for each of the load weights. In the repetitive lifting task, the PLAD resulted in significant reductions in fatigue during static holding tasks. Back muscle endurance after fatigue during a static holding task was significantly better for the PLAD condition by 24% for men and 17% for women. The back muscles were also significantly less fatigued for the thoracic and lumbar regions in men by 11.7% and 19.5% respectively and in women by 18% and 18% respectively for median frequency.

## **Discussion and Conclusions**

The PLAD reduces the L4/L5 moments of force on the spine because the elastic elements are doing some of the work that the spinal muscles would normally perform during each task. This is also reflected in the amount of muscle activity used to generate the lifts, regardless of whether the PLAD is used for one time lifts or repetitive lifting tasks. Further research is needed to determine if technique is being altered by the PLAD or if it can be used effectively to assist with lifting tasks in working situations.

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