COMPARATIVE STUDY OF COMPETITIVE BELTS

TITLE: "The Minimum Abdominal Belt Aided Lifting Weight"
AUTHOR: Thomas Hilgen, Masters Thesis Auburn University, 1990
SUMMARY: This study was a detailed statistical analysis of kinetic and kinematic data, ground reaction force, and integrated EMG's of the erector spinae and abdominal external oblique muscles. Comparisons are of subjects with no support belt, the Air BeltTM lumbar support, and noninflatable type belts. The subjects performed lifting tasks with weights within ranges typically encountered in the workplace (NIOSH lifting guide recommendations) and also exceeding the MPL (maximal permissible limit). The data was sub-divided into four areas of time from just before the weight lift, through the lifting process, until the weight was placed at end of the lift. Statistically significant differences were found in the measurement of erctor spinae and external oblique integrated EMG's, moment impulses, and low back force impulses. The Air Belt™ gave the best results for these parameters during the critical phases of the lifting process.

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I recently had the opportunity to review the Masters thesis entitled "The Minimum Abdominal Belt-Aided Lifting Weight" by Thomas Hilgen at Auburn University in June of 1990. A detailed statistical analysis of kinetic and kinematic data, ground reaction force, and integrated EMG of the erector spinae and abdominal external oblique muscles was performed. Comparisons were made between subjects with no support belt, the Air BeltTM lumbar support, and the ProFlex.

The subjects performed lifting tasks with weights within ranges typically encountered in the workplace (NIOSH lifting guide recommendations) and also exceeding the MPL (maximal permissible limit). The data was sub-divided into four areas of time from just before the weight lift, through the lifting process, until the weight was placed down at the end of the lift. The positions are diagrammatically shown in the author's figures 1 through 3, as pointed out by the author, occur from the initiation of the lift up to the minimum ground reaction force in the vertical plane.

Statistically significant differences were found among the three situations (no belt vs. Air Belt vs. ProFlex) for the measurement of erector spinae and external oblique integrated EMG, moment impulses, and low back force impulses. The Air Belt gave the best results for these parameters during the critical areas of the lifting process. The integrated EMG results are a particularly interesting parameter and provide some useful insights into the practical application of back supports in the workplace. The design of the Air Belt is such that the inflated air chambers provide a means of direct support to the paraspinal muscles. With better support, less activity is needed by these muscles to straighten the spine from its forwardbent position to the upright position. This ideally leads to less fatigue and a small likelihood of strain in a tight, tired muscle. It should also be noted that while the Air Belt was superior to ProFlex in reducing the EMG activity through the largest range of spine movement that it does not completely inhibit the use of the erector spinae muscles and, therefore, would not be expected to create a disuse atrophy situation that arises from immobilization.

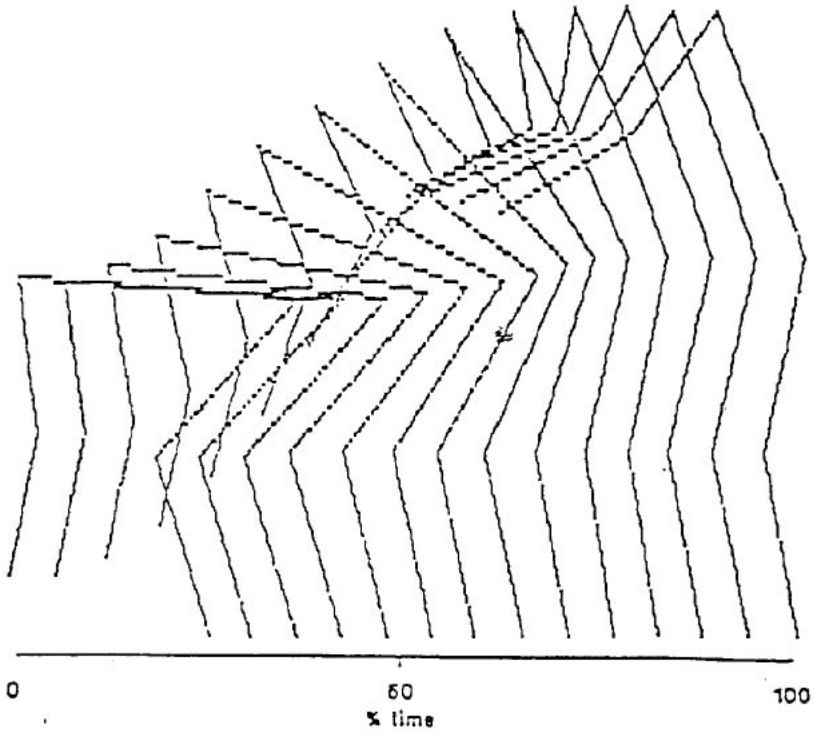
The study concludes that the Air Belt gave the lowest integrated EMG data across the first three areas of the lift and is "beneficial to the user when the trunk is stooped until it is more erect".

In further evaluating the data, the ProFlex belt yielded the best results during the initial stages of the lift (when the absolute trunk angle was below 10 degrees) and from the graphic data even this effect appears to be fairly small when the weights lifted did not exceed the maximal permissible limit (Figure 34). From a practical standpoint, I feel that when educating workers to lift correctly, this degree of forward-bending where the ProFlex seems to be the most effective is typically not an advisable posture to perform a lifting act. With this degree of forward-bending, the erector spinae muscles are stretched near their max and not at a position of optimum strength.

The Air Belt was the most effective belt during the middle stages of the lift (when the absolute trunk angle was between 10 and 70 degrees) in the study, as shown in Figures 35 and 36. In the fully erect position, neither belt showed a benefit vs. the no belt situation, but again I would note that most lifting tasks in the workplace are not likely to be done in this position from start to finish.

The author also indicates the subjects lifted faster while wearing the Air Belt and slowest with no belt suggesting that they felt more comfortable and more at ease. This is most likely due to a better sense of support. The effect of the ProFlex was intermediate in this regard, between the Air Belt and no belt situation. While this assumption is made and probably correct, the subjects were not directly questioned regarding this particular factor in the study. As with any personal protection device, this may well be an important parameter, however, to evaluate due to the importance of user compliance. No device will be helpful unless the user is willing to wear it. In summary, the Air Belt is shown to be superior in providing support during the greatest range of movement during the lifting tasks employed in this rather detailed study. When combined with a good fitness, flexibility and safety program as well as worker education on proper lifting mechanics, I feel that it will continue to provide a significant aid to the worker in the prevention of back injuries.

Peter R. Sebastian, D.O.



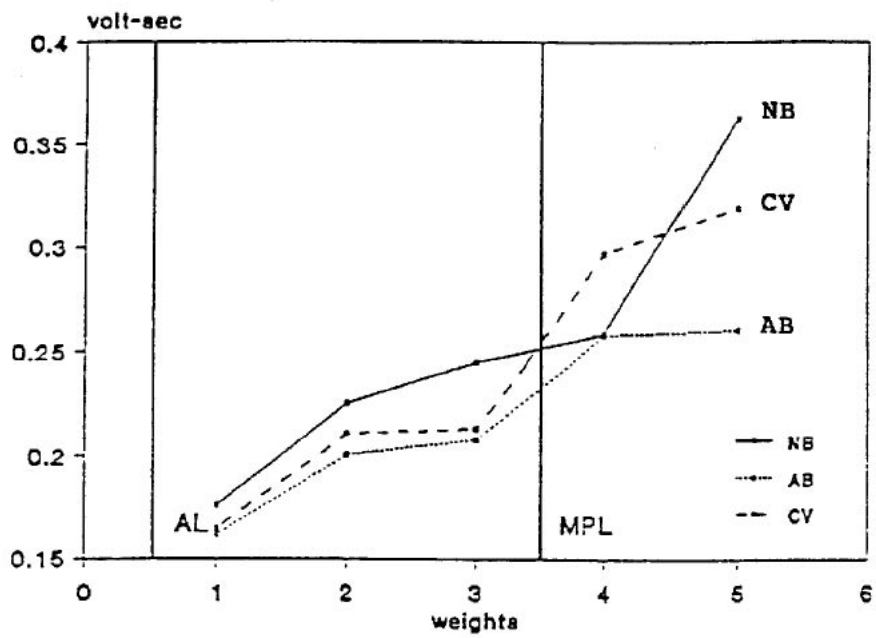


Figure 35 Erector Spinae iEMG (Area 2)

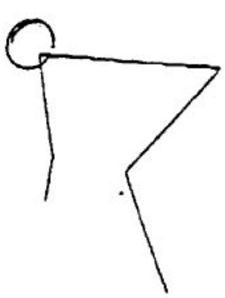


Figure 11: Maximum Z-Force Position Stick Figure

NB - No Belt

AB - Air Belt

CV - Elastic Belt With No Air Chambers

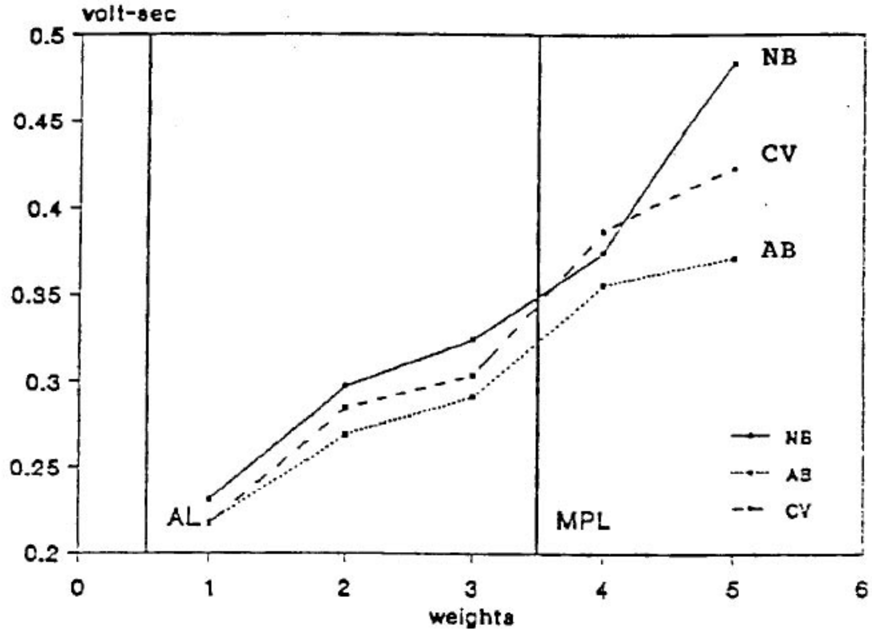


Figure 36 Erector Spinae iEMG (Area 3)

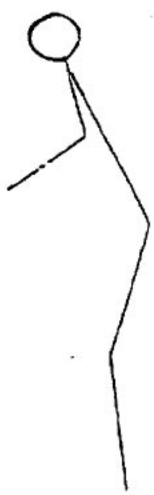


Figure 12: Minimum Z-Force Position Stick Figure

NB - No Belt

AB - Air Belt

CV - Elastic Belt With No Air Chambers