EFFECTS OF BACKPACK CARRIAGE ON GAIT AND POSTURE - DESIGN STUDIES

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INTRODUCTION

School age children are in a critical stage regarding postural development. Wang 2001, stresses that school students represent the largest group of weight-bearing individuals that use backpack form of load carriage [1]. Grimmer et al 1999, studied the effects of backpack load on postural parameters, craniovertebral angle (CVA), or forward head tilt in adolescent [2].

This study will see the effect of backpack carriage on gait and posture. The combined effects of heavy loads and walking speed were hypothesized as factors which were associated with problems such as bad posture and unstable gait.

METHODS

(i) Subjects:

Twenty school children with their age between 8 to 12 years were divided into two equal groups. Group A, ten boys their age 9.62 ± 2.31, height 129.23 ± 10.86 and weight 28.4 kg, and group B, ten girls their age 9.27 ± 3.08, height 132.63 ± 9.69 and weight 31.06kg. All subjects were free from neuromuscular disorders at the time of testing. Subjects came to the laboratory to complete the required test. To stimulate a real situation, the most popular schoolbag was used in this study and books were added to the schoolbag to provide 15% of the subject's body weight (the limits recommended by the American Academy of Orthopedic Surgeon). The two shoulder straps of the backpack were adjusted for each subject so that it could be carried in a comfortable position on the back. Then the subject put on the backpack and performed a 20-min walking on treadmill with a speed of 1.1 m/s, a comfortable walking speed for children [3]. Subjects were then asked to walk at a speed lower and higher than the normal speed. Data was recorded using a unit of 6 CCD cameras.

(ii) Equipment :

Unit of 6 CCD Cameras and Computer, Treadmill,
Force Platform, Anthropometric Instruments,
Retro reflective markers

(iii) Data Collection and Protocols: Kinematic data was collected from the subjects with 25 marker locations in different planes. Data was sampled at 120 Hz and filtered by Butterworth low pass filter with cut-off of 6.0 Hz. Further data was processed using EVA 7.0 and ORTHOTRAK 6.2 to get the data in different planes.

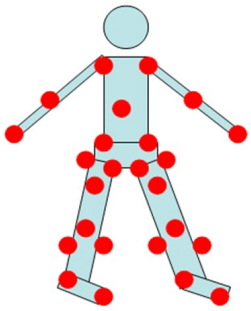

Figure 1: Placement of the markers on the subject

RESULTS AND DISCUSSION

The results show significant increase in the step length, base and angle of the foot placement under loading. The step length of group A and B increased by 5.5cm and 2cm respectively with load at normal walking speed. At higher than normal walking speed an increase of 3.5cm and 3cm without load and a further increase of 0.5cm and 4cm with load was noticed. However, at a lower speed a decrease of 3cm and 3.5cm without load and a further decrease of 7.5cm and 4cm with load was recorded,respectively. As the muscles of the lower extremities are not able to respond immidiately under loading conditions, there was a considerable increase in the forward lean of tunk and unstable gait while walking with a backpack at normal and higher walking speeds.

CONCLUSIONS

If such backpack carriage patterns persist over many schooling years, it can cause chronic back and postural problems that may extend into adulthood.

REFERENCES

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2. Grimmer K. A., Williams M. T. and Gill. T. K. *Spine*. **1(21)**:2262-2267, 1999
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Table 1: Changes in gait parameters (step length in cm) with different walking speeds.

Group	Without load (Normal speed)	With Load (Normal speed)	Without load (Lower than normal speed)	With Load (Lower speed)	Without load (Higher than normal speed)	With load (Higher speed)
A	55	60.5	52	53	58.5	61
B	57	59	53.5	55	60	63