

Prevention and Rehabilitation of Spinal Injuries and Design of Assistive Devices for Appropriate Weight Balance

Sonal Atreya¹ and Sneh Anand²

Abstract:

Research shows that Indian School Children carry up to 8 kg of backpack to school everyday. This study will see the effect of prolonged carriage of the backpack on the autonomic nervous system response, posture and other body deformations. Also, to determine the dimensions of the school backpacks and to identify the methods of carrying bags by school children.

1. Introduction:

School age children are in a critical developmental stage regarding musculoskeletal development. Spinal ligaments and muscles are not fully developed until after the 16th year of life (Partick 2000, in Lai and Jones, 2001). Wang 2001, stresses that these students represent the largest group of weight-bearing individuals that use backpack form of load carriage.

This issue of back pain with backpack use is controversial within the scientific literature with some studies finding no association [1] and some finding an association [2]. The combined effects of heavy loads, position of the load on the body, size and shape of the load, load distribution, time spent carrying, physical characteristics and physical condition of the individuals were hypothesized as factors which were associated with these problems. Grimmer et al 1999, studied the effects of backpack load on postural parameters, shoulders. If such risks persist over many schooling years, it can cause chronic back problems that may extend into adulthood.

Backpack weight measured as a percentage of body weight was effective in predicting back pain in adolescents. A bill was introduced in the Rajya Sabha, 'the children's bags (limitation on weight) Bill No.LXXXXVI of 2006, saying that the weight of the bag should not exceed 10% of the body weight of the student. Malhotra and Sen Gupta [5] suggested Indian children carry a bag weighing 2.6 kg (10-12%) of the body weight but according to our data children are carrying bags which are more than 30% of their body weight which exceeds the permissible limit. In spite of the set limits children continue to carry heavy weights because the curriculum requires so. This load of books, exercise books,

geometrical instruments etc. is normally carried in a school bag which comes in various shapes and sizes.¹

A National Advisory Committee was set up by the Government in March 1992 under the chairmanship of Prof. Yash Pal, former Chairman of the UGC to suggest ways and means to reduce academic burden on school students. So far as physical load of the school bag is concerned, the situation has become worse over the past few years. A heavy school bag can lead to forward trunk lean, muscle strain, distortion of the natural curve of the spine and rounding of the shoulders. If such risks persist over many schooling years, it can cause chronic back problems that may extend into adulthood.

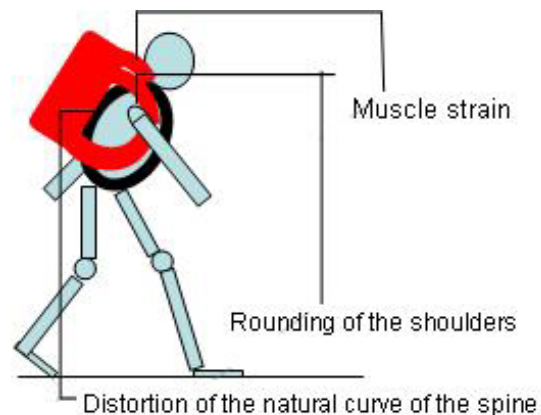


Figure 1: Problems pertaining to load

2. Method:

Subjects:

Thirty school children their age between 8 to 11 years divided into two equal groups. Group A, fifteen boys their age 9.82 ± 2.31 , height 129.23 ± 10.86 and weight 28.4 kg, and group B, fifteen girls their age 9.27 ± 3.08 , height 132.63 ± 9.69 and weight 31.06kg) table 1. All subjects were free from neuromuscular disorders at the time of testing and none

^{1,2}Centre for Biomedical Engineering, IIT Delhi, New Delhi-110016

had history of chronic low back pain. Subjects came to a university lab for one full day in order 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 the 15% of the subject's body weight (the limits recommended by the American Academy of Orthopedic Surgeon). The two shoulders straps of the schoolbag were adjusted for each subject so that it could be carried in a comfortable position on the back.

Group	Age (years)	Weight (Kg)	Height (cm)
A (15 boys)	9.82 ± 2.31	28.4	129.23 ± 10.86
B (15 girls)	9.27 ± 3.08	31.06	132.63 ± 9.69

Table (1): Characteristics of subject's data

The first part of the study will involve investigation of the body distortions due to load. The experimental setup will consist of a grid with reflective markers. The light source will focus on the back of the subject which will be reflected on these markers and the reconstructed model of the spine will be designed on the grid, where we will be able to see the changes in the spine. Load distribution is another important factor, for which we will design a mathematical equation to find the load distribution on the body using the free body diagrams. Preliminary experiments showed interesting results in the stability due to the load. Further experiments will be conducted in the gait lab to see the instability pattern when carrying a load. To find the optimum load and placement, experiments will be carried out in a Research Laboratory

with the help of the equipment telemetric breath by breath analyzer K4b2. We will be able to see the response of the autonomic nervous system under different loads and speeds of walking.

3. Discussion:

This data will be co-related with the epidemiology data, comprising of the various physical problems caused due to load carriage. The new bag design keeping load distribution pattern in focus will help reduce the weight on the children and will thus solve the problems related to heavy backpack carriage.

4. References:

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