

## **BACKPACK SAFETY: AN OXYMORON**

As backpack use for school has become widespread, numerous articles and programs have offered instruction and guidelines in “backpack safety”. Nevertheless, the incidence of backpack-related pain and injury continues to rise and has reached epidemic proportions. Additionally, what we see is probably just the tip of this iceberg, as kids underreport pain, and many parents discount the pain reports they do get, because “they are young” and they see no alternative.

It is becoming apparent that the term “backpack safety” is an oxymoron. Backpacks are off-axis, posterior loading systems which cause the body to compensate with postural distortion. The postural distortion will continue unless the load is aligned with the body’s axis, in obedience to the laws of physics and physiology. It is this postural distortion as well as the posterior protrusion of the backpack, not the magnitude of the imposed load, which are chiefly responsible for the pain and injuries.

Since postural distortion, not the magnitude of the load, is a chief disabling factor, switching to a rolling backpack is a short-term remedy, but not a solution. A rolling backpack provides no postural training — the mechanism is actually heavier and more awkward when carrying is required (busses, stairs, irregular surfaces), and unloading the body is not necessarily a healthy alternative for developing bones. Only during the growth period can bones build density. This also requires adequate daily muscle/bone resistance. Our young people are getting less and less activity. Carrying their books may be their only opportunity for adequate exercise to increase bone density and prevent osteoporosis, the leading cause of fractures in adults, and increasingly seen in children.

The safety hazards inherent in the design of the backpack, originally intended for mountain recreation, not as a school bag or everyday bag – compelled me to design a healthy alternative for school or everyday use: the BackTpack.

### **SAFETY CONCERNS with use of a conventional backpack:**

- 1) **POSTURE DISTORTION:** commonly seen forward head, kyphosis (rounded spine), rounded shoulders, anteriorly tilted pelvis, hyper-extended knees. Poor foot alignment
- 2) **PAIN AND INJURY:** to back, neck, shoulders from poor posture, poor body mechanics: twisting and forward bending. Need for frequent removal, or must sit with poor posture and load on spine
- 3) **INJURY TO OTHERS:** user is unaware of posterior bulk of backpack; can easily knock others down when turning quickly
- 4) **POOR SECURITY:** accessible to those behind you, not to you: must remove to access items or to sit down; difficult to run with on

- 5) **BIKING INSTABILITY, POOR POSTURE, AWKWARD OR NO ACCESS:** top heavy, must remove for access; encourages kyphosis, cervical hyperextension causing neck pain
- 6) **INCREASED WEIGHT OF LOAD INCREASES POSTURAL DISTORTION** and associated pain
- 7) **EMERGENCY EVACUATION CONCERNS:** speed, access, uphill running difficulty (Tsunami evacuation), danger to others in crowd when turning, etc.
- 8) **BALANCE DISTURBANCE RELATED TO POSTERIOR LOADING**

It is a neuromuscular training fact that when resistance is applied against a given direction of movement, that movement is strengthened and trained.

- to train a high stepping gait, we weight the ankles
- to encourage hip flexion in gait we provide resistance to anterior pelvis
- to train a forward head and forward lean with rounded shoulders, we apply resistance anteriorly to shoulders, i.e., a loaded backpack (posterior load) with shoulder straps
- to train upright posture ,we load the body on its vertical axis, i.e., the book on the head, or a balanced bilateral load

The only way to correct the habitual postural distortion trained by a posterior loading system is to apply the load on the axis instead of the back. If we apply these clinically sound principles to the everyday loading system of students, we will train their lifelong postural habits for musculoskeletal health.

### **SOLUTIONS FOR SAFETY that the BackTpack offers:**

- 1) **POSTURE DISTORTION:** Eliminated. Spine is loaded axially. No leaning, reaction to load is vertical posture.
- 2) **PAIN AND INJURY** from poor posture and poor body mechanics: Reduced or eliminated with postural training system of axial loading and the ability to sit with BackTpack on, load transferred off spine and shoulders onto strap over thighs. Since compartments are always accessible, and the wearer can sit unloaded with bag on, there is no need to frequently take the bag off.
- 3) **INJURY TO OTHERS:** from user being unaware of posterior projection: BackTpack wearer is always aware of personal space related to bag he/she is wearing and can accommodate space so as not to impose it on others' safety.
- 4) **SECURITY:** The wearer's items are accessible only to the wearer. The bag does not need to be removed when sitting.
- 5) **BIKING STABILITY, POSTURE, ACCESS:** BackTpack provides a lower center of gravity, is a balanced load, and compartments are easily

accessed. When in the forward lean position, the load is applied to the body in posterior-to-anterior direction against the spine (not from shoulders), promoting a neutral spinal alignment of thoracic spine and neck.

6) **INCREASED WEIGHT OF LOAD INCREASES POSTURAL DISTORTION:** Since the BackTpack is a postural training system, loading axially, there is no postural distortion with increased load. The limit of the load increase is a matter of comfort to the wearer. Some or all of the load can be transferred to the hips via the optional hip loading system provided in the design.

7) **EMERGENCY EVACUATION:** BackTpack remedies all of the safety issues mentioned. The wearer has balance and mobility.

8) **BALANCE DISTURBANCE FROM POSTERIOR LOAD:** No balance disturbance with axial, bilateral loading. Balance is reinforced.

Based on 30 years of evidence, backpacks continue to cause postural distortion, pain and injury when used as a daily school bag in spite of “backpack safety” programs and guidelines. Conversely, a 2004 study with Nestucca Valley Middle School students ([http://www.backtpack.com/btp\\_study.htm](http://www.backtpack.com/btp_study.htm)) has shown that using BackTpack as a school bag effectively addresses the issues contributing to such problems. Testimonial evidence from subsequent users confirms this finding.

If students insist on using their backpacks for school, they and their parents must be made aware of the long term physiological effects and how best to mitigate them with appropriate exercises, training in posture and body mechanics, and to be informed of healthy alternatives for carrying their supplies. Medical professionals can do their part in combating this epidemic by informing the public about these safety issues and about what makes a healthy choice when investing in their child’s school bag.

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