**TITLE:** Vacuum Boards for Spinal Motion Restriction: Clinical Effectiveness

**DATE:** 14 October 2008

**RESEARCH QUESTION:**

What are the clinical benefits and harms of using vacuum boards for spinal motion restriction?

**METHODS:**

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 3, 2008), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international health technology agencies, and a focused Internet search. Results include articles published between 1993 and October 2008, and are limited to English language publications only. No filters were applied to limit the retrieval by study type. Internet links are provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**RESULTS:**

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials and observational studies.

One systematic review, three randomized controlled trials, and five observational studies were identified regarding the clinical benefits and harms of using vacuum boards for spinal motion restriction. No relevant health technology assessments were identified from the literature search results. An additional article of interest may be found in the appendix.
OVERALL SUMMARY OF FINDINGS:

Four of the included studies investigated the effectiveness of vacuum boards for restricting spinal motion,1,6,7,8 two studies measured tissue-interface pressure,5,9 two studies evaluated perceived pain with different immobilization techniques,2,4 and one study examined the effects of immobilization on respiration.5

Kwan et al. conducted a systematic review to examine the effects of pre-hospital spinal immobilization on patients.1 Seventeen randomized controlled trials investigating different types of immobilization, tested on healthy subjects, were included in their analysis. The results showed that collars, spine boards, vacuum boards, and abdominal/torso strapping were all effective in reducing spinal movement. Observed adverse effects included a significant increase in respiratory effort, pain, discomfort and ischemia. Luscombe et al. compared the stability and comfort of spinal boards and vacuum mattresses using nine healthy volunteers.6 Each subject wore a rigid neck collar and was secured to a board. Subjects were tilted from 45 degrees head up to 45 degrees head down, and also 45 degrees laterally to test subject movement. Movement of the head, sternum and pelvis were measured from a fixed position. Movement from all measured positions was significantly greater (p<0.01) when using the spinal board as compared to the vacuum mattress. Subjects rated their comfort level using a 10 point numerical rating scale. The vacuum board was rated as significantly more comfortable (p<0.01). Hamilton et al. studied 26 healthy subjects to determine cervical spine immobilization and comfort of spinal boards compared to vacuum splints, both with and without cervical spine collars.7 Cervical spine range of motion was measured before and after immobilization. The vacuum splint plus cervical collar resulted in significantly superior immobilization of extension and lateral bending as compared to the spinal board plus cervical collar. The vacuum splint alone was more effective at immobilization than the spinal board in all areas but extension. Johnson et al. compared the vacuum splint to spinal board for comfort, speed of use, and degree of immobilization.8 Comfort of each immobilization device was measured using a 10 point scale. The vacuum splint was deemed significantly more comfortable (p<0.01) after 30 minutes of use than the rigid spinal board. The vacuum board was also faster to use and provided less slippage during lifting and better immobilization of the torso; however, head support was better with the rigid backboard with head blocks. All three observational studies concluded that the vacuum splint is a viable alternative to, and more comfortable than, the rigid backboard.6,7,8

Keller et al. compared tissue-interface pressures when using a semi soft overlay mattress, vacuum mattress, and spinal board.5 Pressure was measured at the scapulae, sacrum, and heels in 20 healthy volunteers. Subject comfort was measured using a 10 point visual analog scale (VAS). High, potentially ischaemic pressures were measured on all surfaces, with the highest pressures (>170mmHg) measured on the spinal board. The spinal board received the lowest comfort score of the three surfaces. Lovell et al. compared the spinal stability and tissue-interface pressure of spinal boards, padded spinal boards, and vacuum stretchers in 30 healthy male volunteers.9 Interface pressure was measured at the sacrum and mid-lumbar spine. Highest sacral pressures were measured on the spinal board (147.3 mmHg) and the lowest on the vacuum stretcher (36.7 mmHg). Both studies5,9 observed that the spinal board provided no support to the normal lumbar lordosis, but that support for this area was provided by the vacuum board.

Cross et al. conducted a randomized controlled trial to compare the location and severity of pain experienced by healthy volunteers when placed on either a wooden spinal board or a vacuum mattress splint.2 Volunteers were placed on either a wooden spinal board or one of two different vacuum mattress splints and pain was rated at 0, 30 and 60 minutes using a 10 point VAS. The
test was repeated at two-day intervals until each volunteer had used all three boards. The wooden spinal board was rated as more painful than either of the vacuum mattress splints with the highest pain ratings observed at the occiput, lower back, and sacrum. Chan et al. conducted a randomized controlled trial of healthy volunteers to compare the symptoms observed when participants were immobilized using either a wooden spinal board or vacuum mattress splint. Each participant was randomly assigned to either the wooden board or vacuum mattress and were then immobilized for 30 minutes. The incidence and severity of symptoms was measured and, after a two-week washout period, the test was repeated using the other device. Participants were 3.08 times more likely to experience general symptoms when immobilized with the wooden spinal board, 7.88 times more likely to report occipital pain, and 4.27 times more likely to report lumbosacral pain.

Totten et al. conducted a randomized controlled trial to evaluate the effect spinal immobilization on respiration. Thirty-nine healthy volunteers were immobilized using a wooden spinal board and cervical collar, and a vacuum mattress splint and cervical collar. Respiratory function was measured at baseline and again while using each device. Comfort of each device was also measured. Both immobilization methods had an average of 15% restriction in respiration, but the vacuum mattress splint was rated as more comfortable.

Overall, the studies suggest that vacuum mattresses are a more comfortable alternative to the wooden spinal board. Vacuum mattresses provide greater stability and immobilization than wooden spinal boards, cause less tissue-interface pressure, and cause less pain and general symptoms to the patient.
REFERENCES SUMMARIZED:

Health technology assessments

No literature identified

Systematic reviews and meta-analyses


Randomized controlled trials


Observational studies


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APPENDIX – FURTHER INFORMATION:

Review articles