

Vacuum Immobilisation Mattress (VIM) Research Studies

Please Note:

All studies below compare the Vacuum Mattress against a flat Long Spine Board.

No studies currently exist comparing the Vacuum Mattress against a curved Long Spine Board. Curved devices are known to show significant improvement over flat Boards¹.

Injury. 1994 April; 25(3):179-80.

A Comparison of the Spinal Board and the Vacuum Stretcher, Spinal Stability and Interface Pressure.

Lovell ME, Evans JH.
Noble's Hospital, Isle of Man, UK.

The interface pressures were measured between the sacrum, mid-lumbar spine and various support surfaces.

Thirty healthy male volunteers were recruited. The spinal board, padded spinal board and vacuum stretcher were the support surfaces evaluated. We found high and potentially ischaemic pressures between the sacrum and the spinal board interface (mean 147.3 mmHg). This was reduced in the padded board (115.5 mmHg) but dramatically reduced with the vacuum stretcher (36.7 mmHg).

It was also noted that no support was given to the normal lumbar lordosis by the spinal board (padded and unpadded), but support was given by the vacuum stretcher. This raises the question of how stable is an unstable spinal injury on a flat supporting surface.

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J Emerg Med 1996 May-Jun;14(3):293-8

Backboard Versus Mattress Splint Immobilization: A Comparison of Symptoms Generated.

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The study objective was to compare spinal immobilization techniques to a vacuum mattress-splint (VMS) with respect to the incidence of symptoms generated by the immobilization process. We used a prospective, cross-over study in a university hospital setting. Participants consisted of 37 healthy volunteers without history of back pain or spinal disease. Interventions consisted of two phases.

In Phase I, subjects were randomly assigned to be immobilized on either a wooden backboard or a mattress-splint for 30 min. The incidence and severity of any symptoms generated by the immobilization process were recorded.

In Phase II, the two groups were again tested after a 2-week washout period, with the method of immobilization being reversed. Symptoms and severity were again recorded. Pain symptoms were confined to four anatomic sites: Occipital prominence, lumbosacral spine, scapulae, and cervical spine.

After adjusting for the effect of order of exposure, subjects were 3.08 times more likely to have symptoms when immobilized on a backboard than when immobilized on the VMS. They were 7.88 times more likely to complain of occipital pain and 4.27 times more likely to complain of lumbosacral pain. Severity of occipital and lumbosacral pain was also significantly greater during backboard immobilization.

We conclude that, when compared to a VMS, standard backboard immobilization appears to be associated with an increased incidence of symptoms in general and an increased incidence and severity of occipital and lumbosacral pain in particular.

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Am J Emerg Med 1996 Jul;14(4):369-72

Comparison Of A Vacuum Splint Device To A Rigid Backboard For Spinal Immobilization.

Johnson DR, Hauswald M, Stockhoff C.
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In this study, comparison of a vacuum splint device to a rigid backboard was made with respect to comfort, speed of application, and degree of immobilization.

The study was a prospective, non blinded comparative study conducted at a statewide emergency medical services (EMS) training facility and included a convenience sample of emergency medical technician (EMT) and paramedic students.

The vacuum splint was judged to be significantly more comfortable on a 10-point scale than the rigid backboard after subjects had been lying on each device for 30 minutes ($P < .001$). It was also faster to apply: 131.6 +/- 24.3 seconds versus 154.6 +/- 22.2 seconds ($P < .001$). Various measures of immobilization were similar for the two devices.

The vacuum splint provided better Immobilization of the torso and less slippage on a gradual lateral tilt. The rigid backboard with head blocks was slightly better at immobilizing the head. Vacuum splints offer a significant improvement in comfort over a traditional backboard for the patient with possible spinal injury.

They can be applied in reasonable time frames and provide a similar degree of immobilization when compared to a standard rigid backboard.

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J Emerg Med 1996 Sep-Oct;14(5):553-9

The Efficacy and Comfort of Full-Body Vacuum Splints for Cervical-Spine Immobilization.

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We performed a prospective crossover study to determine the cervical spine immobilization and comfort level of healthy subjects on a full-body vacuum splint in comparison with a standard backboard, with and without cervical spine collars.

Twenty-six healthy volunteers were immobilized on a backboard (BB) and a full-body vacuum splint (VS), both with and without a cervical collar (CC). Pre- and post-immobilization cervical spine range-of-motion measurements were made using an electronic digital inclinometer and a standard handheld goniometer.

Subjects were also asked to subjectively grade their immobilization and discomfort both overall and in seven specific body regions. No statistically significant difference was found between the VS+CC and the BB+CC for flexion and rotation, although the VS+CC combination provided significantly superior immobilization to the BB+CC for extension and lateral bending.

The VS alone, in all cases except extension, provided superior immobilization to the BB alone. A statistically significant difference in subjective perception of immobilization was noted, with the BB being less effective than the other three alternatives and the VS+CC providing the best immobilization.

A significant difference in overall comfort and occipital region comfort, favoring the vacuum splint, was found. In conclusion, the vacuum splint is an effective and more comfortable alternative to the background for cervical spine immobilization.

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Prehosp Emerg Care 1999 Oct-Dec;3(4):347-52

Respiratory Effects of Spinal Immobilization.

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OBJECTIVE: To evaluate the effect of whole-body spinal immobilization on respiration.

METHODS: This was a randomized, crossover laboratory study with 39 human volunteer subjects (20 males; 19 females) ranging in age from 7 to 85 years.

Respiratory function was measured three times: at baseline (seated or lying), immobilized with a Philadelphia collar on a hard wooden backboard, and on a Scandinavian vacuum mattress with a vacuum collar.

The comfort levels of each of the two methods were assessed on a forced Likert scale.

RESULTS: Both immobilization methods restricted respiration, 15% on the average. The effects were similar under the two immobilization conditions, although the FEV1 was lower on the vacuum mattress.

Respiratory restriction was more pronounced at the extremes of age. The vacuum mattress was significantly more comfortable.

CONCLUSION: This study confirmed the previously reported respiratory restriction caused by spinal immobilization. Vacuum mattresses are more comfortable than wooden backboards.

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Prehosp Emerg Care 2001 Jul-Sep;5(3):270-4

Comparison of Perceived Pain With Different Immobilization Techniques.

Cross DA, Baskerville J.

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OBJECTIVE: To compare the locations and severities of pain generated by a hard wooden spine board vs a soft vacuum mattress splint on immobilized volunteers.

METHODS: This was a prospective randomized crossover study conducted in an emergency medical services (EMS) classroom within a university teaching hospital. Participants were 18 healthy volunteers with no history of acute or chronic back pain, pregnancy, or recent analgesic use.

The subjects were placed in one of three immobilization boards (hard spine board and two different vacuum splint models, identified as red and blue) for 60 minutes. At 0, 30, and 60 minutes the subjects rated their pain at multiple locations on their body using a visual analog scale (VAS).

After a two-day washout period, this procedure was repeated on a different board and later a third board until all the subjects had been tested on all three boards.

RESULTS: Although many pressure point locations were studied, only three had results that appeared statistically significant: the occiput, lower back, and sacrum. The hard spine board had higher mean pain scores as well as a higher percentage of subjects who reported any pain when compared with the two vacuum mattress splints.

Mean scores for the 30- and 60-minute times were: occiput 2.06 and 2.78 for the hard board compared with 0.78 and 0.56 for red and 0.44 and 0.67 for blue; lower back 1.39 and 1.44 for the hard board compared with 0.28 and 1.11 for red and 0.06 and 0.17 for blue; and sacrum 1.56 and 2.06 for the hard board compared with 0.33 and 0.39 for red and 0.89 and 1.06 for blue.

CONCLUSION: The hard-board method of spinal immobilization generates higher self-reported pain scale scores than the two vacuum mattresses.

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Emergency Medical Journal: EMJ. 2003 Sep;20(5):476-8.

Comparison of a Long Spinal Board and Vacuum Mattress for Spinal Immobilisation.

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OBJECTIVES: This study was designed to compare the stability and comfort afforded by the long spinal board (backboard) and the vacuum mattress.

METHODS: Nine volunteers wearing standardised clothing and rigid neck collars were secured on to a backboard and vacuum mattress using a standard strapping arrangement.

An operating department table was used to tilt the volunteers from 45 degrees head up to 45 degrees head down, and additionally 45 degrees laterally.

Movements of the head, sternum, and pubic symphysis (pelvis) from a fixed position were then recorded. The comfort level during the procedure was assessed using a 10 point numerical rating scale (NRS) where 1=no pain and 10=worst pain imaginable.

RESULTS: The mean body movements in the head up position (23.3 v 6.66 mm), head down (40.89 v 8.33mm), and lateral tilt (18.33 v 4.26mm) were significantly greater on the backboard than on the vacuum mattress ($p<0.01$ for all planes of movement).

Using the NRS the vacuum mattress (mean score=1.88) was significantly more comfortable than the backboard (mean score=5.22) ($p<0.01$).

CONCLUSIONS: In the measured planes the vacuum mattress provides significantly superior stability and comfort than a backboard.

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Research Links

Company / Name:	Website Address:
¹ Krell JM, et-al	Comparison from the Ferno Scoop Stretcher with the Long Backboard for Spinal Immobilization. Pre-hospital Emergency Care, 2006 Jan-Mar; 10(1); 46-51
Krell JM, et-al	http://www.ncbi.nlm.nih.gov/pubmed?Db=pubmed&Cmd=ShowDetailView&TermToSearch=16418091&ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum
A Comparison of the Spinal Board and the Vacuum Stretcher, Spinal Stability and Interface Pressure.	
Lovell ME	http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Lovell%20ME%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstractPlus
Evans JH	http://www.ncbi.nlm.nih.gov/pubmed?Db=pubmed&Cmd=Search&Term=%22Evans+JH%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstractPlus
Comparison of a Long Spinal Board and Vacuum Mattress for Spinal Immobilisation.	
Luscombe MD	http://www.ncbi.nlm.nih.gov/pubmed?Db=pubmed&Cmd=Search&Term=%22Luscombe+MD%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstractPlus
Williams JL	http://www.ncbi.nlm.nih.gov/pubmed?Db=pubmed&Cmd=Search&Term=%22Williams+JL%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstractPlus