

# Comparison of Three Different Pelvic Circumferential Compression Devices: A Biomechanical Cadaver Study

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**J Bone Joint Surg Am.** 2011;93:230-40 • doi:10.2106/JBJS.J.00084




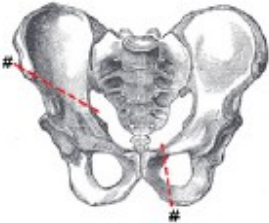
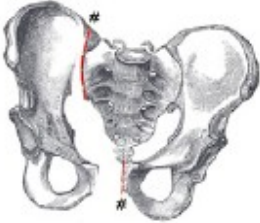
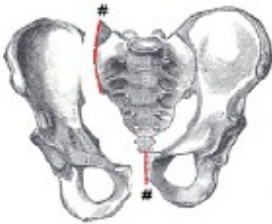
PCCD	Product details
	<p>Pelvic Binder (Pelvic Binder Inc., Dallas, TX, USA)</p> <ul style="list-style-type: none"> <li>- One size fits all, "cut-to-fit" 6-8" gap</li> <li>- Velcro-backed fastener with shoelace mechanism</li> <li>- Health care providers should be able to insert at least two fingers between the patient and the binder after maximal tensioning</li> </ul>
	<p>SAM Sling (SAM Medical Products, Newport, OR, USA)</p> <ul style="list-style-type: none"> <li>- Sized to fit, three different standard sizes</li> <li>- Fastener with an Autostop buckle (33lb) that limits circumferential compression</li> <li>- Pulled tight with two hands in opposite directions</li> <li>- Small belt, leaving more space for clinical diagnostics or entrance to the abdomen in case of laparoscopy or laparotomy</li> </ul>
	<p>T-POD (Bio Cybernetics International, La Verne, CA, USA)</p> <ul style="list-style-type: none"> <li>- One size fits all, "cut-to-fit" 6-8" gap</li> <li>- Simultaneous circumferential compression through Velcro-backed mechanical advantage pulley system with a pull-tab</li> <li>- Health care providers should be able to insert two fingers between the patient and the T-POD after maximal tensioning</li> </ul>

Fig. 1

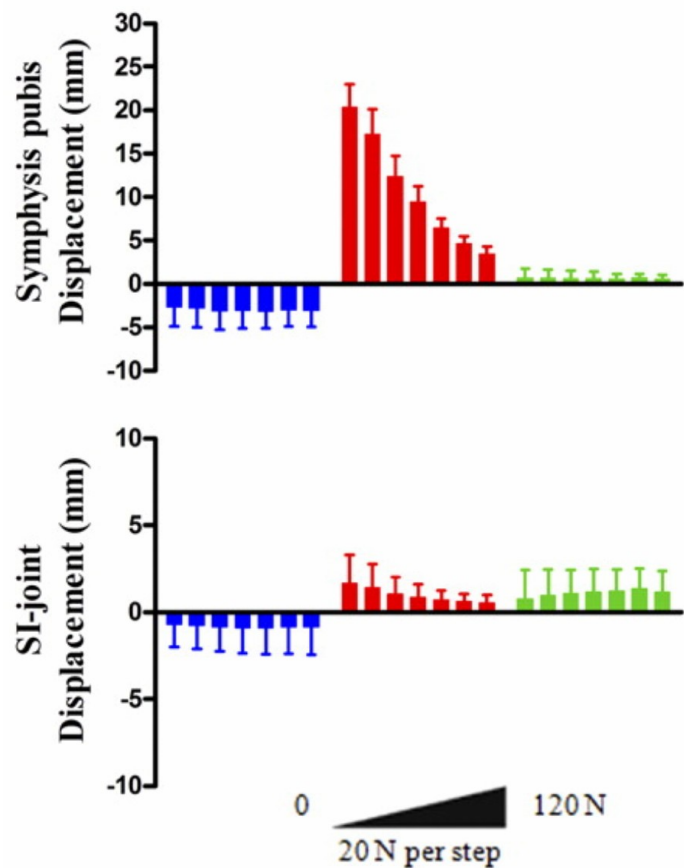
The three commercially available pelvic circumferential compression devices evaluated in this study (Pelvic Binder, SAM Sling, and T-POD) with the product details and manufacturers' guidelines for their application.

Classification	Stability	Study definition
Tile A	Stable	<p>A fracture in the os pubis was created 2 cm lateral from the symphysis pubis combined with a large fracture of the os ilium, ranging from the spina iliaca up to the tuber</p> 
Tile B1 (50 mm) (100 mm)	Partially stable	<p>A fracture in the os pubis was created through the symphysis pubis and displaced (50 or 100 mm) with a Finochietto rib spreader, causing unilateral rupture of the anterior ligaments of the SI-joint</p> 
Tile C	Unstable	<p>Complete pelvic ring instability was created through a fracture of the os pubis and a unilateral rupture of the SI-joint, including disruption of the soft tissue and rupture of the sacroiliac and sacrotuberous ligaments</p> 

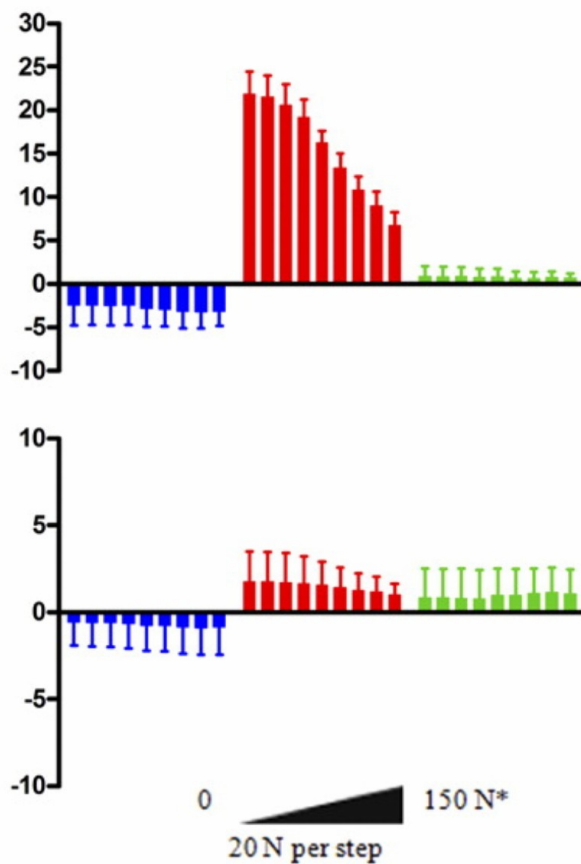
In the acute management of pelvic ring fractures, a pelvic circumferential compression device is recommended as one of the first steps for prompt and easy stabilization of hemodynamically unstable patients<sup>6,30</sup>. However, only limited scientific evidence is available to support this recommendation. For most patients in whom a pelvic fracture is suspected, current guidelines recommend the application of a pelvic circumferential compression device. The exact behavior of the fracture fragments after application and tensioning of a pelvic circumferential compression device remains unknown, so this cadaver study was performed to assess the quality of reduction by pelvic circumferential compression devices in different types of pelvic ring fractures.

### C Tile B1 (100 mm) fractures

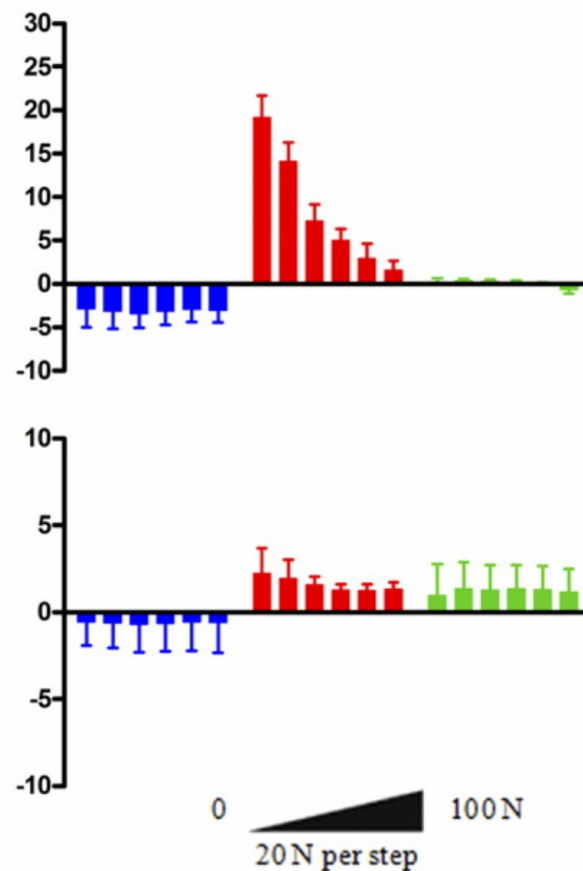
#### Pelvic Binder



#### SAM Sling



#### T-POD





**Background:** Pelvic circumferential compression devices are designed to stabilize the pelvic ring and reduce the volume of the pelvis following trauma. It is uncertain whether pelvic circumferential compression devices can be safely applied for all types of pelvic fractures because the effects of the devices on the reduction of fracture fragments are unknown. The aim of this study was to compare the effects of circumferential compression devices on the dynamic realignment and final reduction of the pelvic fractures as a measure of the quality of reduction.

**Methods:** Three circumferential compression devices were evaluated: the Pelvic Binder, the SAM Sling, and the T-POD. In sixteen cadavers, four fracture types were generated according to the Tile classification system. Infrared retroreflective markers were fixed in the different fracture fragments of each pelvis. The circumferential compression device was applied sequentially in a randomized order with gradually increasing forces applied. Fracture fragment movement was studied with use of a three-dimensional infrared video system. Dynamic realignment and final reduction of the fracture fragments during closure of the circumferential compression devices were determined. A factorial repeated-measures analysis of variance with pairwise post hoc comparisons was performed to analyze the differences in pulling force between the circumferential compression devices.

**Results:** In the partially stable and unstable (Tile type-B and C) pelvic fractures, all circumferential compression devices accomplished closure of the pelvic ring and consequently reduced the pelvic volume. No adverse fracture displacement (>5 mm) was observed in these fracture types. The required pulling force to attain complete reduction at the symphysis pubis varied substantially among the three different circumferential compression devices, with a mean (and standard error of the mean) of  $43 \pm 7$  N for the T-POD,  $60 \pm 9$  N for the Pelvic Binder, and  $112 \pm 10$  N for the SAM Sling.

**Conclusions:** The Pelvic Binder, SAM Sling, and T-POD provided sufficient reduction in partially stable and unstable (Tile type-B1 and C) pelvic fractures. No undesirable overreduction was noted. The pulling force that was needed to attain complete reduction of the fracture parts varied significantly among the three devices, with the T-POD requiring the lowest pulling force for fracture reduction.

**Clinical Relevance:** The results of this biomechanical cadaver study suggest that circumferential compression devices can provide early, noninvasive circumferential compression in partially stable and unstable pelvic fractures for advantageous realignment and reduction of these fractures without overreduction. Clinical effectiveness of circumferential compression devices in patients with pelvic ring fractures remains to be determined.

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