

# The Use of a Kickstand Modification for the Prevention of Heel Decubitus Ulcers in Trauma Patients With Lower Extremity External Fixation

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**Summary:** External fixation is frequently used to manage patients with lower extremity trauma. Excessive pressure from contact surfaces must be avoided to prevent added morbidity from heel ulcers. The purpose of this article is to present a simple solution to off-load the heel by adding a “kickstand” to the external fixator. The kickstand modification is designed to prevent breakdown of the soft tissue covering of the heel that can complicate the treatment of the initial injury and may also result in calcaneal osteomyelitis. By preventing such damage, the kickstand modification may also help to avoid radical procedures for soft tissue coverage, prolonged treatment times, and, ultimately, amputations. The kickstand device is made by adapting 2 extra rods and clamps to the primary external fixator to obtain proper clearance of the heel when the foot is resting over a surface. In cases where traditional off-loading devices are difficult to apply and can interfere with proper wound care, the kickstand might provide a useful preventive solution. From January to August 2006, we applied this technique in 10 patients with lower extremity trauma (11 fractures) and have seen no heel ulcers or other complications as per the staging system from the National Pressure Ulcer Advisory Panel.

**Key Words:** kickstand, external fixation, damage control orthopaedics, heel ulcer, trauma

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## INTRODUCTION

The heel is the second most common site for pressure ulcer development. The incidence of heel ulcers varies throughout the literature with some studies reporting between 30% and up to 67%.<sup>1–3</sup> All patients with limited mobility may be at risk for developing heel pressure ulcers.

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The devices that are discussed in this article are Food and Drug Administration approved.

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External fixators are frequently used in the treatment of lower extremity fractures, either as definitive management or as temporary fixation, although the local or systemic conditions of the patient allow for conversion to internal fixation.<sup>4,5</sup> However, certain external fixators, depending on configuration, can leave the heel vulnerable to excessive pressure when the lower extremity rests over a contact surface. The use of common off-loading devices not only may be difficult to apply when an external fixator is in place but also may interfere with proper wound care. The following technique provides a solution to prevent this problem.

Using external fixation to off-load and protect the heel when managing soft tissue reconstructive procedures has been previously described.<sup>6,7</sup> The addition of a kickstand has been found advantageous in the treatment of high-energy extremity trauma associated with complex soft-tissue wounds in a military setting.<sup>8</sup> We present our technique for applying a kickstand in a nonmilitary population.

## TECHNIQUE

The kickstand is added to an external fixator so that the heel is off-loaded when the patient is supine and resting the extremity over a contact surface.

Manufacturer recommendations and surgical guidelines should be followed to assemble and apply the main portion of the external fixator in a biplanar configuration, such as a delta frame. Different manufacturers have frame components that can easily be assembled into a kickstand (Table 1). Instrumentation trays, already in the operating room when placing the main portion of the external fixator, should have all the parts needed to build the kickstand. No additional or specialized tools are required.

To build a kickstand, 2 additional bar-to-bar clamps and 2 bars or struts are needed (Fig. 1). The bars are usually 10–15 cm in length. Alternatively, 2 pin-to-bar clamps may be used instead of the bar-to-bar clamps. The following steps are suggested to apply the kickstand.

1. Enough space should be left distally on the bars of the external fixator to facilitate application of a bar-to-bar clamp. When using a centrally threaded transfixing pin through the posterior tuberosity of the calcaneus, pin-to-bar clamps may be used to replace the bar-to-bar clamps. This decision is made on an individual basis, based on ease of application and adaptability of the clamps to the frame already in place.

**TABLE 1.** Parts Needed to Make a Kickstand and Their Associated Costs

External Fixator	Part Description	Part Number	List Price (US dollars)*
Smith & Nephew, MR Safe	Bar-to-bar clamp	7106-4002	688
	Bar-to-pin clamp	7106-4001	688
	100-mm bar	7106-2100	231
	150-mm bar	7106-2150	231
Synthes, MR Safe	Tube-to-tube clamp	390.007	656
	100-mm tube	394.80	216
	150-mm tube	394.82	216
Hoffman II MRI (Stryker)	Rod-to-rod coupling	4921-1-010	618
	Pin-to-rod coupling	4921-1-020	618
	100-mm carbon rod	5028-8-100	202
	150-mm carbon rod	5028-8-150	202

MR, magnetic resonance; MRI, magnetic resonance imaging.  
 Three magnetic resonance-compatible devices are presented.  
 \*Prices referenced for 2007 and may vary between states and specific contracts.

2. One clamp should be attached on either side of the hindfoot, close to the level of the heel, to provide maximum clearance of the heel from the contact surface.
3. A bar is attached to each of the clamps.
4. With the clamp's tightening bolts loose, an assistant holds the leg and frame and rests it over a hard flat surface. A tray lid, not just the operating table, is recommended for this purpose. This serves as a leveling device for the kickstand, which gives a better view, not only for the appropriate heel clearance but also helps to control rotation of the extremity to reduce stress on the fracture site and the soft tissues.
5. Ensure that the struts are perpendicular to the bed surface to maximize height and heel clearance.
6. Once the desired level is obtained, the clamps are tightened to create a stable construct.



**FIGURE 1.** Intraoperative placement of the kickstand. Leveling is achieved with tray lid or other hard surface.

7. A final general inspection is recommended to check for overall tightness of all bolts and clamps and for the final alignment and position of the limb.
8. Fine adjustments should be made as necessary.

### CLINICAL SERIES

From January to August 2006, the kickstand modification described in this article was applied to the external fixator in the treatment of 10 patients (11 fractures) as part of staged protocols. Injuries included fractures to the distal tibia, calcaneus, and foot. One patient with bilateral comminuted distal tibial fractures as a result of a high-speed motor vehicle accident required 3 weeks of intensive care monitoring, before transition from spanning external fixation to definitive internal fixation. While waiting for final fixation, none of the patients showed any signs of heel ulceration, according to the staging system from the National Pressure Ulcer Advisory Panel.<sup>9</sup>

Neither the stability of the external fixator nor the reduction or alignment of the fracture was adversely affected by the addition of the kickstand in any of the patients in this series. No other methods to off-load the heel were necessary while using the kickstand. No loosening was seen, and no further adjustments were needed postoperatively.

### DISCUSSION

Once patients with multiple trauma or patients with complicated lower extremity fractures are stabilized with a temporary external fixator, the lower extremity injury is often not the main priority. Attention is often focused toward other life-threatening injuries, and in this case, it is not uncommon for pressure sores to develop on unprotected heels. Examples include patients in the intensive care unit, patients with obesity, elderly patients, and multiple trauma victims, including head-injured or sedated patients with loss of protective reflexes. Excessive heel pressure might also become a problem when long transport times are required between hospitals. If adequate off-loading of the heel is not achieved, pressure changes may progress to full-thickness ulceration of the soft tissues and include bone with subsequent osteomyelitis.<sup>10,11</sup> Development of decubitus ulcers increases the morbidity in the outcome of the lower extremity injuries. The use of common off-loading devices such as foam heel lifts, gels, sheepskin, and pressure-relieving ankle-foot orthosis is difficult to apply when external fixation is in place around the ankle and interferes with proper wound care. Other methods such as air or water mattresses may be damaged by the external fixation hardware. The application of a kickstand to the frame is proposed as a clean, effective, and versatile solution to relieve pressure from the heel.

We recommend the kickstand technique when using a bar- and pin-type external fixator because not all external fixators need a kickstand. By design, circular frame external fixators, such as the Ilizarov and Taylor Spatial Frames and others where footplates or U rings are used, already provide protection and pressure relief. In addition, the kickstand we describe might be difficult to apply to a monolateral bar-type fixator, such as the Orthofix or Jet-X Central, as clamps and

bars must be adapted either to the fixator itself or to the half-pins or wires that are used.

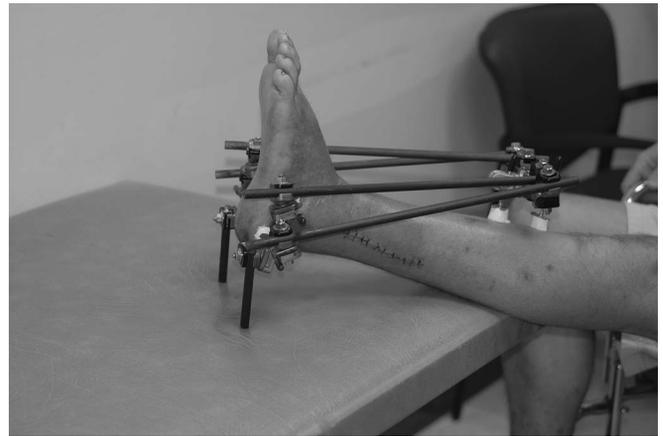
The kickstand technique is simple, and its assembly does not require a specific vendor. In fact, the surgeon might be able to construct a kickstand by using different parts from the ones described in this article if they adapt to the frame better.<sup>6–8</sup> The ultimate goal is to off-load the heel for prevention of ulcers or to provide easier access for soft tissue management. If the bars used are too long, for instance, more than 15 cm, knee hyperextension may become an issue, especially if there are associated injuries to the knee or if the fixator used does not span the knee. Furthermore, if the bars are excessively long, they may be cumbersome during patient transfers. In our patient series, using 10- or 15-cm bars, we did not encounter adverse issues with the knee. Popliteal relief was obtained by placing a pillow under the knee when needed.

Another benefit of the kickstand is that it allows for soft tissue swelling to subside as the extremity is kept in an elevated position. In our clinical series, fracture reduction and stability were not affected by the kickstand modification; therefore, it is considered safe to use. In addition, because it is simple and quick to apply, surgical time is minimally affected and intensive care management is facilitated. If time is critical or a frame is applied without a kickstand, one can easily be added later when the patient is outside the operating room. The kickstand can be applied under nonsterile conditions because it is an attachment to the main frame and not to the patient's limb. There is no need for additional skin incisions or pin placement. In the same manner, further adjustments to the kickstand can be easily made at bedside to adapt to changing conditions. The kickstand may also be removed if needed without compromising the rest of the fixation.

In most of our cases, we used 10-cm bars. In some, this resulted in minimal clearance of the heel from the contact surface when the patient placed his or her leg over a soft surface such as a mattress. If the leg was rested over a firmer surface, higher clearance was noted.

In all cases, the kickstand provided enough lift to effectively off-load the heel to prevent skin changes and ulceration without the need for adjustments. If more clearance is needed, however, consider using 15-cm bars. Appropriate bar length also depends on where the pin-to-bar or bar-to-bar clamps are attached to the frame, as discussed above in the "Technique" section.

Prevention is a key component in the management of heel ulcers. The kickstand modification presented is one method to achieve this. When applying the kickstand, cost must be considered. We have outlined costs below (Table 1), according to parts needed for compatible external fixators. In our series, the cost of the kickstand represented approximately 20% of the total cost of the external fixator used (Figs. 1, 2). A future modification of this technique might include designing a strut with a flip and lock mechanism to make the kickstand more adaptable and perhaps less expensive. In a similar fashion, a kickstand can easily be adapted to external fixators



**FIGURE 2.** Lateral view of the kickstand showing adequate clearance of the heel with a 10-cm bar.

applied to the upper extremity when there is a need to provide better limb support, elevation, wound access, and prevention of pressure ulceration while the patient is in bed.<sup>8</sup>

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