

New Tool for Applying Traction During Open Reduction and Internal Fixation of Acetabular Fractures

Fang-Chieh Lien, MD

Abstract: Open reduction and internal fixation is used to treat complex acetabular fractures. Traction on the femur is necessary to reduce the acetabulum and is accomplished by surgical assistants or with mechanical devices. To overcome the disadvantages of various traction methods, the author designed a simple, novel traction device that can be used on an ordinary orthopedic or radiolucent operating table and has advantages over manual traction and commercial traction tables. The device consists of a horizontal cross-bar supported over the patient by 2 free-standing legs and is constructed from commercially available parts.

During open reduction and internal fixation (ORIF) of an acetabular fracture, traction of the ipsilateral femur is necessary to reposition and hold the acetabulum. This is accomplished manually by surgical assistants or with the aid of mechanical devices.¹⁻³ To replace the manual traction provided by surgical assistants during a Kocher-Langenbeck exposure, we designed a simple,

novel traction device that can be used on a ordinary orthopedic or radiolucent operating table; the device has advantages over manual traction and commercial traction tables.

SURGICAL TECHNIQUE

The design of the scaffold is a cross-bar (the suspension rod) supported by 2 legs with long feet; traction hardware is clamped to the cross-bar

(Figure 1). The device is built using components from the Large External Fixator Set (Synthes, West Chester, Pennsylvania) and stainless steel tubes. The 2 feet are called ground rods and are composed of stainless steel tubes that are 11 mm in diameter and 25 to 30 cm long.

The scaffold is not attached to the operating table; rather it is stabilized by the ground rods. The 2 legs are called main arms and are composed of stainless steel tubes that are 11 mm in diameter and 40 to 65 cm long.

The 2 main arms are clamped to the ground rods at a vertical 45° angle with articulator 1 (Rod-to-Rod Clamp, part number 393.71 or 393.36; Synthes). The 2 main arms are connected to the suspension rod at horizontal 45° angles with articulator 2 (Rod-to-Rod Clamp, part number 393.71; Synthes).

During use, articulators 1 and 2 can be loosened to adjust the relative height and rotation of the ground rods and main arms. Articulator

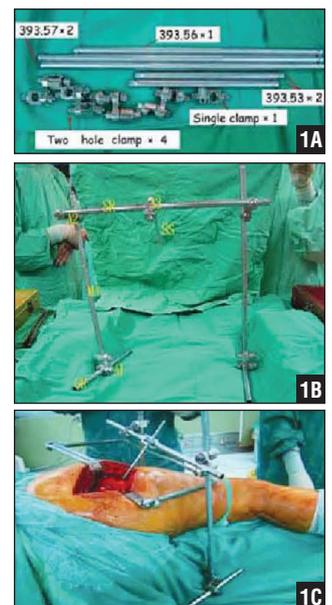


Figure 1: Photographs of the Lien Traction Scaffold. Components (A). Traction scaffold assembled (B). Traction scaffold supporting a single Schanz screw intraoperatively (C). Abbreviations: A1, articulator 1; A2, articulator 2; A3, articulator 3; GR, ground rod; MA, main arm; SR, suspension rod; SS, Schanz screw.

3 (Clamp, clip-on, self-holding, MR-safe, part number 393.97; Synthes) can be placed on the suspension rod and used to clamp 1 Schanz screw. We use stainless steel Schanz screws with a 50-mm

Dr Lien is from the Department of Orthopaedics, Chia-Yi Christian Hospital, Chia-Yi, Taiwan.

Dr Lien has no relevant financial relationships to disclose.

Correspondence should be addressed to: Fang-Chieh Lien, MD, Department of Orthopaedics, Chia-Yi Christian Hospital, No. 539 Chung Hsiao Rd, Chia-Yi, Taiwan (cych00660@gmail.com).

doi: 10.3928/01477447-20120327-03



Figure 2: Radiographs showing a Müller AO compression type B2-3 right acetabular fracture (A, B). Photograph of open reduction and internal fixation of the acetabular fracture. The patient is on a ordinary orthopedic operating table in the lateral decubitus position with the right leg exposed (C). Postoperative radiograph (D).

thread that was 5 mm in diameter and 20 cm long (part number 294.560; Synthes). More than 1 articulator can be clamped to the suspension rod for use with a Schanz screw, if required.

In practice, we first insert 1 Schanz screw approximately

60 mm into the proximal femur. The Schanz screw is positioned from the interior border of the greater trochanter to the femoral neck, along the anteversion axis of the femoral head; the location is similar to the lag screw position of a dynamic hip screw placed

for femoral intertrochanteric fracture management.

When the Schanz screw is in place, the traction on the femur is manually adjusted and the Schanz screw is clamped to the Suspension rod using articulator 3. In osteoporotic bone, 2 screws may be needed to safely achieve the desired traction. The traction on the femur can be adjusted at any time intraoperatively by loosening articulator 3 or by readjusting the position of the scaffold. After fixation is complete, the Schanz screws are removed.

RESULTS

Patient 1

A 38-year-old woman was struck by an automobile and sustained a right acetabular fracture, Müller AO compression type B2-3 (Figures 2A, 2B). Using the traction scaffold, we performed ORIF with plates using a posterior Kocher-Langenbeck exposure with greater trochanter osteotomy (Figure 2C). Operative time was 2.5 hours, with a blood loss of approximately 400 mL. The patient was discharged on postoperative day 10 day, and the postoperative functional outcome was good (Figure 2D).

Patient 2

A 22-year-old woman with major depression jumped from the third floor of a building and sustained a left acetabular fracture, Müller AO compression type C1-3 (Figure 3A), as well as an L3 burst fracture (Frankle grade C), a L2 compression fracture, a left calcaneal open type 2 fracture, and a right talonavicular dislocation.

One week after initial damage control operations, an ORIF with plates was performed for the left acetabular fracture using the posterior Kocher-Langenbeck approach with a greater trochanter osteotomy. The traction scaffold was used using 2 Schanz screws (Figure 3B). Operative time was 4 hours, with a blood loss of approximately 650 mL. Successful healing of the reduced fracture was noted at follow-up (Figure 3C).

Patient 3

A 60-year-old man was in a motor vehicle collision and sustained a left iliac wing fracture, left hip fracture-dislocation, posterior right femoral supracondylar fracture, and pubic symphysis diastasis (Figure 4A). The traction scaffold was used in 2 procedures.

On the day of admission, ORIF with a plate for left iliac wing and anterior column of acetabular fracture, the pubic symphysis diastasis, and associated operation with L-plate fixation for the femoral supracondylar fracture were performed while the patient was in the supine position; op-



Figure 3: Radiograph showing a Müller AO compression type C1-3 left acetabular fracture (A). Photograph of open reduction and internal fixation of the acetabular fracture. The patient is on a ordinary orthopedic operating table in the lateral decubitus position with the left leg exposed and 2 Schanz screws holding the femur (B). Postoperative radiograph (C).

erative time for all procedures was approximately 4 hours (Figure 4B). Approximately 1 week postoperatively, ORIF with a reconstruction plate of the acetabular fracture was performed while the patient was in the lateral decubitus position; operative time was approximately 2 hours (Figure 4C).



Figure 4: Radiograph on admission revealed a left iliac wing fracture, left hip fracture-dislocation, posterior right femoral supracondylar fracture, and pubic symphysis diastasis (A). Postoperative radiograph after open reduction and internal fixation of the femoral supracondylar fracture and L-plate fixation of the femoral supracondylar fracture were performed in the supine position (B). Postoperative radiograph after open reduction and internal fixation with a reconstruction plate of the acetabular fracture performed in the lateral decubitus position (C).

DISCUSSION

During ORIF of acetabular fractures, intraoperative traction is necessary to achieve anatomic reduction and to sublunate the femoral head from within the acetabulum, allowing the surgeon to inspect and debride the fractured acetabulum.¹⁻³ The traction scaffold described in this article is simple and flexible, avoids the use of a dedicated assistant for traction, continuously and precisely maintains traction for prolonged periods, and provides an open field for surgery and fluoroscopy.

The simplest way to achieve traction is through manual reduction (ie, flexing the patient's knee, which is necessary to prevent traction of the sciatic nerve) and pulling on the patient's thigh.¹⁻³ Alternately, hardware devices can be used, such as inserting a corkscrew or large Schanz pin (with a T-handle) through the lateral femur into the fem-

oral head or placing a bone hook in the fossa between the greater trochanter and the femoral neck.¹⁻³

The classic alternative to manual reduction is the Tasserit (Judet-type) fracture table.¹⁻³ With a fracture table, pins are placed in the distal femur and mechanical traction is applied to the flexed leg via the pins. This action is analogous to manual traction on the thigh of the flexed leg and has the same risk of damaging nerves because the traction pulls on the bone and soft tissues.¹⁻³ The benefit of the fracture table is that constant and precise traction can be maintained indefinitely, although an additional surgical assistant is still required to operate the table. Drawbacks are that the design of the traction table limits certain movements of the extremity and interferes with certain fluoroscopic views.¹⁻³

The AO Universal Large Distractor (Synthes) is in the form of a C-clamp.¹⁻³ One arm of the clamp attaches via a Schanz screw to the trochanter, while the other arm braces against the opposite sciatic buttress via a Schanz screw, hugging the pelvis. The device can then be used to pull the trochanter away from the pelvis. A surgeon can operate this device with no additional assistant and maintain constant, precise, and prolonged traction. A disadvantage is that a Schanz screw must be placed in an otherwise healthy sciatic buttress. The Universal Large Distractor can be used with an anterior or posterior approach, whereas the Lien scaffold can be used with the patient in a lateral position, which is amenable to most surgical exposures.

The device is limited if the patient has osteoporotic bones. Because a screw is placed into the femur to pro-

vide traction, sufficient anchoring may not be possible if the bone is osteoporotic. In addition, the traction scaffold has not been tested while patients are in a supine or prone position, but the device should be useable in those positions. The Lien traction scaffold provides constant mechanical traction for an indefinite time period, and its design allows it to be easily moved and repositioned intraoperatively. ■

REFERENCES

1. Giannoudis PV, Grotz MR, Papakostidis C, Dinopoulos H. Operative treatment of displaced fractures of the acetabulum. A meta-analysis. *J Bone Joint Surg Br.* 2005; 87:2-9.
2. Tile M, Helfet D, Kellam J. *Fractures of the Pelvis and the Acetabulum.* 3rd ed. New York, NY: Lippincott Williams & Wilkins; 2003.
3. Harris AM, Althausen P, Kellam JF, Bosse MJ. Simultaneous anterior and posterior approaches for complex acetabular fractures. *J Orthop Trauma.* 2008; 22:494-497.