

Overview of Traction techniques in orthopaedics

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Skin versus Skeletal Traction

The skin can only take about 5kg traction in an adult. If more than this force is required to obtain or maintain a reduction **Skeletal** traction must be used. Avoid skeletal traction in children - *growth plates* can easily be damaged by skeletal pins.

Indications for Skin Traction

- Children
- Temporary traction - only a few days eg Preoperative
- Small force required to maintain reduction



Fragile or delicate skin

In the elderly or patients with allergy to *Elastoplast* (Zinc) hypoallergic skin traction bandages are available.

Contraindications to Skin Traction

- Force required > 5kg
- Skin damage or sepsis in area

Indications Skeletal Traction



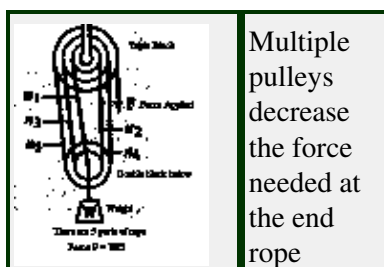
- Adults requiring > 5kg traction
- Skin damage requiring dressings
- Long term

Counter Traction

Any force needs an opposing force. If traction pulls a limb distally the patient will slide downwards towards the pulley, and the traction will not be effective. Provide an opposing force by **raising** the foot of the bed on *blocks*. By sloping the bed in the other direction the tendency to slide will be opposed. In Cervical traction the *front* end of the bed needs raising, and with Dunlop traction the *side* of the bed near the injury needs elevation.

Multiple Pulley Systems

In many situations multiple pulleys are used, so that less weights are necessary. Multiple pulleys are commonly used in pelvic traction where high forces (commonly up to 40 kg) may be needed.



Multiple pulleys decrease the force needed at the end rope

If a triple and double block were used as in the picture only 40/5 or 8 kg. would be required to generate the 40 kg. lift needed.

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Traction Techniques - Femur

[Skin traction](#)

Skin Traction - Lower Extremity

[Cervical spine traction](#)

Buck's skin traction is widely used in the lower limb for femoral fractures, lower backache, acetabular and hip fractures. Skin traction rarely reduces a fracture, but reduces pain and maintains length in fractures.

[Dunlop Traction](#)

Method

[Femur fractures](#)

The skin is prepared and shaved -it must be dry. *Friar's balsam* may be used to improve adhesion. The commercially available strapping is applied to the skin and wound on with an overlapping layer of bandage. The bandage should not extend above the level of the fracture.

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Dangers of Skin Traction

- Distal Oedema
- Vascular obstruction
- Peroneal nerve palsy
- Skin Necrosis over bony prominences



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Avoid complications resist the temptation of trying to improve adhesion by wrapping the bandages *more tightly*. If the tapes slip rather use skeletal traction if possible (not a child)

Gallows Traction

This is used in infants and children with femoral fractures.

Indications Gallows Traction

- Child must weigh **less** than 12 kg
- Femoral fractures
- Skin must be intact



Both the fractured and the well femur are placed in skin traction and the infant is suspended by these from a special frame. Vascular compromise is the biggest danger. Check the circulation twice daily. The buttocks should be just off the bed.

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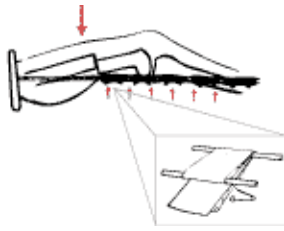
Femur Fractures in older children

Older children with femur fractures can be treated with skin traction in a *Thomas* splint. Unlike the adult the knee must be kept straight in the Thomas Splint.



The ring of the Thomas splint must allow two finger clearance on all sides- try it on the well leg for fit before applying. The skin strapping is applied and the Thomas Splint fitted. The ropes from the strapping are tied to the end of the Thomas splint. The outer one is passed *under* the Thomas splint bar and the inner one *Over*. This rotates the foot internally. The limb is rested on three flannel strips secured by safety pins. The *Master* sling is the flannel strip directly distal to the fracture.

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Slings of flannel 150mm wide are positioned down the length of the Thomas splint. The Master sling should be just distal to the fracture, allowing the proximal fragment to reduce under gravity.

These slings can be adjusted so that the fracture ends align in the vertical plane. The longitudinal traction needs adjustment **every day** in the first week. The knot at the end of the Thomas splint is loosened and the slack taken up. The quality of reduction is confirmed by regular X rays.



Inner Under
Outer Over
for
counter-torque

The Thomas splint is suspended from a *Balkan* Frame. This is a frame attached to the bed. To allow the patient to move about in the bed eg to use a bed pan. The limb with the Thomas splint is suspended from the top of the Thomas Splint by means of a counter weight. The longitudinal traction exerts pressure on the groin and a further weight is placed over a pulley on the balkan frame. It is in line with the long axis of the limb at the foot of the bed. This counter acts the reactive force on the groin generated by the skin traction.

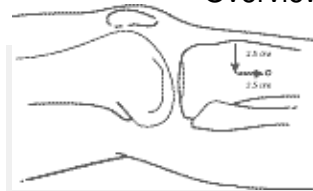
Overgrowth Slight overlapping (up to 2 cm) of the bones is acceptable, as the fracture stimulates *overgrowth* in the local growth plates. End-on-end reduction, as with plating and other internal fixations, sometimes results in the injured limb growing more than the uninjured. Most of the overgrowth takes place in the first year after fracture.

Femur Fractures in Adults

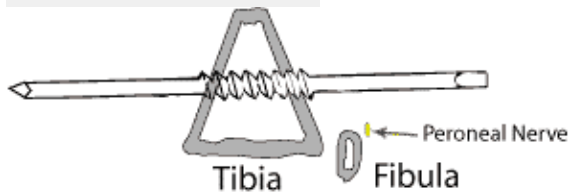
This requires a skeletal pin.

At Tygerberg hospital the Denham pin is commonly used. This has a threaded middle portion that keeps it in the tibia. For femoral fractures the Denham Pin through the proximal tibia. Always insert from lateral to medial in the proximal tibia, as the peroneal nerve needs to be missed and the site of exit is unpredictable. On some occasions a distal femoral site, or even the *calcaneus* may be used.

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Site for prox. tibial **Denham** pin
2.5 cm inferior and distal to tibial
tubercle



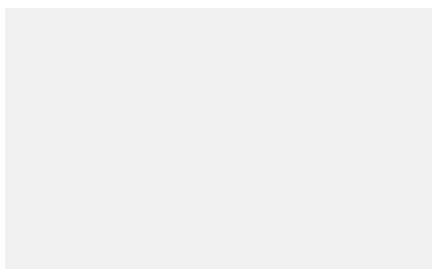
Thomas Traction -Adult

[Click to see associated larger image](#)

A Thomas splint, (check it fits, by trying on the well leg) is applied. Three flannel slings are secured by safety pins under the thigh. The "Master spint" is the one under the fracture. The correct tension on this sling will align the fracture in the lateral plane. The knee can be flexed by using a Pearson flexion splint attached to the Thomas splint at the knee. The desired knee flexion can be maintained by a rope at its end leading from the Thomas splint to the Pearson attachment. Ropes from the Denham pin can either be tied distally to the Thomas splint (static traction) or they can be led over a pulley on the end of the *Balkan* frame (dynamic Traction) In either case start with 7 kg (or 10% body weight) in the long axis of the femur. This opposes the pull of the thigh muscles. As with the child, the traction is made balanced by a system of pulleys on the horizontal limb of the *Balkan* frame to allow the patient to move his limb. A "monkey chain" hung above the arms also allows the patient to transfer himself onto a bedpan. as he moves in the bed.

Alignment of Thomas Splint

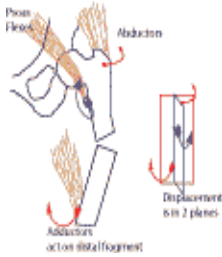
The Thomas splint must be aligned by pointing the *Balkan* frame in the direction of the proximal fragment.



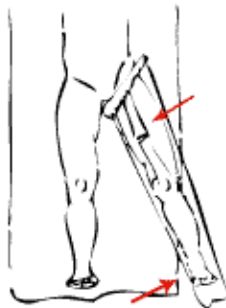
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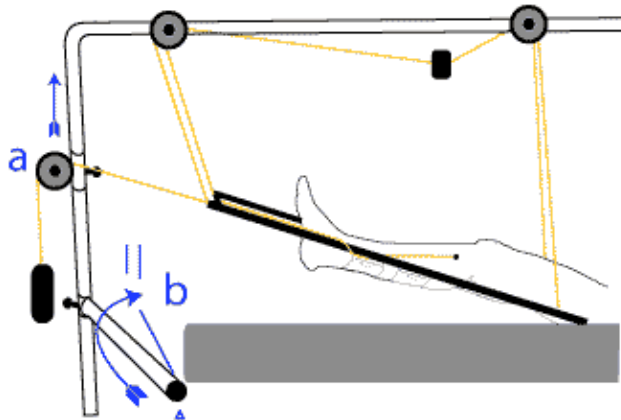
Displacement of a femur fracture



Muscles causing the displacement



How to align the Thomas Splint. Also raise foot-end to provide flexion



Balkan Frame Adjustment: For flexion, raise pulley (a). For abduction, swing foot-end of balkan wide of bed (b)

Displacement - Proximal femur fracture

- Prox. Femur - Flexion
- Prox. Femur - Abduction
- Align frame - Flexion & Abduction

Mid-shaft fractures remain relatively undisplaced as the proximal and distal muscles balance.

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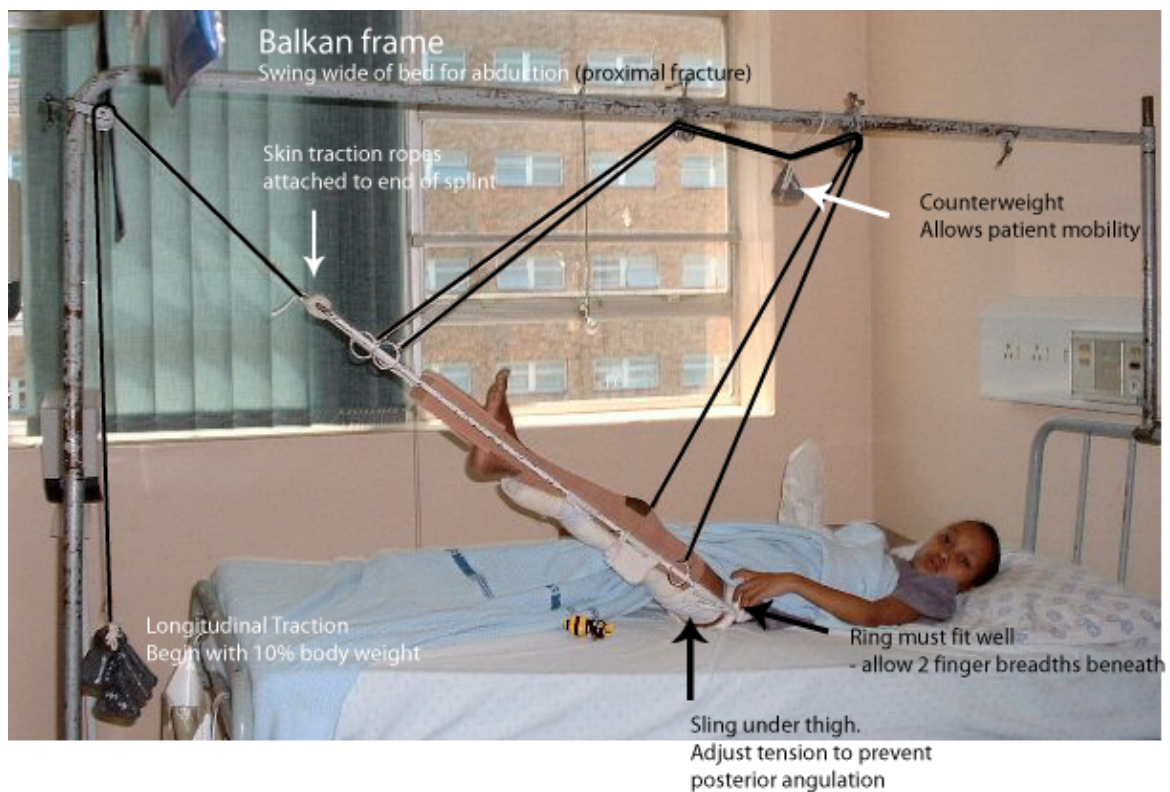
Distal femur fracture displacement

- Posterior angulation - pull of gastrocnemius
- Solution - flex the knee as far as possible

Bed Blocks

Bed Blocks must be placed under the foot end of the bed with all the above types of traction. **Raising** the foot of the bed a few centimeters provides a counter force to prevent the patient being pulled distally down the bed by the longitudinal traction.

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Details of Thomas traction for conservative treatment of a femur fracture in a child

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Traction Techniques - Cervical Spine

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Halter Traction

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Halter traction is used for short term cervical traction. Uses include minor neck injuries without obvious fractures eg Whiplash injury, neck muscle spasm, conservative treatment of cervical disk lesions.

[Dunlop Traction](#)

Children with cervical fractures can also be treated without skeletal pins as their skull is too fragile to withstand pins.

[Femur fractures](#)

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Problems with Halter Traction

- Uncomfortable
- Temporomandibular pain
- Contraindicated in mandible fractures
- Difficult to control flexion - extension

Flexion Extension cervical X-rays

If a patient has normal cervical X-rays, but has neck muscle spasm *Flexion Extension* views may be needed to exclude serious instability of the cervical spine. Halter traction is a good way to relieve the spasm before these X Rays can be done. The patient is admitted and placed in Halter traction until the neck is free of muscular spasm. Under direct supervision of the attending doctor the flexion extension views are taken in the X ray department. The patient must have no pain when the neck is flexed and extended. If neurological symptoms such as parasthesia develop the X rays are abandoned.

Skull Traction

In more serious cervical injuries skull tongs such as Cones calipers are indicated. Indications include the conservative treatment of cervical fractures and dislocations.

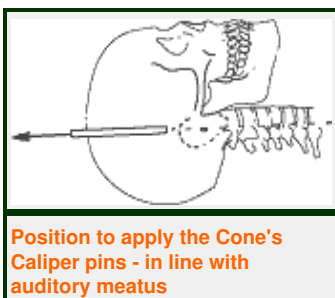


Application of Cones Calipers

- Shave the hair above the ear region
- Local anaesthetic

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- Avoid masseter
- Avoid Temporal artery
- Small incision above ear in line with auditory meatus
- Screw in pin until it just perforates outer table skull
- Tie on rope
- Attach weights



Direction and Weights

- Force - 2.5 kg for head and 1/2 kg for each vertebra*
- Direction Neutral In line with Auditory meatus
- Flexion needed - raise pulley
- Extension needed - use double mattress ending @ shoulders

*(Each uninvolved vertebra cephalad)

Complications of Cervical Traction

- Bleeding - temporal artery
- Pressure sore on skull - avoid downwards vector to rope
- Sepsis - from skin to subdural abscess
- Worsening neurological status
- Squint from 6th cranial nerve fallout

Contraindications Skull Tongs

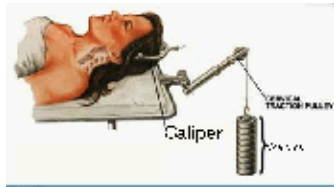
- Children
- Local sepsis
- Skull fracture

The double mattress method is an effective way to extend the neck. Never place the head pulley too low as a pressure sore can result on the occiput, especially in the unconscious or neurologically compromised patient.

At Tygerberg Hospital the Cone's calipers are commonly used. The Crutchfield tongs are another caliper that fit higher on the skull vault and allow easier turning of the paralysed patient.

Reduction of Facet dislocations

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Skeletal traction to the skull can be used to reduce cervical facet dislocations. Weights are serially added while the neck is positioned in flexion. After each 2.5kg weight is added a lateral X ray is taken to determine reduction. The attending doctor checks for neurological signs. If neurology deteriorates the weights are removed. Up to 20 kg. traction may be used in this way for a few hours only. After reduction the neck is placed in extension and the lighter maintenance weights are used.

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Traction Techniques - Other

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Dunlop Traction

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The main use of Dunlop's traction is in the maintenance of reduction in supracondylar fractures of the humerus in children.

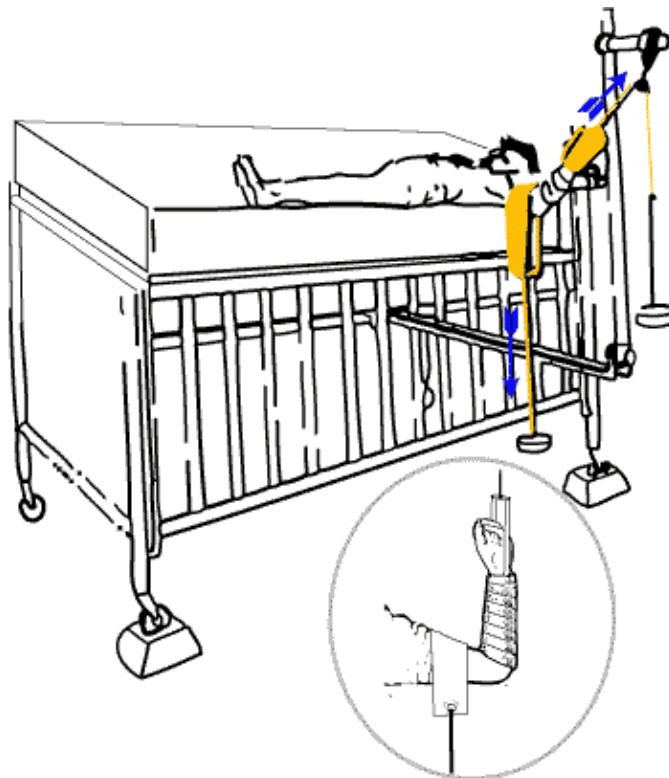
[Cervical Traction](#)

Dunlop Traction

- Supracondylar fractures in children
- Allows swollen elbow to settle
- Contraindicated in open fractures and skin defects

[Femur fractures](#)

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Skin traction is placed on the forearm and A special frame used on the side of the bed.

Traction is placed along the axis of the forearm as well as at right angles to the humerus by means of a broad sling placed around the upper arm. Bed blocks are required on the lateral side (fracture side up) of the bed.



If a supracondylar fracture cannot be reduced to over 90 degrees elbow flexion this method of traction is an alternative to invasive methods such as a percutaneous K-wires. It allows swelling to subside. Do not rely on this method to reduce a supracondylar fracture, a manipulation will still be required!

Pelvic traction for Backache

In sciatica and other backaches relief from pain can be obtained by means of pelvic traction. Traction is applied to a pelvic harness with weights over the end of the bed.

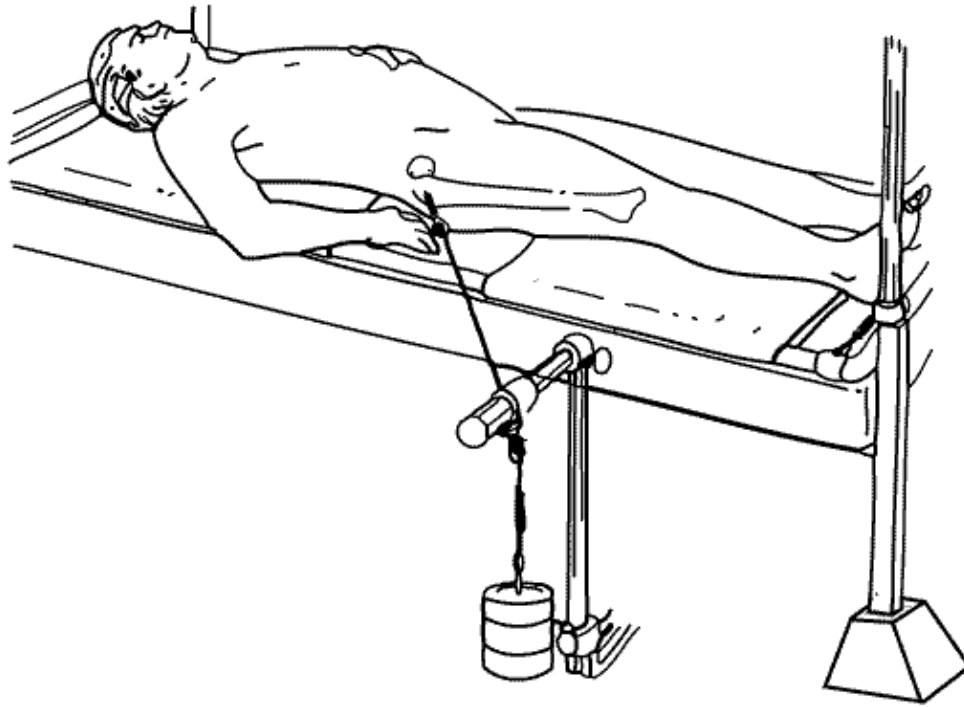


An alternative in *Sciatica* is the 90-90 position. By means of cushions under the knees, the hips are flexed near 90 degrees, as well as the knees. This shortens the sciatic nerve and relieves pain.

Acetabular Traction

In conservative treatment of acetabular fractures longitudinal traction in the long axis of the limb is often used. In addition the head of the femur can be disimpacted from the acetabulum (*central fracture dislocations*) by means of manipulation under anaesthesia. The reduction is maintained by means of lateral traction from pins placed in intertrochanteric region.

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