Prosthetics II

UOMU0103051

Lab. 2
Transfemoral amputation
(above-knee amputation)

Al-Mustaqbal University College of Engineering

Department of prosthetics and orthotics engineering

Third Stage

By:

Eng. Aya Talib

Measurement of Transfemoral Amputation

You will need the following materials:

1. 2 elastic straps-25 mm (1 inch) wide, 1m (39 inches) and 2m (78 inches) in length
2. Ruler, Vernier (caliper)
3. Tape measure.
4. Indelible pencil
5. Reduction table

The procedure of taking measurements

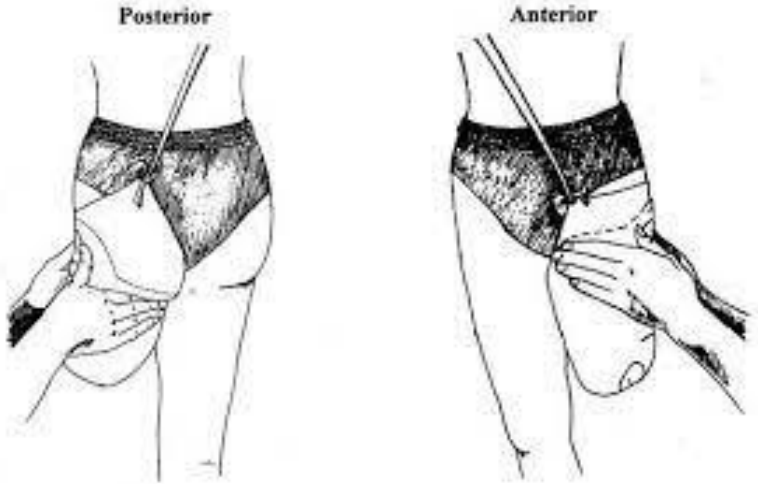
1. By the tape measure, the length from:
- ❖ The ischial tuberosity to the end of the stump.
- ❖ The ischial tuberosity to the end of the bone (femur).

2. Mark the medial side of the stump 5 cm below the perineum.

3. Measure the stump circumferences and record on the chart.

Take the first circumference measurement at the ischial site level, placing the tape around the stump.

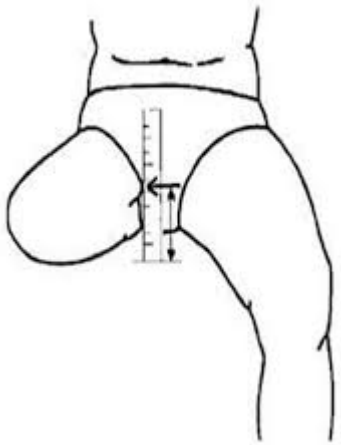
Take the second circumference measurement at the 5 cm level marked on the stump in step 2, and continue at 5 cm intervals.



Note/DO NOT apply tension on the tape measure.

4. Measure the Medio-lateral diameter of the residual limb with a caliper,
measure the inclined distance from the greater trochanter to the tendon of
The adductor longus muscle at its point of origin.

5. Measure the anterior-posterior diameter of the stump with the amputee seated in a hard chair, and measure the vertical distance from the chair surface to the tendon of the adductor longus.
In most cases, the measurement can be made easily if the amputee sits with the stump somewhat abducted and then adducts it against resistance to make the tendon prominent.



Measurement of the sound leg

Note/ All measurements should be taken with no shoes

- With the patient standing, measure the overall length, from the ischial tuberosity to the floor.

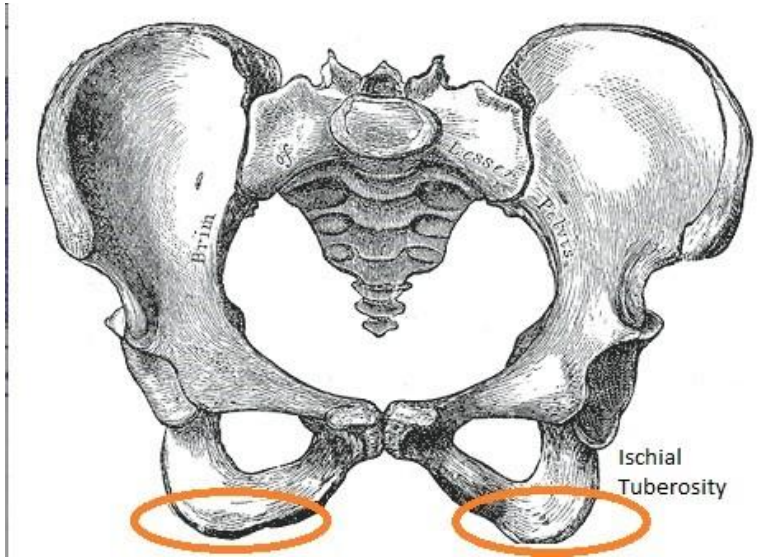
Ensure the patient is standing straight, with their knees bent, and not wearing any shoes.

- Ask the patient to sit, and measure:

-The length from MTP to the ground.

-The length of the foot.

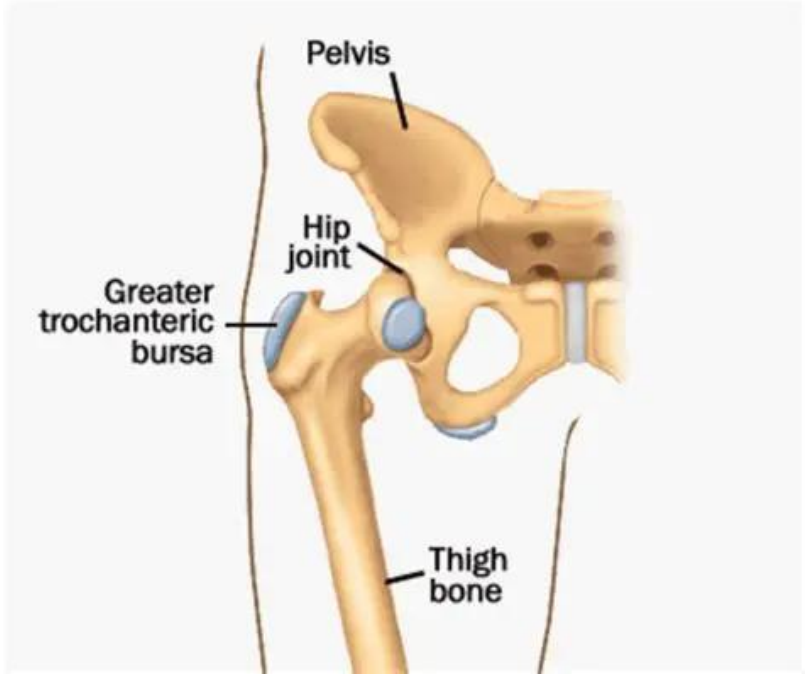
- In some cases, measure the circumference of the thigh and calf for cosmetic.



Suspension measurement

Note/This measurement is taken when using a Silesian belt.

It is taken from the greater trochanter on the amputated side, posteriorly to the patient's midline



Types of suspentions

- Suspension belt with stump socks
- Direct Skin Suction
- Silicone suspension liner with or without pin (Vacuum technology)
- Lanyard suspension Otto Bock KISS

Suspension belt with stump socks

Direct Skin suction

Silicone suspension liner with or without pin (Vacuum technology)

Lanyard suspension Otto Bock KISS

Casting
negative plaster cast.

There are two ways of casting the first one is using the hand and the second is using
the brim

In hand casting also there is more ways to take cast and now we will teach you one
of them.
Note: ask the patient to keep his leg muscle relaxed.

First step:

Cover the residual limb with a Stockinet closed over the end. The stockinet should fit closely over the end of the residual limb and extend above the level of the trim line.

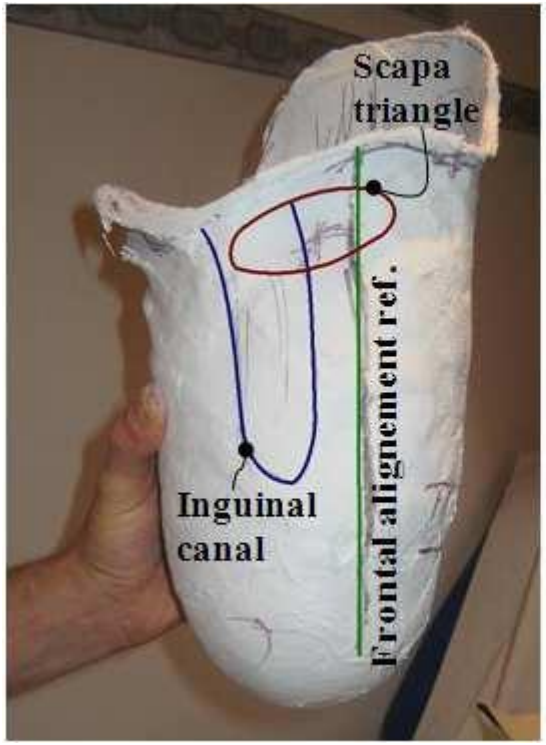
The stockinet is held in position by two lengths of elastic strap and four Yates clamps. It should not be pulled upwards too tightly, since this would distort the stump shape.

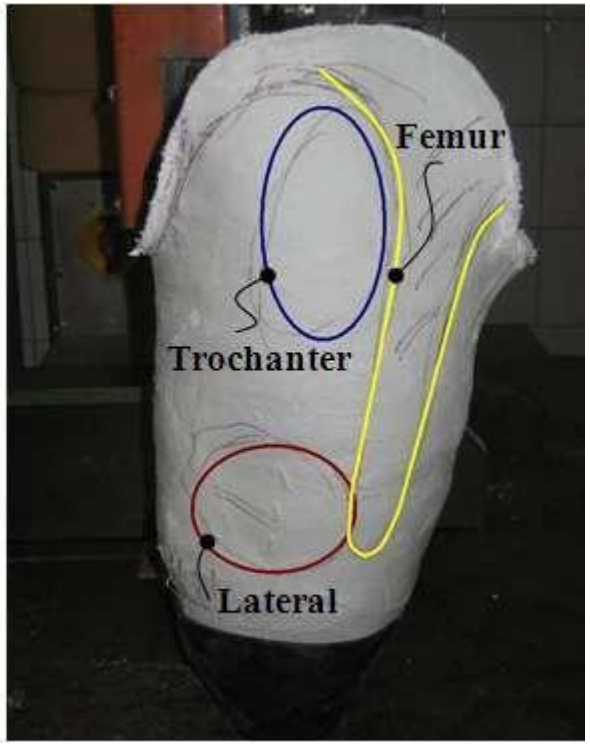
Second step:

Make a (3-5) layer slab with enough length to cover the area from the trochanter moves anteriorly, passes beside the perineum, and moves posteriorly to the ischial tuberosity and to the trochanter again.

Make another slab with the same thickness as the length from the trochanter to cover the end of the stump.

Third step:
Wet these slabs and apply them to the stump.
Fourth step:
Apply 15 cm bandages on the stump and cover the end of the stump.
Fifth step:
In some cases, you will need to cover the pelvic area with one layer of bandage to suspend your mold.
Sixth step:
Now it is time to position your hand on the mold. Put your thumb on the anterior part and move your hand to the medial part of the stump to the ischial, the
The other hand is positioned from the ischial to the trochanter (your thumb is on the trochanter).





=Bilateral transfemoral casting

3 Procedure

First, the plaster negative is poured and removed from the mould. The plaster positive is measured and reduced to the specified standard sizes. Next, the lowest point of the socket brim is modelled. Finally, the area of the residual limb end is modelled.

3.1 Preparing the Plaster Positive

Place the vacuum pipe in the plaster negative and fill in around the vacuum pipe with plaster. Let the plaster positive cure. In order to transfer the line of progression and plumb lines to the plaster positive, markings are made with an awl through the plaster negative into the plaster positive. Remove the plaster negative from the plaster positive. Trace the line of progression and plumb lines along the marks on the plaster positive. Measure the circumference of the plaster positive and enter the results in the measurement form.

3.2 Volume Reduction of the Plaster Positive

INFORMATION

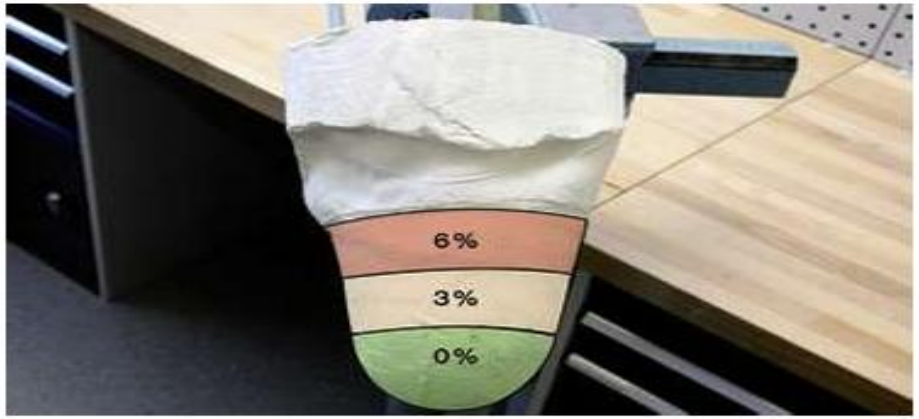
The specified reductions are general indications.

Based on individual factors for the patient (underlying illness, overall situation, etc.), the required measurements may differ.

Subtract the reductions from the patient's measurements.

INFORMATION

Make sure that the residual limb shape is maintained. Only reduce the circumference in the anterior and posterior areas.



Calculate the final measurements using the patient's circumferential measurements and the reduction factors.

From the upper circumference line, divide and reduce the plaster positive in three sections:

- Upper third: **6%**
- Middle third: **3%**
- Lower third: **0%**

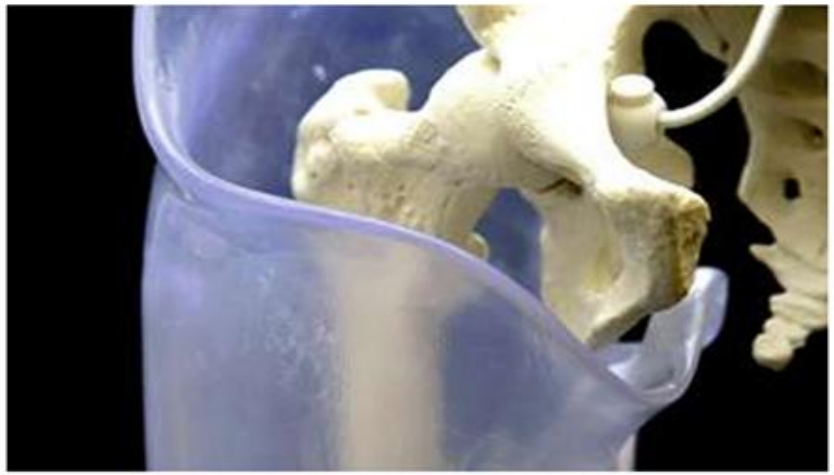
3.3 Modelling the Lowest Point of the Socket Brim

Adjust the **m - l measurement** with a reduction on the lateral side.

Only smooth the medial containment wall on the medial side.

Shape the medial containment wall in the area of the gluteus minimus by **15-20 °** into the direction of the median plane.

The level of the socket edge and containment wall is approx. **8-12 cm** above the trochanter major.



Adjust the contour of the medial socket edge, taking the following points into account.

To prevent the ischial tuberosity from slipping out of the socket:

- Position of socket edge of medial containment wall: **3 cm** proximal to lower edge of ischial tuberosity

So that the pubic bone (ramus ossis pubis) can be released from the socket without contact:

- Position socket edge in front of the medial containment wall anteriorly: **1 cm** distally from lower edge of ischial tuberosity.

Adjust the contour of the medial socket edge, taking the following points into account.

To prevent the ischial tuberosity from slipping out of the socket:

- Position of socket edge of medial containment wall: **3 cm** proximal to lower edge of ischial tuberosity

So that the pubic bone (ramus ossis pubis) can be released from the socket without contact:

- Position socket edge in front of the medial containment wall anteriorly: **1 cm** distally from lower edge of ischial tuberosity.

The images show an impression of a hand in the plaster positive and the trim line.

Reduce planar surface of the plaster positive in the anterior area.

The socket edge lies **3-5 cm** above the trochanter major and varies according to the residual limb length. The shorter the residual limb is, the higher the anterior socket edge must be.

In the posterior area create support surfaces to obtain the reduced measurements.

The posterior trim line lies approx. **2 cm** below the trochanter major.

Leave the gluteus muscles free.

If necessary, fix the socket edge by applying plaster.

3.4 Modelling the Control Area

Finish modelling the femur cuff in the control area.

INFORMATION: The femur cuff improves control of the prosthesis.

Shape the control depression of the femur cuff, particularly posterior to the trochanter major.

Reinforce the femoral support for additional relief at the end of the femur in the medial residual limb area.

3.5 Modelling of the Residual Limb End Area

Leave the impression of the end of the residual limb area on the plaster negative as is.

Manipulate all sides of the plaster positive:

- Smooth the plaster positive
- Mark the line of progression and plumb lines

Place the valve distally, and medially along the adductor tendon.

INFORMATION: If the valve is easier to handle at another position due to other limitations, functionality is more important than cosmetics.

Create a flat surface for the valve dummy at the selected position.

Lamination of the Transfemoral Cast

1.Prepare the Positive Model

1. Smooth, dry, and seal the plaster model with shellac or PVA.
2. Mount securely on a lamination stand.

2.Apply PVA Bag

Pull a PVA bag over the model to prevent resin absorption and air bubbles.

3.Lay Reinforcement Layers

1. Apply layers of nylon, Perlon, and carbon/fiberglass as required.
2. Add reinforcement at the ischial seat, distal end, and brim.

4.Add Outer PVA Bag

Cover with another PVA bag, seal ends, and attach a vacuum line.

5.Resin Application

1. Mix resin with hardener and pour into the funnel.
2. Apply vacuum to draw resin through all layers evenly.

6.Curing

Let the socket cure under vacuum (45–60 min at room temp or 20–30 min with heat).

7.Finishing

1. Remove the outer bag, trim excess, and separate the socket from the model.
2. Smooth and polish edges.

8.Final Check

Inspect for bubbles, weak spots, and correct shape.


carbon fiber
perlon
PVA
hardner

Parts of an Above-Knee (AK) Prosthesis

1.Socket – fits the residual limb and supports body weight.
2.Suspension – holds the prosthesis in place (suction, belt, liner).
3.Knee Joint – allows bending and control.
4.Pylon (Shank) – connects the knee to the foot, provides structure.
5.Foot – provides balance and walking function.
6.Cosmetic Cover – for natural appearance (optional).


Thank you
for listening