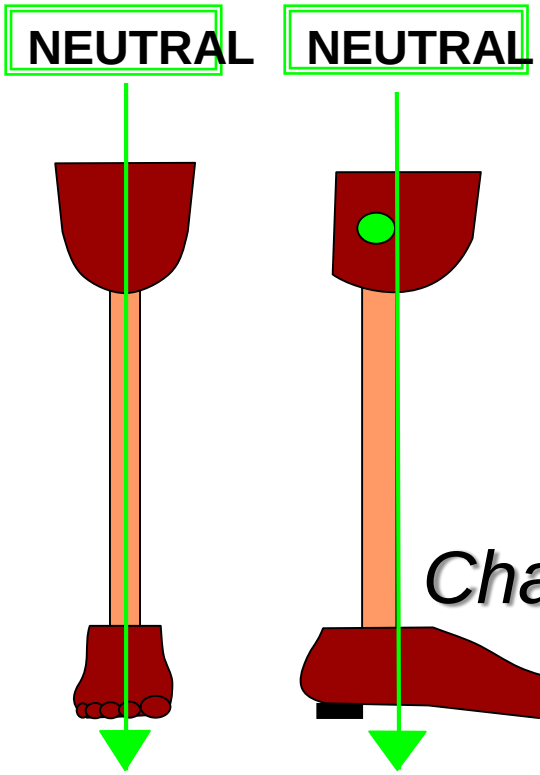
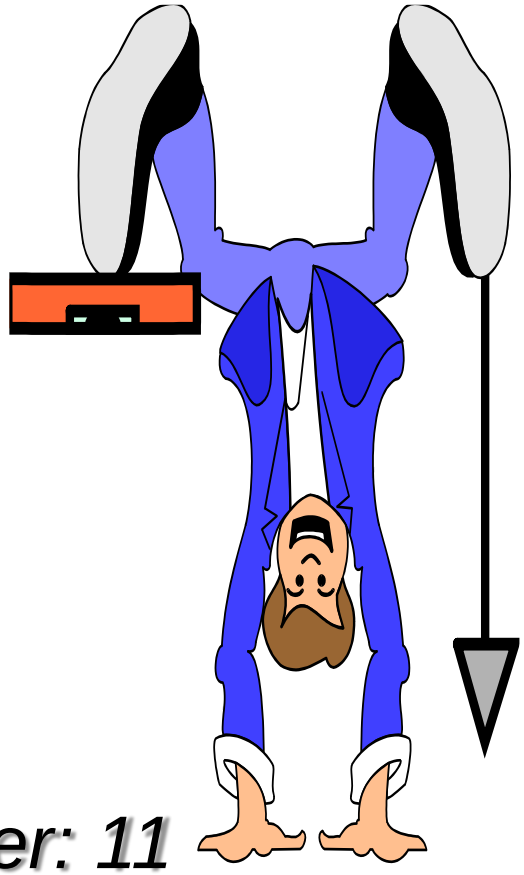
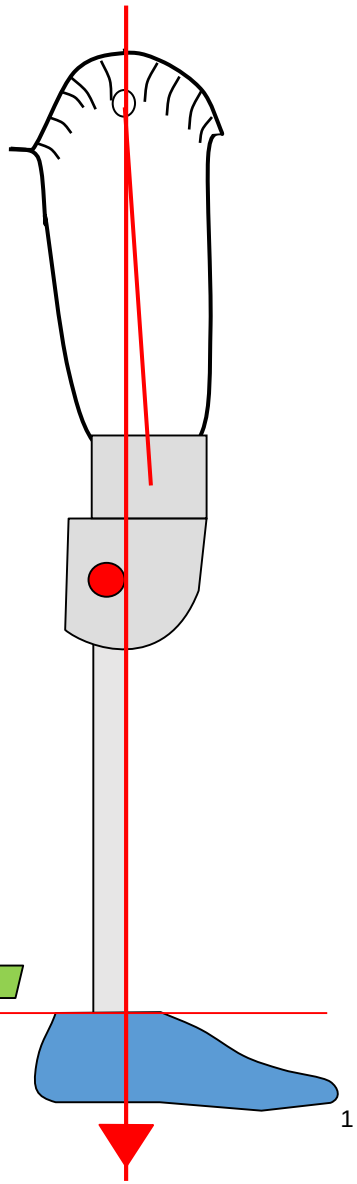
Transfemoral Prosthetic Course







Chapter: 11

ALIGNMENT

Objectives

- By the end of this lecture, students will be able to:
  - Explain differences between bench alignment, static alignment, dynamic alignment
  - Set up the bench alignment
  - Know what to check during static and dynamic alignment
  - Know how to correct alignment

Introduction

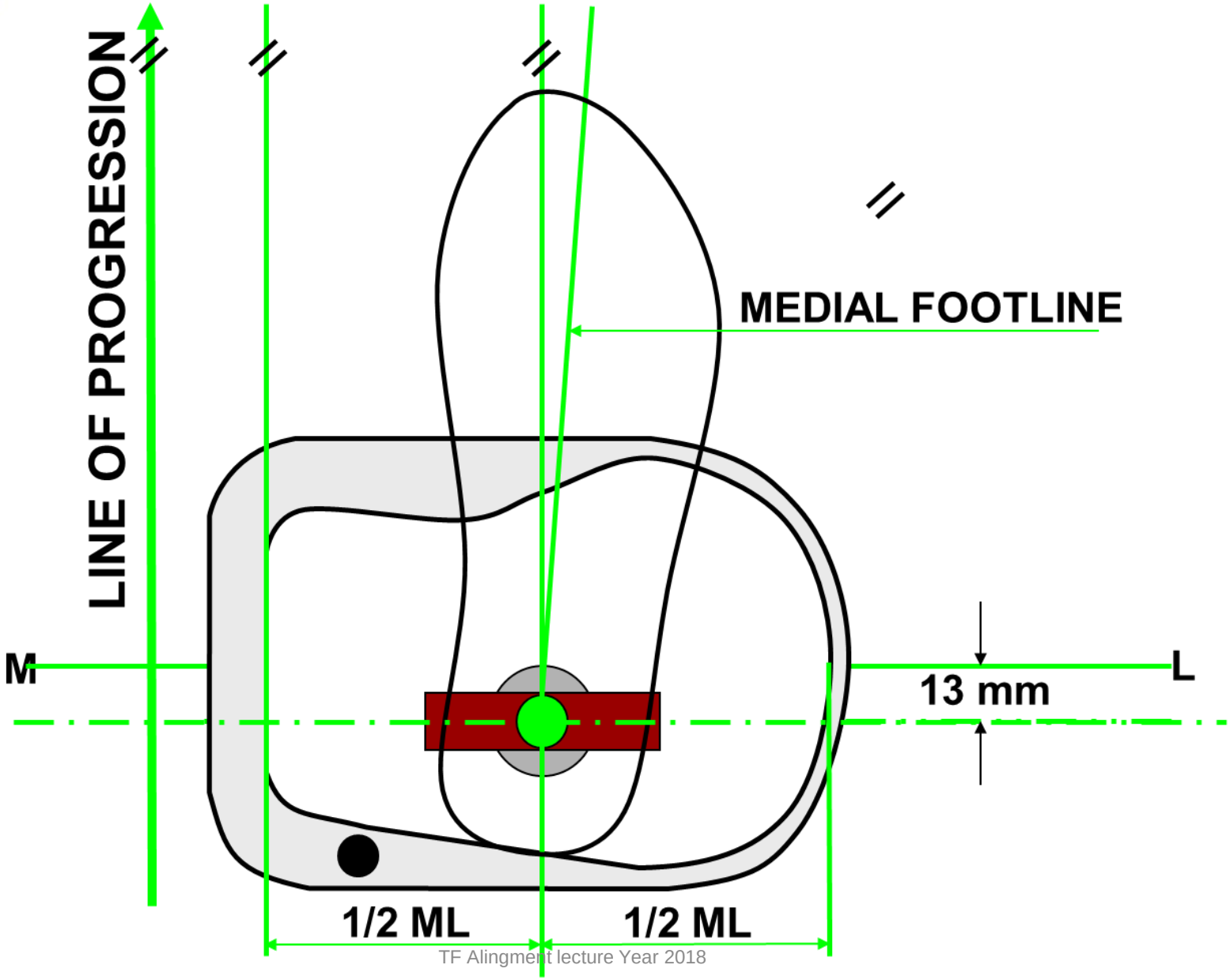
Alignment in P&O field are divided into 3 main situations

1. Bench Alignment – initial alignment before fitting
2. Static Alignment – Alignment when patient is in stance
3. Dynamic Alignment – Alignment when patient is walking

1. Bench Alignment

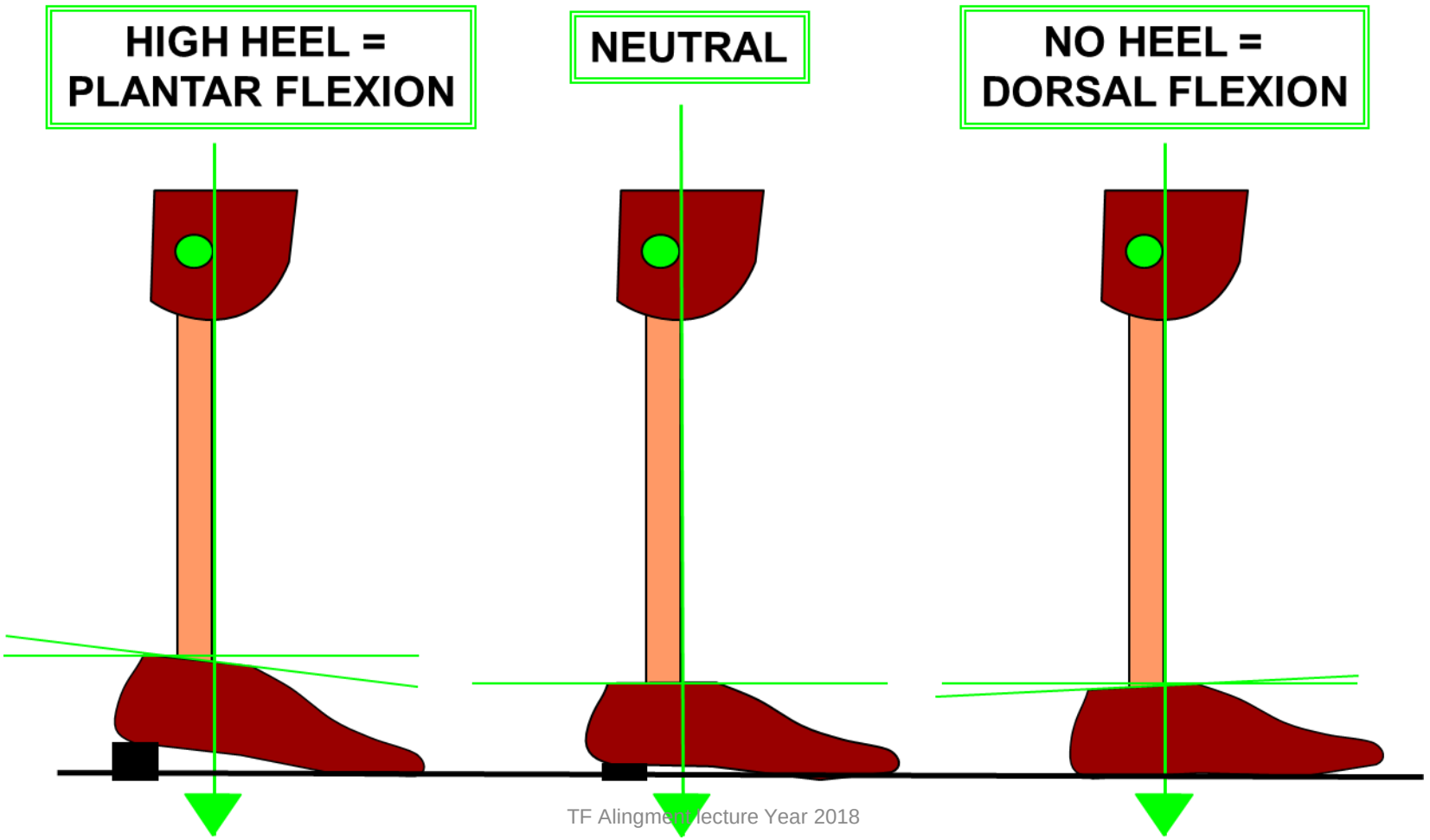
Bench alignment: refer to the process of attaching the Foot, Shank, Socket as close as to optimal alignment and according to Stump length, muscle strength, and components will be affect.

TF INITIAL ALIGNMENT: TRANSVERSAL VIEW

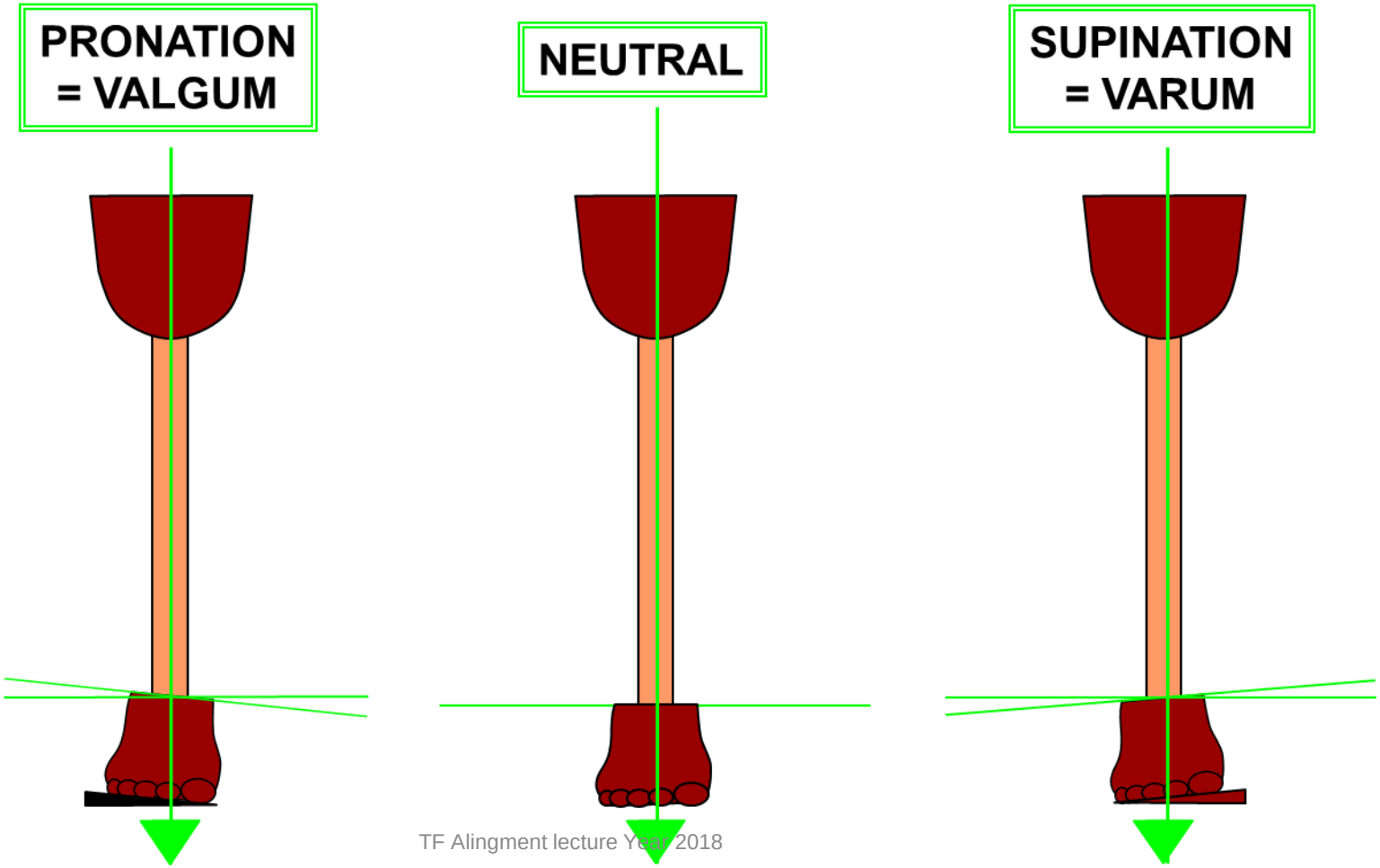


BENCH ALIGNMENT TF: SIDE VIEW

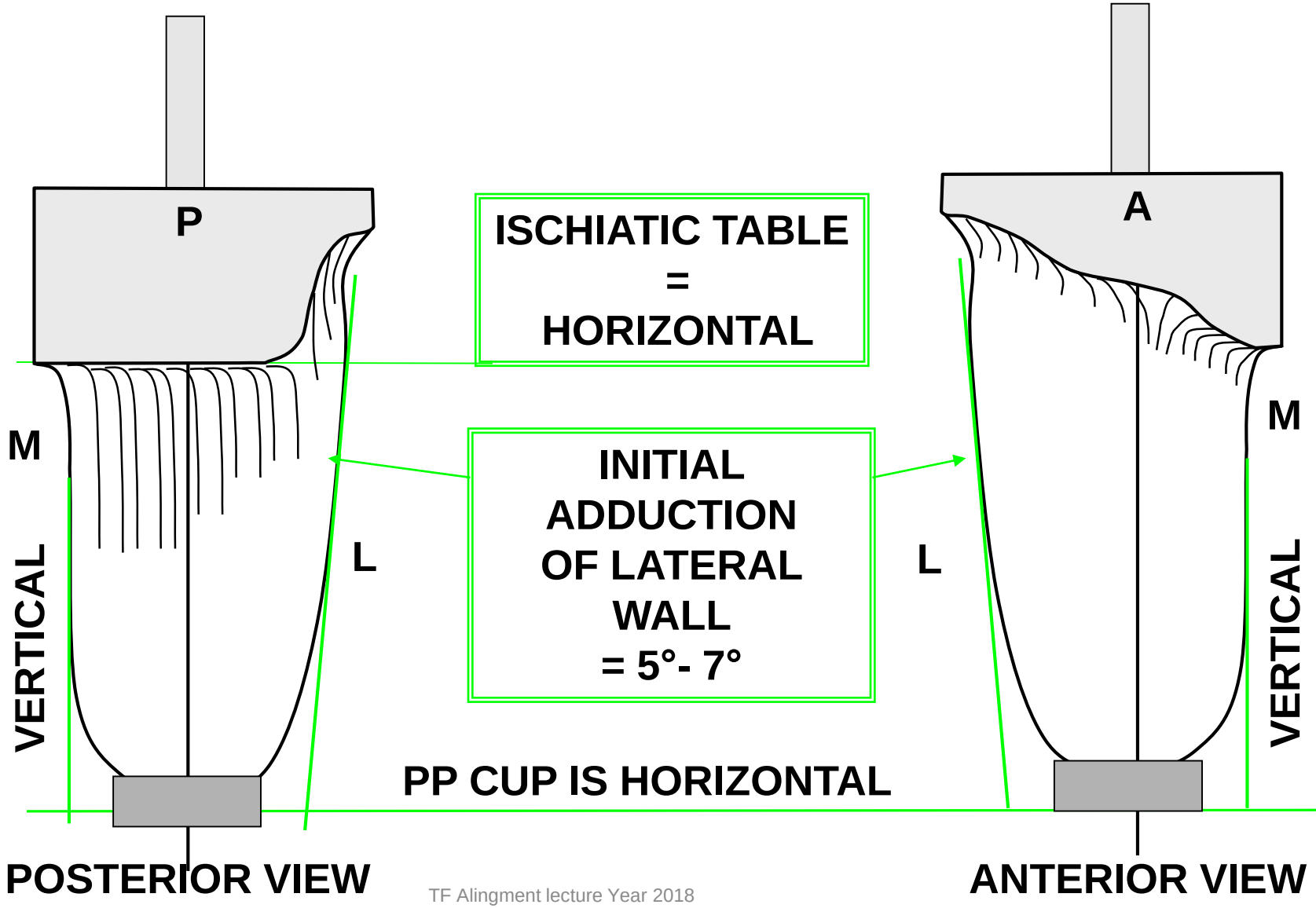
VERTICALITY OF THE TUBE ACCORDING TO THE HEEL HEIGHT

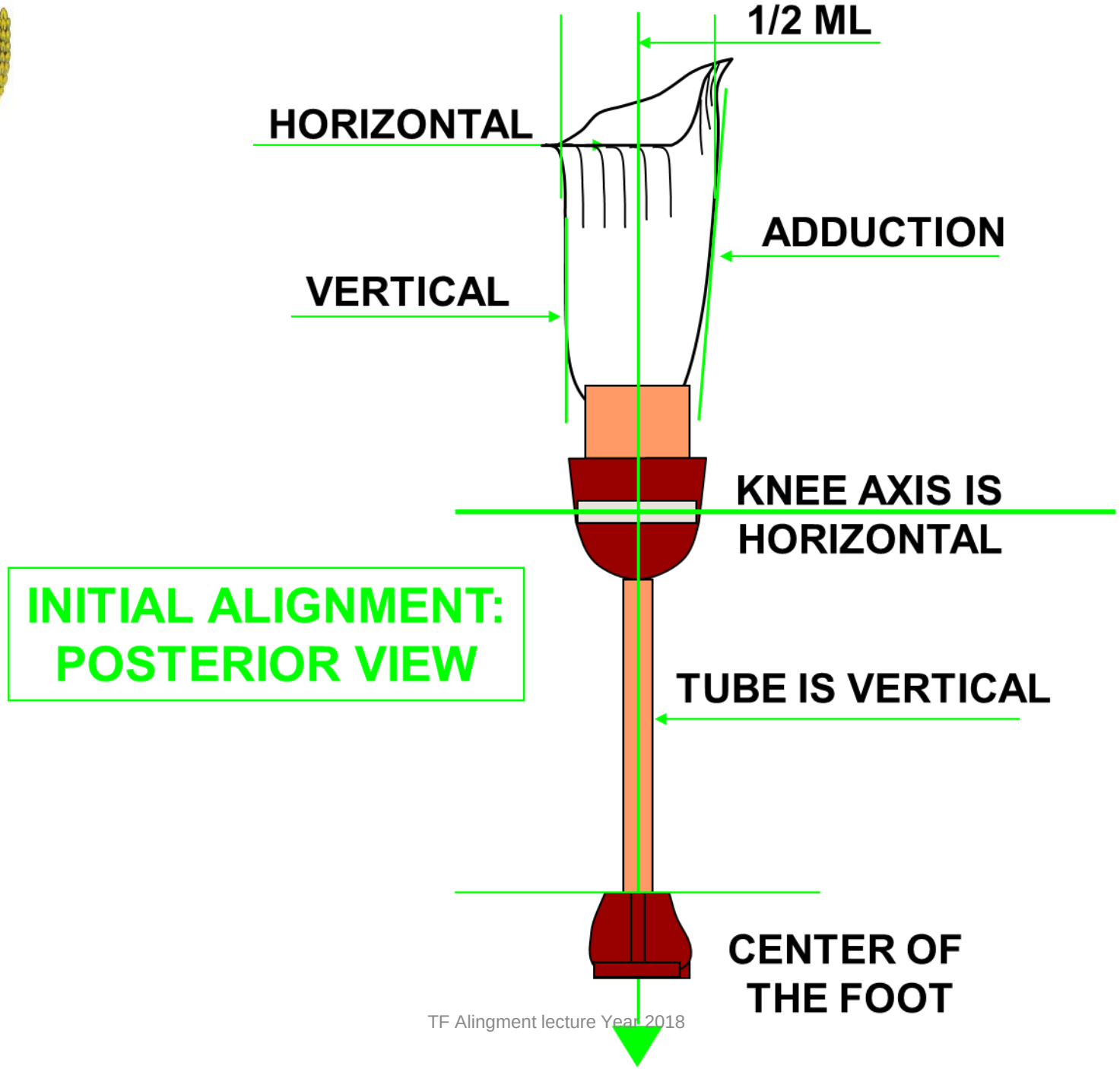


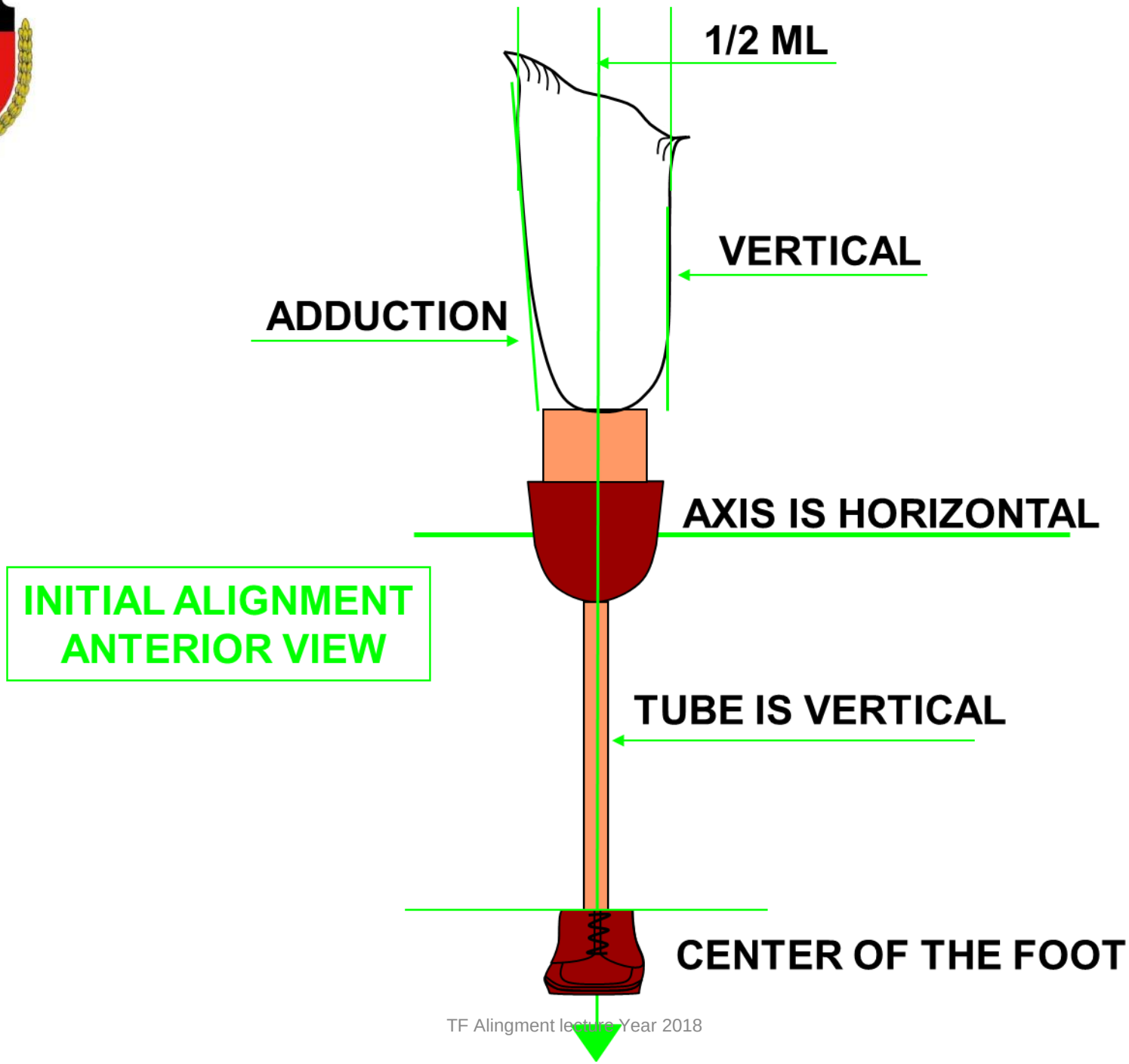
BENCH ALIGNMENT TF: FRONT VIEW



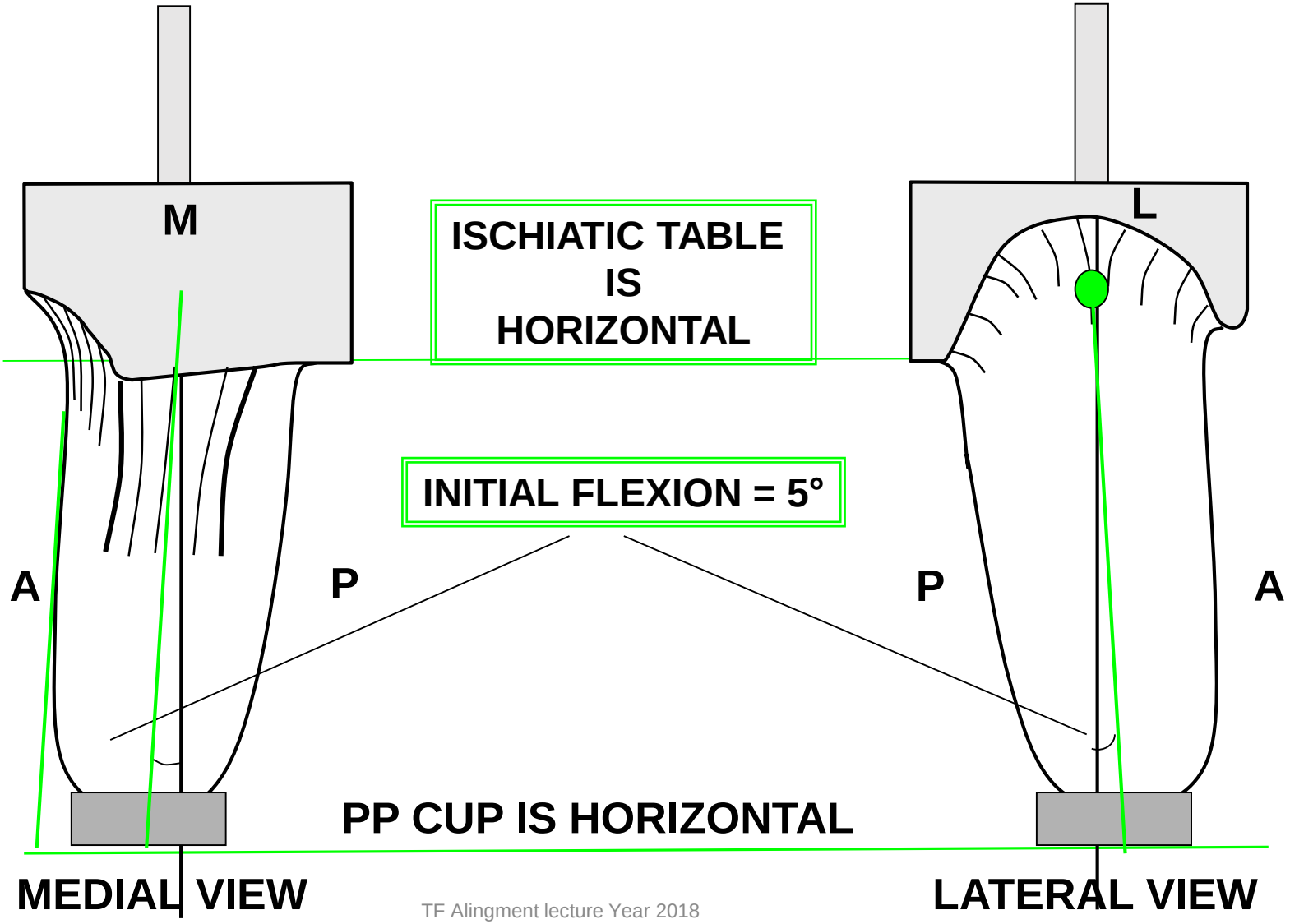
INITIAL ALIGNMENT: POSTERIOR & ANTERIOR VIEW

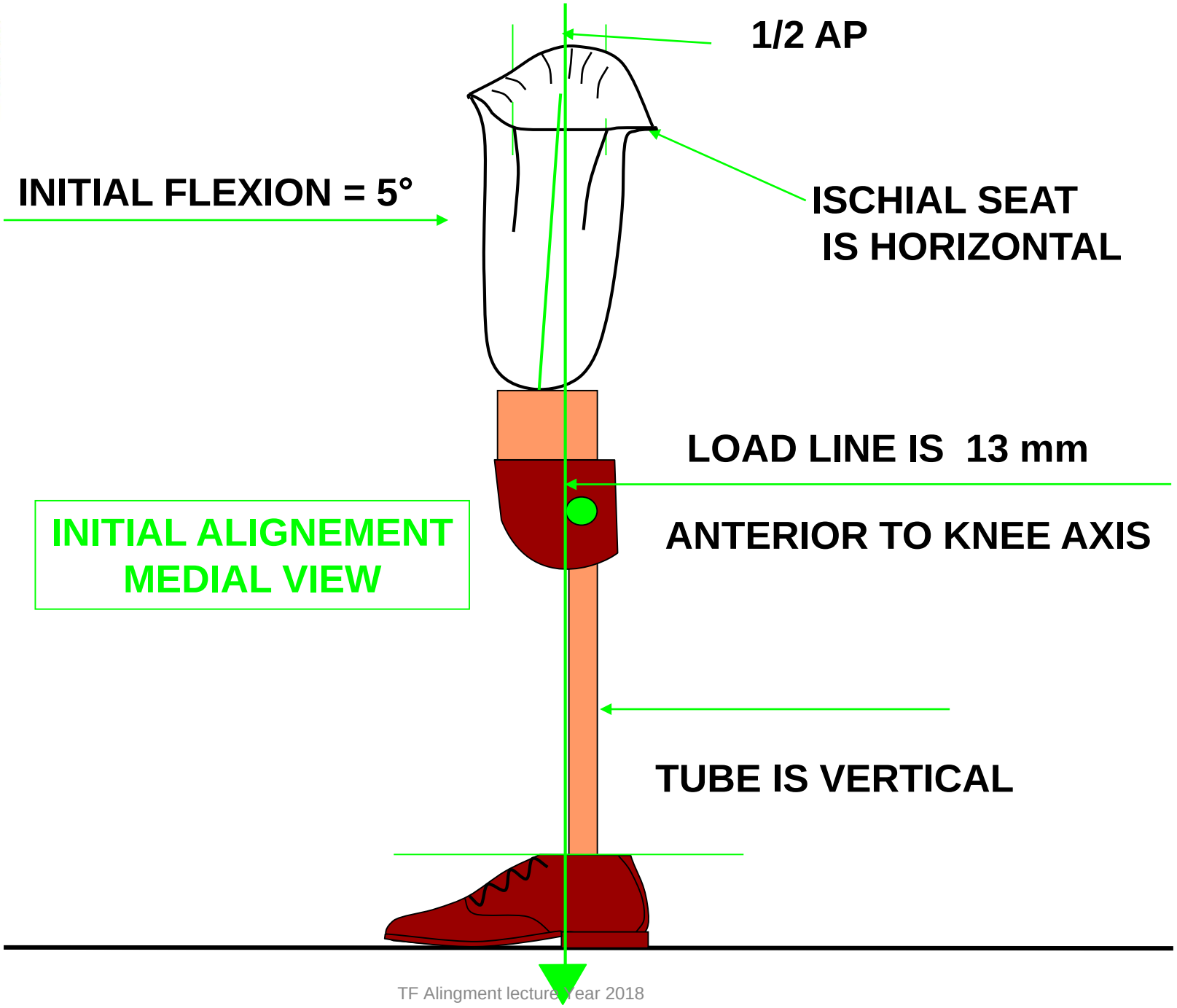


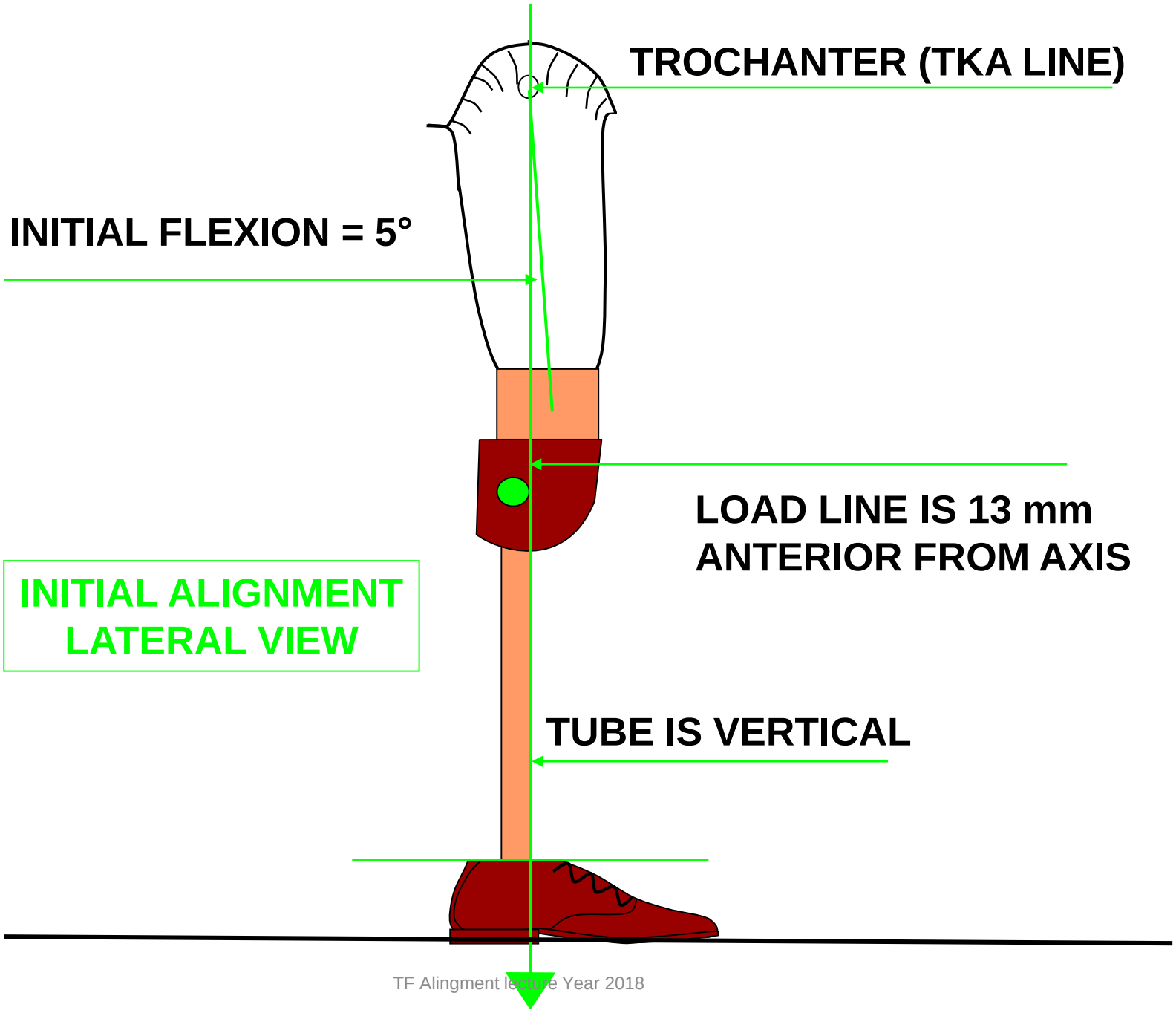

1/2 ML
HORIZONTAL
ADDUCTION
VERTICAL
KNEE AXIS IS HORIZONTAL
INITIAL ALIGNMENT: POSTERIOR VIEW
TUBE IS VERTICAL
CENTER OF THE FOOT


1/2 ML
VERTICAL
ADDUCTION
AXIS IS HORIZONTAL
INITIAL ALIGNMENT
ANTERIOR VIEW
TUBE IS VERTICAL
CENTER OF THE FOOT

INITIAL ALIGNEMENT: MEDIAL & LATERAL Views




1/2 AP
INITIAL FLEXION = 5°
ISCHIAL SEAT
IS HORIZONTAL
LOAD LINE IS 13 mm
INITIAL ALIGNEMENT
MEDIAL VIEW
ANTERIOR TO KNEE AXIS
TUBE IS VERTICAL


TROCHANTER (TKA LINE)
INITIAL FLEXION = 5°
LOAD LINE IS 13 mm
ANTERIOR FROM AXIS
INITIAL ALIGNMENT
LATERAL VIEW
TUBE IS VERTICAL

Alignment for a short stump

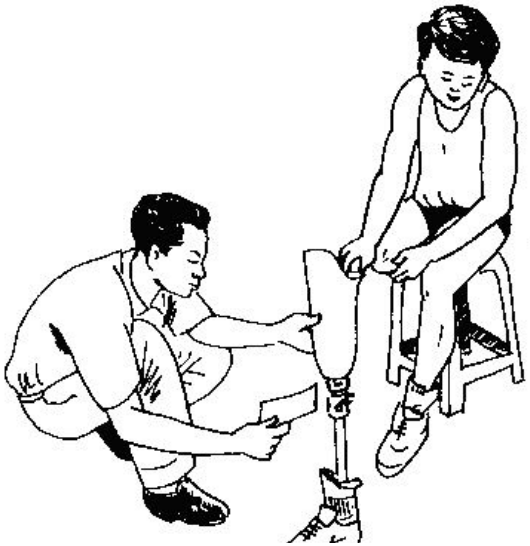
View	***Angulation***
Coronal	Abduction of the socket
Sagittal	Increase flexion of the socket up to 15 degrees
Transverse	5 degrees external rotation of the foot

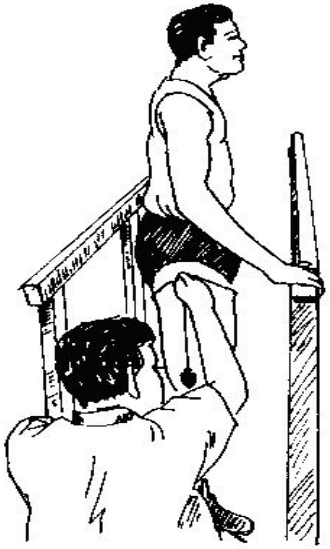
Question

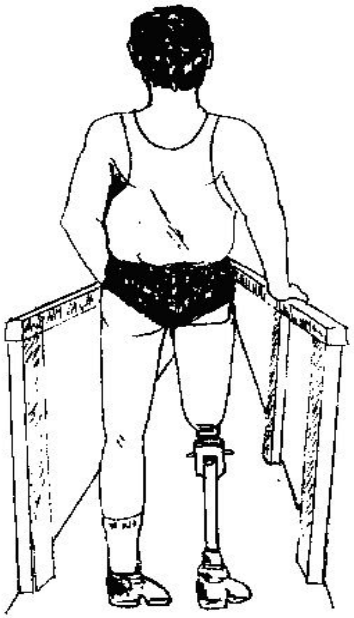
- How would you set up the alignment for a TF patient who has flexion contracture:
  1. 5 degree?
  2. 15 degree?
  3. Why?

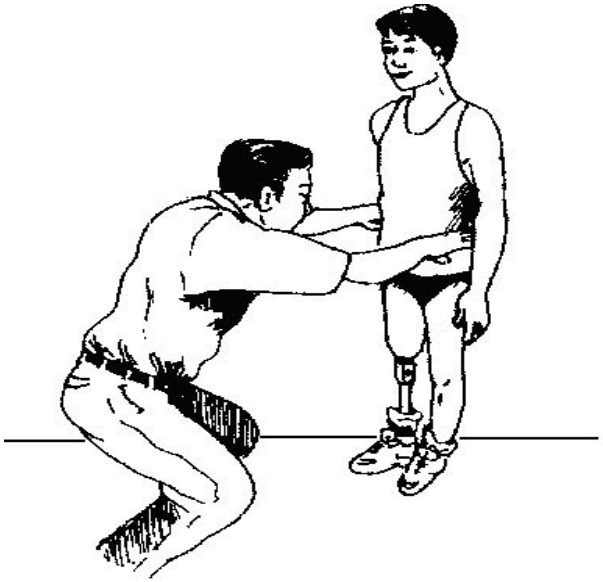
Note: page 80-81

2. Static Alignment









Purposes of static alignment

"Static Alignment" means " Alignment of standing – not moving"

The goals of static alignment:

1. To check the fit of the socket
2. To check and change the bench alignment to suit the individual patient
3. To check the length of the prosthesis
4. To check the quality of suspension

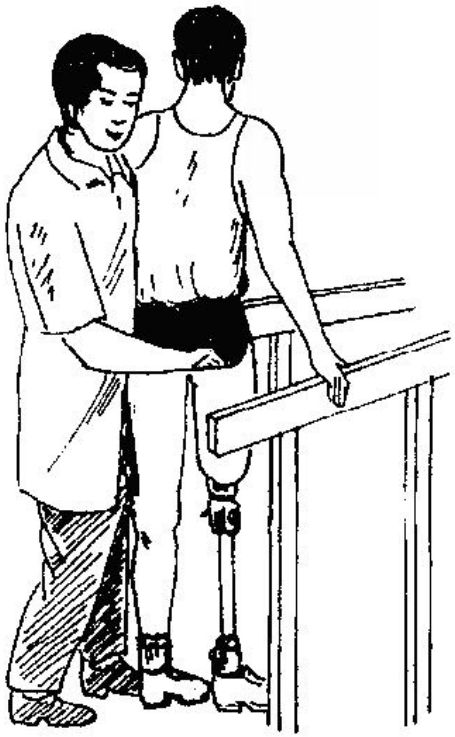
Static Alignment procedure

Things to be checked during the static alignment:

- Old prosthesis and its Gait
- Compare the Prescription with the new device
- Examination of the stump
- Putting on the new prosthesis
  - Check for adductor tendon position and the Ischial tuberosity position
- Check during standing
  - Base of support – distance between the feet
  - Equal Weight distribution on the feet

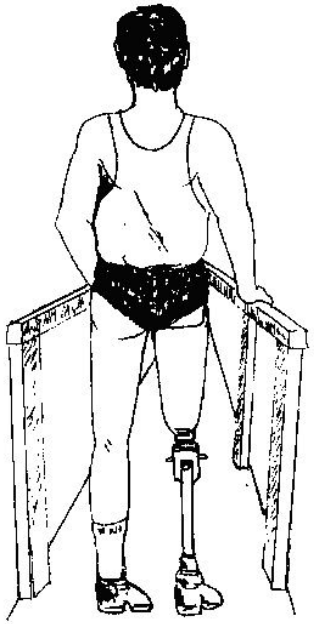
Static Alignment procedure

- Check the fit of the socket
  - Ischial tuberosity & Adductor tendon
  - Medial wall
  - Socket volume
  - Socket diameters
  - Stump colors
  - Distal contact
  - Trim lines



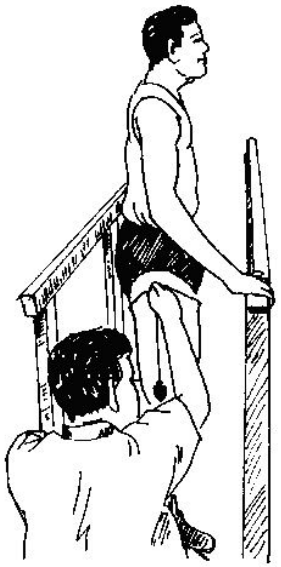
Static Alignment procedure

- Check the alignment is correct
  - Vertical pole
  - Medial and posterior wall horizontal in weight bearing



Static Alignment procedure

- Flexion and adduction angles
- Stability in medio-lateral and anterior posterior directions
- TKA line and the Posterior plumb line
- Toe out

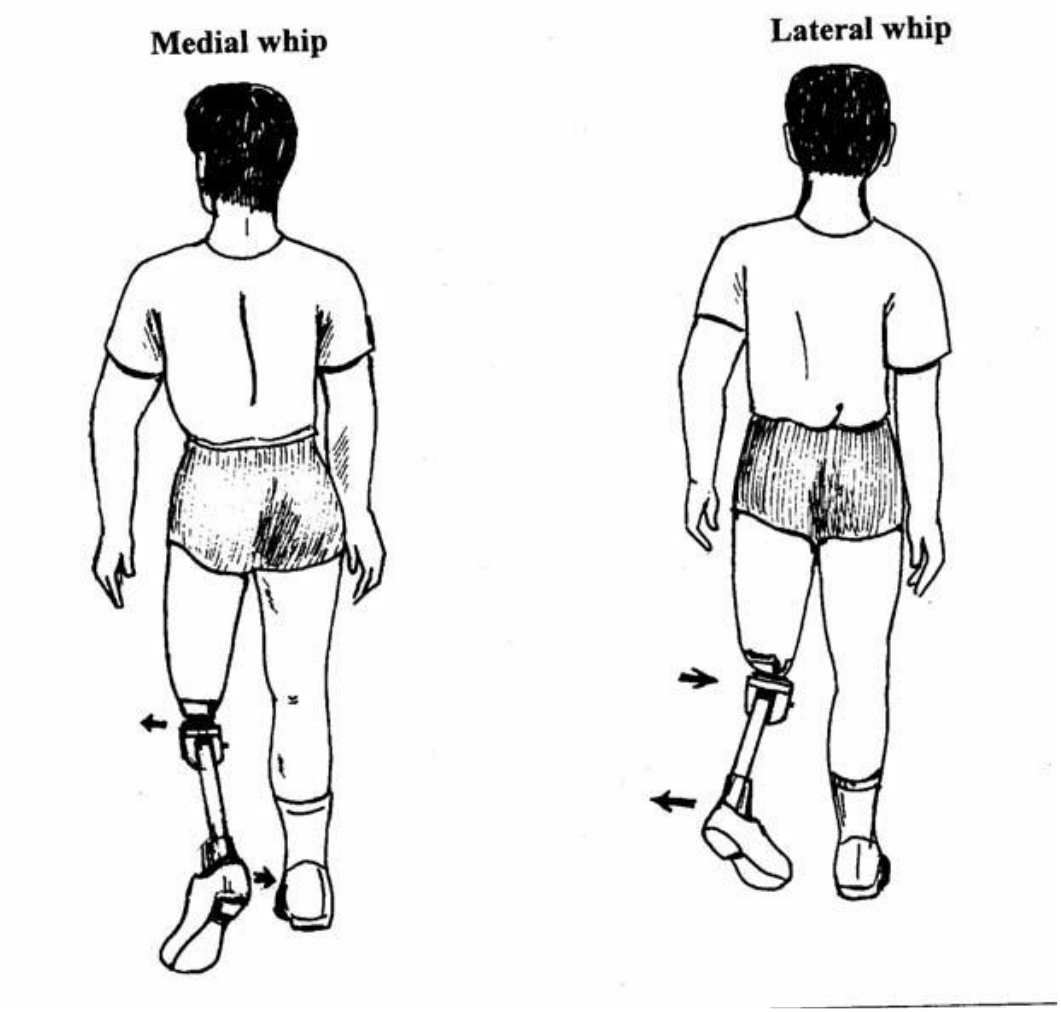


Static Alignment procedure

- Check the length of the prosthesis
  - Equal weight bearing on both the feet during standing

- Check the suspension
  - Downward movement of the prosthesis during weight transferring to the sound side

3. Dynamic Alignment



Purposes of dynamic alignment

- To ensure that the patients are able to walk with the prosthetics to do their daily activities comfortably and safely
- Fine tuning of the device (Make adjustment)
- Correct Gait deviations

Dynamic Alignment Procedure

Check list for the dynamic alignment – Stance phase

1.Foot function

- Heel strike (normally 1-1.5cm compress)
  - The heel – too soft difficult for roll over
  - The heel too hard cause knee flexion movement. So patient compensate by rotation the foot.

Dynamic Alignment Procedure

- Mid stance
  - Pole vertical – foot flat during the single limb support

- Push off
  - Smooth roll over from heel off to toe off and its effects on the knee joint
    - Resistance to the dorsiflexion is too much or less
    - Climbing up hill effect or drop off effect

Dynamic Alignment Procedure

- Check the Toe rise at heel strike:
  - Excessive toe rise (not enough socket flexion)
  - and too little toe rise (Too much socket flexion).

2. Stance phase Knee Stability / Instability

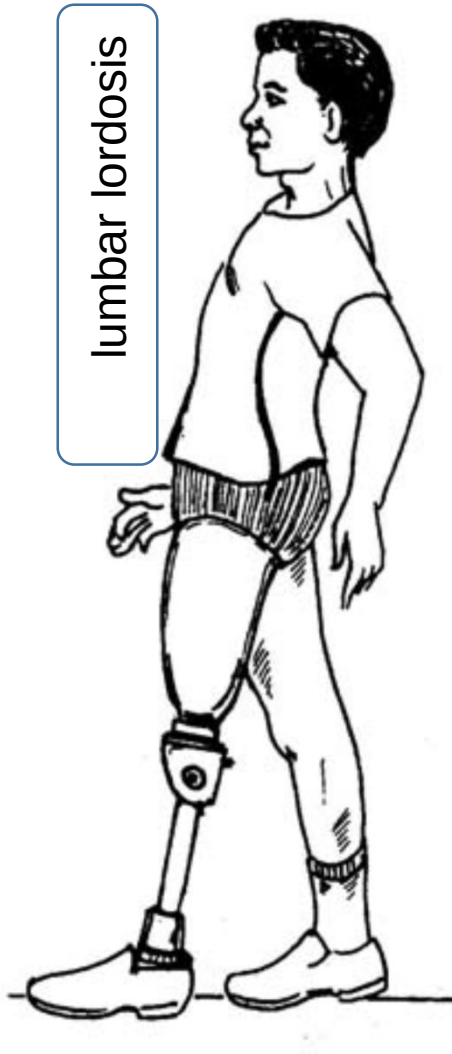
- TKA line
  - Knee axis is posterior to the TKA line (more or less knee stability)

Dynamic Alignment Procedure

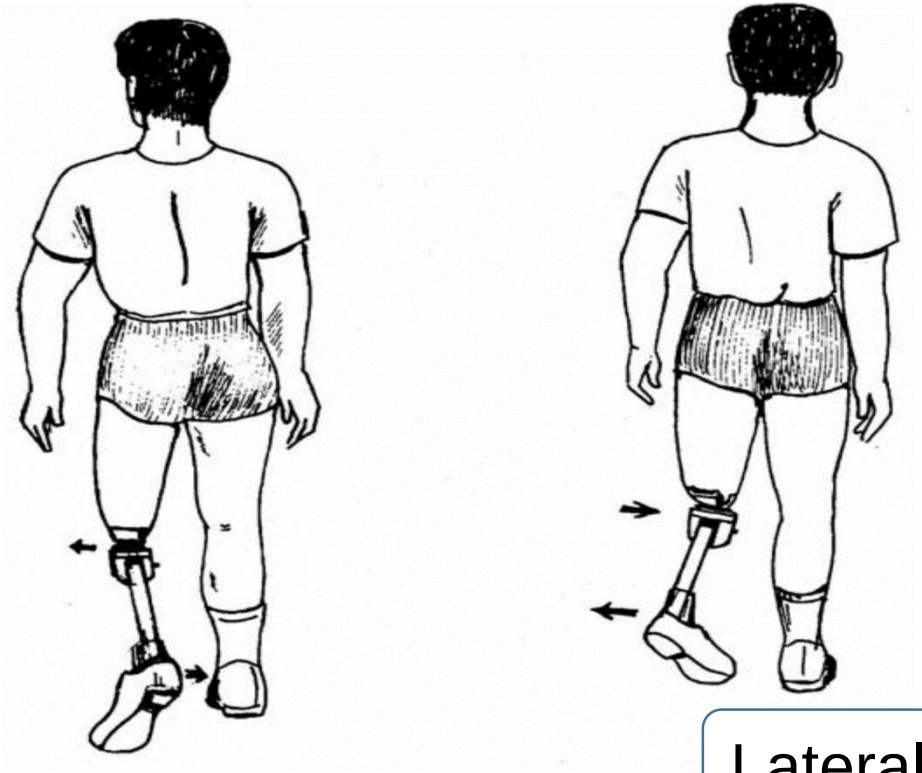
- Foot and ankle action
  - Early stance – too hard/ too soft heel,
  - Mid-Late stance –
    - forefoot too soft, less resistance to dorsiflexion, knee flexion moment
    - forefoot too hard or keel too long, knee extension moment

Dynamic Alignment Procedure

- Stance phase Knee Stability/Instability
- Socket Flexion (initial socket flexion + flexion contracture angle)
- Hip flexion contracture not accommodated
- Early stance to Mid stance – hip is stuck in flexion - GRF will remain posterior to the knee joint – difficult to maintain knee stability by using the gluteal muscles
- Mid stance to Late stance – limited extension ROM - compensates by pelvic anterior tilt and excessive lumbar lordosis



Dynamic Alignment Procedure



Medial whip

Lateral whip

3.Medial Whip and Lateral whip

Dynamic Alignment Procedure

3.Medial Whip and Lateral whip (due to socket rotation)

- A medial whip is corrected by rotating the knee internally.
- A lateral whip is corrected by rotating the knee externally.
- Not enough socket space for large muscle groups
- Too much pressure on the gluteal muscles above the posterior brim
- Soft tissue consistency – soft and loose
- Incorrect Silesian belt attachment points

Dynamic Alignment Procedure

4.Check the heel rise at swing phase

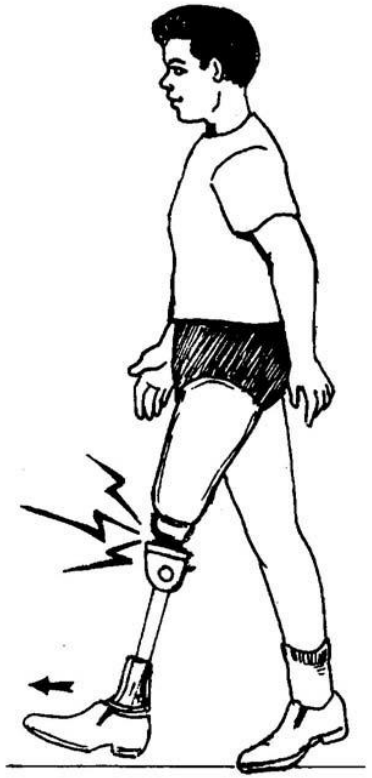
- Check the heel rise of the prosthetic foot in early swing phase
- Too much heel rise , long swing phase , uneven timing , due to less flexion control *(friction/ pneumatic/ hydraulic)*
- Less heel rise – functionally longer prosthesis, too much knee flexion control or patient not using the hip flexors actively



Dynamic Alignment Procedure

5.Check the timing of the swing and terminal impact

- Terminal impact can be corrected once the heel rise has been corrected only
- Check when sitting
- Check proximal trim lines for sitting comfort
- Check the stump at the end



Question???



Thank You!