KINEMATIC ORTHOTIC ALIGNMENT

Applying biomechanics to standing and walking.

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CLINICAL PRESENTATIONS

Pre-Ambulatory:

• Pre-Ambulatory patients are represented by the lack of **Independant Standing Balance (ISB**) or standing balance that is in a weak state of development. ***Here, there is a clear need to focus on an ISB that leads to weight shifting, followed by assisted initial steps before independant ambulation can evolve.***

Therapeutic:

• The therapeutic patient exhibits a plantar flexion contracture issue limiting range of motion to ten or more degrees plantar flexed and/or exhibit gait patterns that need to be normalized or retrained, as in toe walking. In this stage, the focus is on alignment and balance to promote optimum gait biomechanics. This presentation will relieve the contracture and regain range of motion, promote proper gait characteristics creating better functionality. Therapeutic can be full-time wear or limited 45-minute wear twice a day. ***The key is to focus on attaining heel strike first, then terminal stance knee extension.***

Functional:

• Functional patients exhibit a dorsiflexion range of motion that is less than 5 degrees plantar flexed, and are often within -3 ± 5 degrees of neutral. At this point, symmetrical stride has been attained, and dynamic foot modification and ESR designs become effective.

GAIT PRESENTATIONS

Two Primary Presentations:

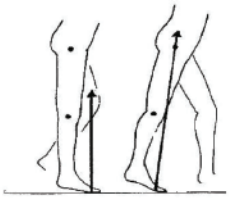
Insufficient Shank Angle:

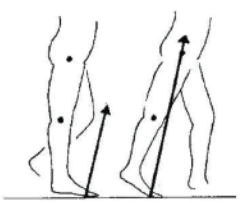
•An Insufficient Shank Angle results when the tibia does not incline forward or vertical at mid-stance. It is often associated with hemi-paresis, stroke, plantar flexion contracture, osteoarthritis, and fused ankles. Unilateral involvement is most common.

Excessive Shank Angle:

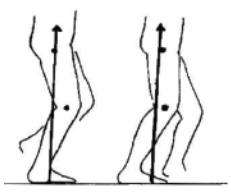
•An Excessive Shank Angle results when the tibia is inclined forward or vertical at mid-stance. It is typically seen with a crouch gait presentation and is often associated with diplegia, plantor flexor weakness, and toe-walkers.

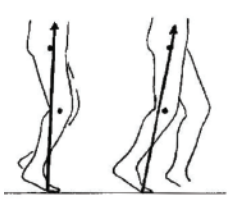
Insufficient Shank Angle





Excessive Shank Angle





PATIENT EVALUATION

Assess Ankle ROM:

- Knee Flexed
- Knee Extended

Assess ML Stability of Foot:

- Determine position to control.
- Determine hindfoot alignment.
- Determine forefoot alignment.
- Determine when foot goes "tri-planar" -- ***very important to identify!***

Assess Standing Stability:

- Determine Clinical Presentation
- If Ambulatory, determine Gait Presentation.

Assess Knee ROM:

- Are there any limitations that are going to affect the tibial shank alignment?

If Ambulatory, Assess Hip:

- Rotary Issues
- Abduction Issues

PROTOCOL

For Pre-Ambulatory and Theraputic Patients

Tune for Maximum Stability:

•90 degree to 15 degree tibial incline

What to Look For:

- Feet are quiet and anchored.
- Spine is upright.
- Weight line extends through center of foot.

Functional Measures:

- Timed Independant Standing
- Functional Reach Test
- **Range of Motion** - Expect improvement adjust lifts as necessary, but maintain the same shank angle.
- Assess for positive hip abduction.

When Standing Balance is Achieved:

(initial steps)

Tune to Induce Heel Strike:

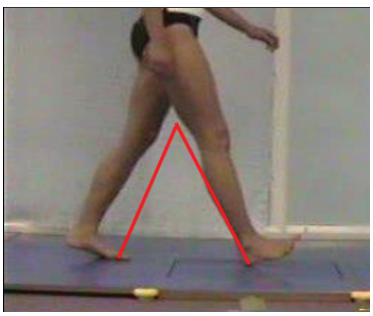
10 degree to 20 degree tibial incline
Turning into “stance” after one to two weeks.

Alignment, when attained, will result in the following:

- Stability in mid-stance.
- Dictation of thigh, pelvis, trunk, and head kinematics
- Facilitation of ballistic movement of the thigh and trunk.
- Facilitation of knee and hip extension.
- Conservation of energy

What to Look For:

- Heel strike achieved
- Terminal stance induced knee extension.
- Status of inverted “V”
    - Stride length symmetry right to left:



Functional Measures:

- Functional Reach Test
- **Range of Motion** - Expect improvement adjust lifts as necessary, but maintain the same shank angle.
- Timed up and go.
- Measure the footprints and compare to norms.

Proceed to Follow-ups

FOLLOW-UPS: DOCUMENT CHANGES

- **Assess ROM -** expect improvement adjust lifts as necessary but maintain the same shank angle.
- **Assess all applicable functional measures**
- **Assess heel strike; must be strong.**
- **Assess terminal stance.**
  - Is knee going to full extension?
  - Is leg dropping off due to short lever?
  - **Add point-load rocker or lengthen brace:**

point-load rocker

Understanding foot/shoe/brace lever arm length:

LENGTH ADJUSTMENT REQUIRED FOR SHOE/BRACE

10 degree incline normal

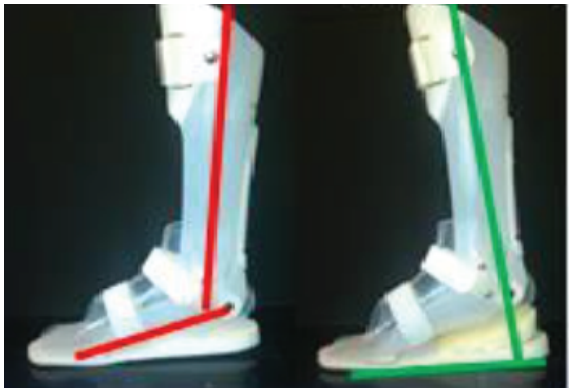
20 degree incline where lever is shortened.

- **Assess symmetry of stride length (inverted "V").**
  - If not equal, assess hip abduction weakness.
  - Ankle ROM typically lags on the affected side.
  - **Adding heel sole elevation with point-load rocker on the non-affected side will induce lengthening at terminal stance. The result will be symmetrical.**

DYNAMIC ALIGNMENT

Tunning the Shank Angle

Static Dynamic



AA or AFO SVA

Excessive Shank Incline Starting Point:
Brace Set-Up

23° PF - R1 and range

Standard heel height:
3/8”

At least 10° floor to shank

Set-up with shoe, tibia is inclined at least to 10°

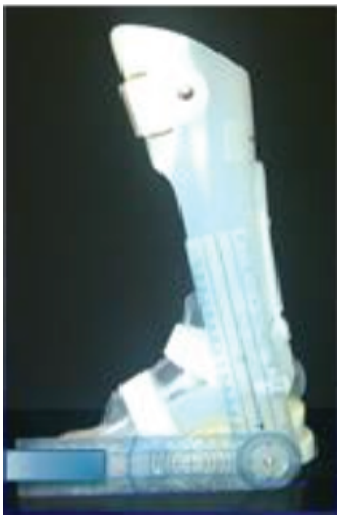
NOTE: *this starting point may need to increase incline based on gait.*

Excessive Shank Incline Starting Point:
Brace Set-Up after ROM Change

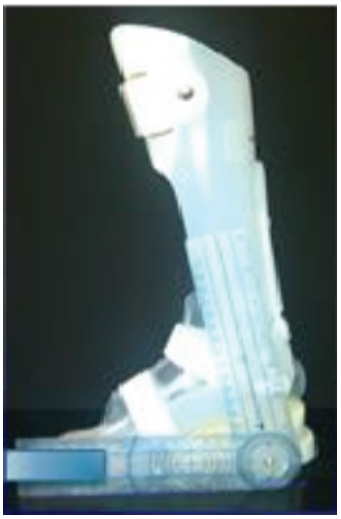
Re-assess tibial alignment to the floor, and based on gait characteristics either remove or add heel elevation.

Add or Remove Elevation:

- If cadence/velocity has stayed the same you will remove elevation and maintain tibial angle.
- If cadence/velocity has increased, you will need to add elevation.



PROGRESSION



Start = 23° PF

3/4” lift + 3/8” heel height

Half-way

= 10° PF

1/2” lift + 3/8” heel height

END = 90° PF

+ 3/8” heel height