Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

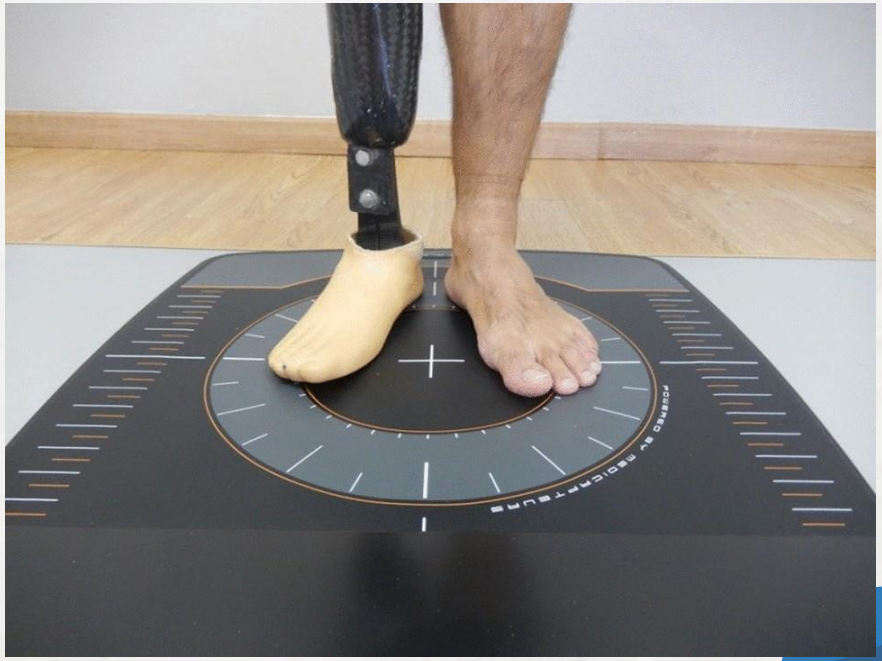
PROSTHETICS I

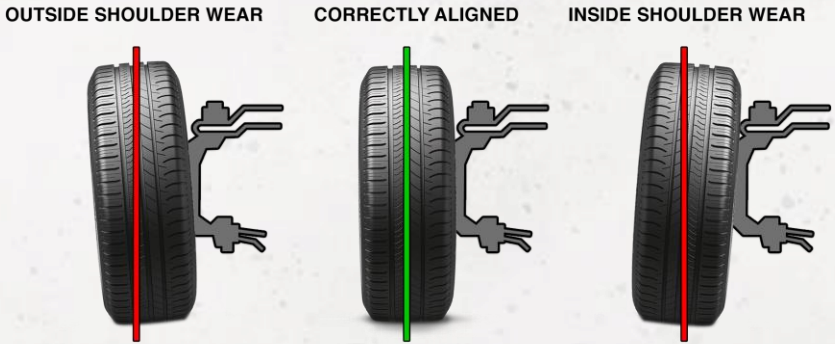
Asst. Lec. Muntadher Saleh Mahdi

2st term – Lecture 6

2024-2025

Muntadher.saleh.mahdi@uomus.edu.iq
UOMU013041




OUTSIDE SHOULDER WEAR
CORRECTLY ALIGNED
INSIDE SHOULDER WEAR

Prosthetic Alignment for Transtibial Amputations

Definition

Adjusting the spatial orientation of the prosthetic socket relative to the foot to ensure natural gait, comfort, and minimized strain.

Goals of Prosthetic Alignment

- Facilitate heel strike at initial contact
- Ensure single limb stability during the stance phase
- Smooth forward progression (rollover)
- Adequate toe clearance during swing phase

Practical Prosthetic Alignment Considerations

Socket Adjustments: Tilting the socket forward (flexion) or backward (extension) affects how forces are distributed during gait, impacting the wearer's comfort and stability.

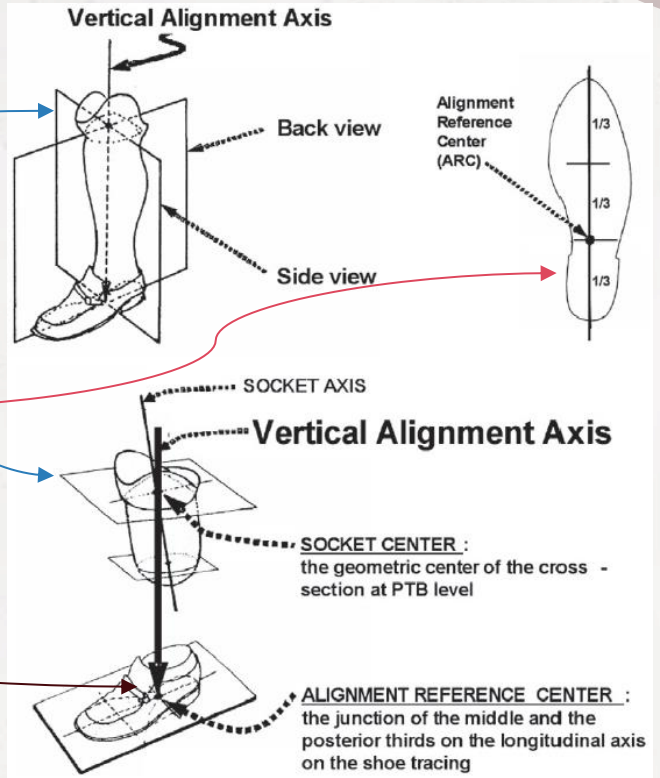
Linear Changes: Adjusting the socket medially, laterally, anteriorly, or posteriorly ensures proper alignment of the foot under the knee, crucial for static and dynamic stability.

Customization: Alignment is tailored to the user's anatomy, gait, and specific challenges like joint contractures or deformities.

Bench Alignment, The Starting Point

is the initial setup for prosthetic adjustments. It ensures proper positioning and load distribution by:

- Setting 5° socket flexion and adduction.
- Keeping the prosthetic foot level in both frontal and sagittal planes.
- Aligning the foot's medial border parallel to the progression line.
- Dropping a plumb line from the knee center to a specific point on the foot for shock absorption and stability during gait.

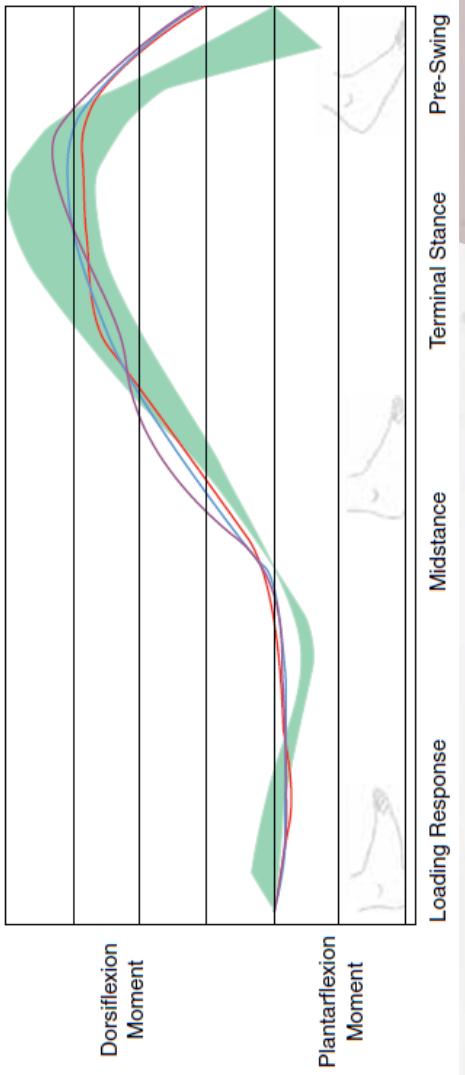


Understanding Electronic Alignment

- Uses advanced sensors embedded in prosthetic components
- Records real-time gait data as the user walks
- Captures forces and moments acting on the prosthesis during the gait cycle

The Role of Technology in Prosthetics

- Wireless transmission of gait data to a computer
- Software processes and compares recorded data with norms
- Provides essential cues for prosthetists to refine alignment



Benefits of Electronic Alignment

- **Precision in Prosthetic Alignment:** Enables tailored adjustments by visualizing forces and moments
- **Prevention of Long-term Damage:** Detects and corrects issues to avoid long-term damage (like premature medial compartment osteoarthritis)
- **Objective Data Analysis:** Provides biomechanical insights for better prosthetic fitting
- **Documentation:** Stores data for tracking progress and future adjustments

Dynamic Alignment

is a step-by-step process in which the patient walks with an adjustable prosthesis, allowing for fine-tuning to improve fit and function.

This process focuses on:

- Adapting the prosthesis to the user's natural gait
- Relieving pressure issues inside the socket
- Balancing stability, mobility, and comfort

Dynamic Alignment

It includes precise adjustments to the prosthetic components (socket, pylon, and foot), including:

Angular changes: flexion, extension, abduction, adduction, inversion, eversion, plantarflexion, and dorsiflexion.

Linear shifts: Moving the socket or foot in specific directions (medially, laterally, anteriorly, posteriorly).

MCQ

1. What is prosthetic alignment?

A) The process of designing a prosthetic socket

B) The adjustment of the prosthetic socket in relation to the foot

C) The manufacturing of a prosthetic limb

D) The physical therapy process for amputees

2. Why is prosthetic alignment important?

A) To improve the cosmetic appearance of the prosthesis

B) To ensure a natural gait and reduce body strain

C) To reduce the weight of the prosthetic limb

D) To make the prosthesis easier to manufacture

MCQ

3. Which of the following is NOT a goal of prosthetic alignment?

A) Facilitating heel strike at initial contact

B) Increasing the weight of the prosthesis

C) Ensuring single limb stability during stance phase

D) Guaranteeing adequate swing phase toe clearance

4. Dynamic alignment is an iterative process that involves:

A) Adjusting the prosthesis while the wearer walks

B) Designing the prosthetic socket from a mold

C) Selecting the materials for the prosthesis

D) Measuring the user’s residual limb

MCQ

5. Which adjustments are made in dynamic alignment?

A) Angular and linear adjustments

B) Only angular adjustments

C) Only linear adjustments

D) No adjustments are needed

6. Which of the following is NOT an angular adjustment in dynamic alignment?

A) Flexion

B) Extension

C) Plantarflexion

D) Medial shift

MCQ

7. What is the starting point of prosthetic alignment?

A) Dynamic alignment

B) Electronic alignment

C) Bench alignment

D) Socket fitting

8. How much socket flexion is typically included in bench alignment?

A) 0 degrees

B) 3 degrees

C) 5 degrees

D) 10 degrees

MCQ

9. What is the role of the plumb line in bench alignment?

A) To measure the weight of the prosthesis

B) To ensure proper load distribution and shock absorption

C) To align the prosthetic knee with the residual limb

D) To determine the length of the prosthesis

10. How does tilting the socket forward (flexion) affect gait?

A) It improves comfort and stability

B) It reduces the durability of the prosthesis

C) It increases the weight of the prosthesis

D) It makes walking impossible

MCQ

11. What is an example of a linear adjustment in prosthetic alignment?

A) Flexion

B) Abduction

C) Anterior shift

D) Dorsiflexion

12. Which factor does NOT affect prosthetic alignment customization?

A) The user's anatomy

B) The color of the prosthesis

C) Gait peculiarities

D) Joint contractures

MCQ

13. What does electronic alignment use for real-time gait analysis?

A) Mechanical springs

B) Manual observation

C) Embedded electronic sensors

D) Handwritten measurements

14. What is the purpose of electronic alignment?

A) To generate power for the prosthesis

B) To provide real-time gait data for precise adjustments

C) To replace the prosthetic socket

D) To increase the weight of the prosthesis

MCQ

15. How does electronic alignment transmit data?

A) Through manual recording

B) Using a printed chart

C) Wirelessly to a nearby computer

D) By adjusting the prosthesis manually

16. What does electronic alignment help to prevent?

A) Excessive prosthetic weight

B) Premature medial compartment osteoarthritis

C) Excessive foot rotation

D) Increased prosthetic cost

MCQ

17. Why is objective data analysis important in prosthetic fitting?

A) It makes the prosthesis cheaper

B) It allows precise adjustments based on biomechanical impact

C) It reduces the time needed for manufacturing

D) It makes the prosthesis heavier

18. Which of the following is NOT a benefit of electronic alignment?

A) Precision in prosthetic alignment

B) Prevention of long-term limb damage

C) Increased cosmetic appeal of the prosthesis

D) Objective data analysis

MCQ

19. How does stored gait data help in future prosthetic adjustments?

A) It helps track gait pattern evolution

B) It increases prosthetic weight

C) It prevents any need for future adjustments

D) It eliminates the need for dynamic alignment

20. Which of the following is a key advantage of electronic alignment in prosthetics?

A) It eliminates the need for bench alignment

B) It allows for precise, real-time adjustments

C) It makes prosthetic alignment unnecessary

D) It only works with mechanical prostheses


Thank
you