Al-Mustaqbal University
Collage of Engineering
Prosthetics and Orthotics Engineering

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Prosthetics I

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Lecture 4

Asst. Lect. Muntadher Saleh Mahdi

Muntadher.saleh.mahdi@uomus.edu.iq

Subject: Prosthetics 2
Lecturer: Samer Aswad Alaseedi
sameralaseedi@gmail.com

Gait Deviations in Prosthetics

Causes and Evaluation

Gait deviations in prosthetic users can stem from various factors, including improper socket fit, misalignment, muscle weakness, or other musculoskeletal pathologies. It's crucial to conduct a thorough evaluation to pinpoint the cause of these deviations and develop a strategy for correction. A review of the biomechanics of normal gait is recommended to understand these deviations better.

Impact of Changes on Gait

Even small changes in a wearer's routine can lead to gait deviations. Such changes might include:

- **Limb Volume Variations** Changes in diet, medication, or activity levels can affect limb volume, altering the fit of the socket.
- **Footwear Alterations** A change in shoe heel height can impact the orientation of the socket to the ground. If the prosthetic components don't accommodate the new heel height, the wearer's gait could be adversely affected.

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Prosthetic Gait Biomechanics - Initial Contact

Sagittal Plane Mechanics at Initial Contact

1. **Heel Strike Optimization**
   - The heel should be the first point of contact with the ground, which requires careful prosthetic design and wearer training.
   - Deviations such as forefoot contact can indicate excessive plantarflexion of the prosthetic foot or a limited knee extension range of motion, leading to an increased knee extension moment.
2. **Consequences of Improper Contact**
   - If initial contact is not with the heel, it can reduce gait efficiency and potentially cause damage to the knee over time.
3. **Strategies for Correction**
   - Therapeutic exercises can be employed to increase knee range of motion and strengthen knee extensors.
   - Prosthetic alignment may be adjusted to accommodate for knee flexion contractures.
   - Ensuring proper prosthesis height and suspension is crucial; an overly long prosthesis or poor suspension can cause premature contact during swing phase, disrupting the gait cycle.

Frontal Plane Mechanics at Initial Contact

1. **Foot Alignment**
   - The prosthetic foot should contact the ground evenly, without excessive inversion or eversion.
   - The heel's lateral border should make the initial ground contact, reflecting a standard toe-out angle of 5 to 10 degrees.
2. **Importance of Heel Leveling**

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- This precise contact sequence allows for a normal progression of the ground reaction force, traveling up the lateral border of the foot and then crossing to the medial forefoot during the stance phase.

Transverse Plane Mechanics at Initial Contact

1. **Consistency of Rotation**
   - Throughout the stance phase, the rotation of the prosthesis should remain consistent, with the medial border of the foot parallel to the line of progression.
2. **Indicators of Misalignment**
   - Rotational deviations at initial contact can indicate a loose fit in the socket or incorrect positioning of the foot under the limb.
   - An inset foot may cause observable external rotation, while an outset foot may result in internal rotation.