Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

PROSTHETICS I

Asst. Lec. Muntadher Saleh Mahdi

2st term – Lecture 5

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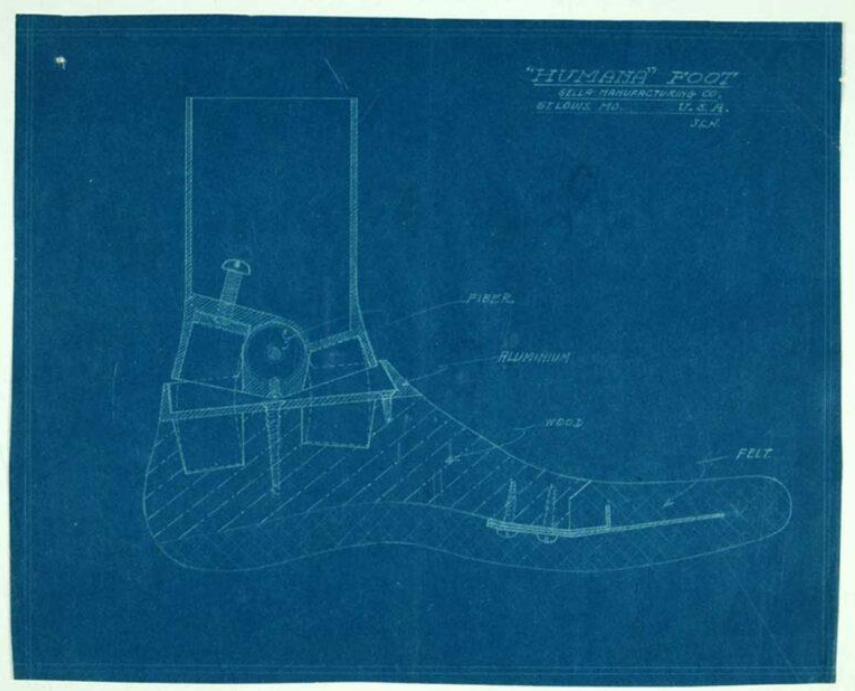
Muntadher.saleh.mahdi@uomus.edu.iq
UOMU013041



Understanding Prosthetic Suspension Systems

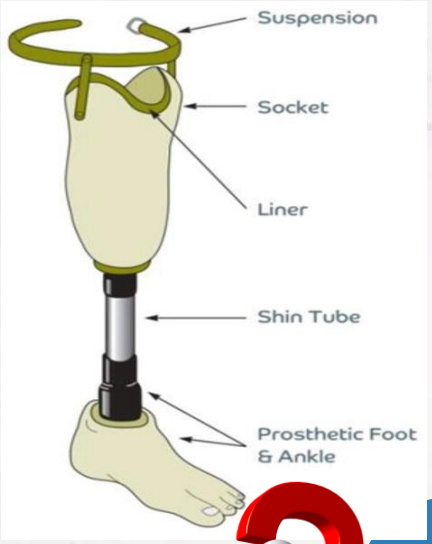
Introduction

- Suspension is how a prosthesis attaches to the limb.

-A good suspension system keeps the socket securely in place.

- No movement should occur between the socket and the limb.

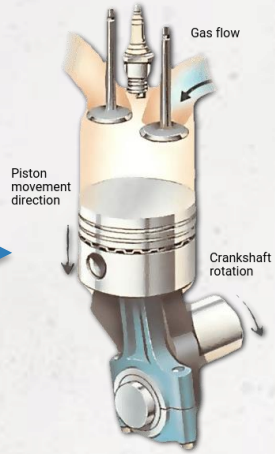
- Ensures stability and comfort for the user.



The Challenge of Pistoning

Pistoning:

- Unwanted movement between the prosthetic socket and the limb.
- Similar to how a piston moves in an engine.



Problems Caused by Pistoning:

- Discomfort and pain.
- Skin breakdown and damage.
- Reduced control over the prosthesis.

Importance: Minimizing pistoning is essential for a comfortable and functional prosthetic fit.

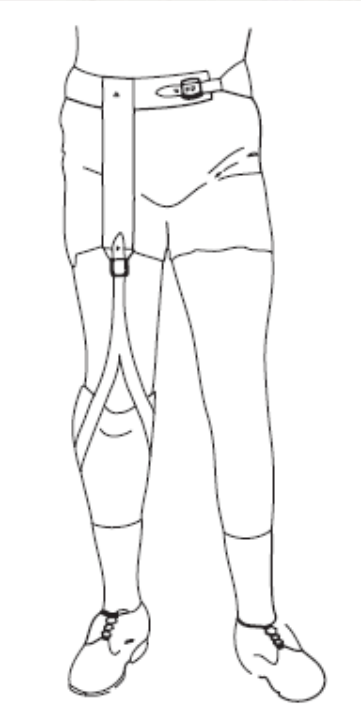
Suspension Strategies in Prosthetics

To prevent unwanted movement (pistoning) and ensure a secure fit, various suspension techniques are used. These can be combined for better stability and comfort.

1. Waist Belt Suspension

Description: Uses a waist belt connected to a thigh corset with an elastic strap, wrapping around the pelvis.

Benefits: Allows hip and knee movement, reduces pistoning, and tension can be adjusted for comfort.



Suspension Strategies in Prosthetics

2. Joints and Corset Suspension

Description: Combines suspension with weight-bearing using a leather corset secured with straps and steel knee joints.

Benefits: Provides a secure fit, reduces pistoning, and is good for those with knee instability.

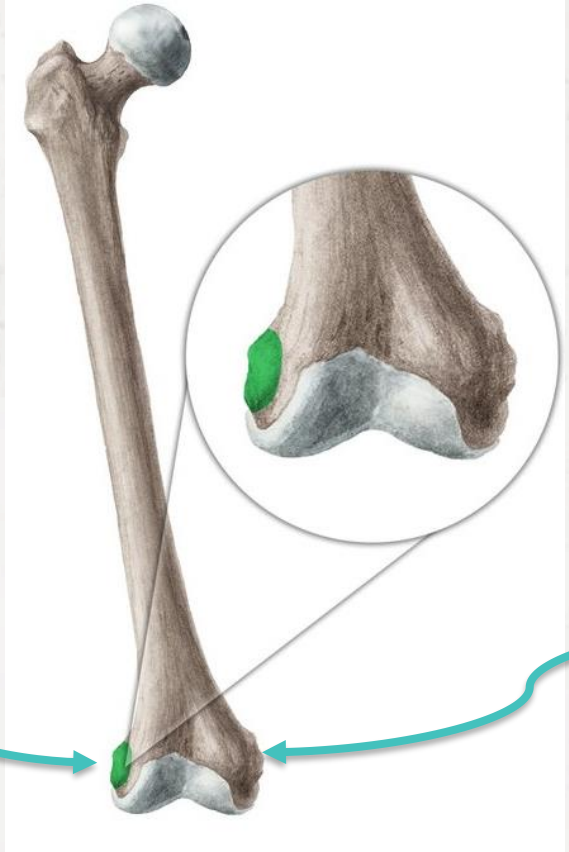
Suspension Strategies in Prosthetics

3. Cuff Strap Suspension

Description: A flexible leather cuff attaches to the socket and encircles the thigh near the knee.

Functionality: Secures the prosthesis, allows knee movement, but less suitable for short limbs or those with significant muscle or fat.

Advantages and Limitations: Simple, quick to make, but lacks weight-bearing capacity and lateral stability.



Lateral Condyle

Medial Condyle

Suspension Strategies in Prosthetics

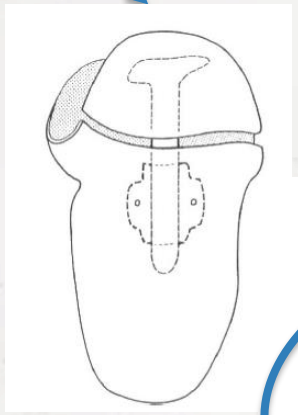
4. Supracondylar Suspension

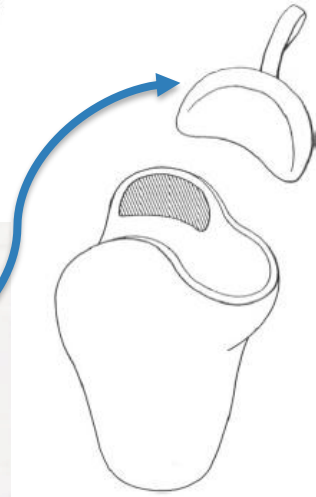
Description: Encloses the femoral condyles within the socket, with high trim lines above the knee to secure it.

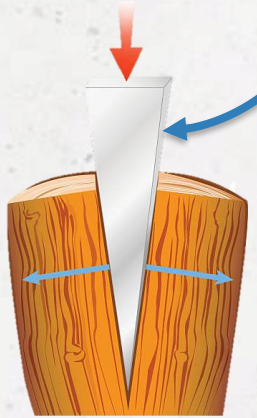
Benefits: Increases stability, especially when combined with PTB-style sockets, and improves control.

Donning Techniques: Uses either a detachable medial wall or a supracondylar wedge for easier insertion.

Considerations: Requires a specific fit around the knee, and high walls may be visible through clothing when seated.







MCQ

1) What is the purpose of various suspension techniques in prosthetics?

a) Enhance aesthetic appeal

b) Combat pistoning and ensure a secure fit

c) Reduce manufacturing costs

d) Increase weight of the prosthesis

2) What is the key feature of waist belt suspension?

a) Metal hooks

b) Inverted Y-strap

c) Suction cups

d) Magnetic clasp

MCQ

3) How does the waist belt suspension permit hip and knee flexion?

a) Using rigid straps

b) Through elastic straps and Y-strap design

c) With hydraulic joints

d) By adding springs

4) Which of the following is a benefit of the waist belt suspension?

a) Limits knee movement

b) Reduces the risk of pistoning

c) Increases the weight of the prosthesis

d) Enhances aesthetic design

MCQ

5) What additional feature does the waist belt suspension provide for user comfort?

a) Fixed tension

b) Adjustable tension

c) Built-in cushioning

d) Metal reinforcement

6) What materials are typically used in joints and corset suspension?

a) Plastic and rubber

b) Leather and steel

c) Fabric and wood

d) Silicone and carbon fiber

MCQ

7) How does joints and corset suspension reduce pistoning?

a) By using elastic straps

b) By providing a secure fit over the femoral condyles

c) Through suction technology

d) By increasing socket length

8) Who benefits most from the joints and corset suspension?

a) Individuals with knee ligament instability

b) People with short residual limbs

c) Those with significant muscle or fat

d) Children with growing limbs

MCQ

9) What function does the flexible leather cuff serve in cuff strap suspension?

a) Provides weight-bearing support

b) Attaches to the socket and encircles the thigh

c) Enhances aesthetic appeal

d) Increases socket rigidity

10) Which part of the body does the cuff strap suspension leverage for suspension?

a) Ankle

b) Patella and femoral condyles

c) Hip

d) Lower back

MCQ

11) Why is cuff strap suspension less suitable for individuals with short limbs?

a) It requires significant muscle strength

b) It relies on thigh geometry for suspension

c) It needs a longer limb length

d) It uses heavy materials

12) What is a major limitation of cuff strap suspension?

a) Complexity in fabrication

b) Lack of mediolateral stability

c) High production cost

d) Incompatibility with modern prostheses

MCQ

13) What technique achieves suspension by fully encompassing the femoral condyles?

a) Waist belt suspension

b) Joints and corset suspension

c) Cuff strap suspension

d) Supracondylar suspension

14) How does supracondylar suspension enhance mediolateral stability?

a) By using elastic straps

b) Increasing lever arm length proximal to the knee center

c) Adding springs to the socket

d) Using magnetic locks

MCQ

15) Which socket style is often combined with supracondylar suspension for improved stability?

a) Plug-fit socket

b) TSB-style socket

c) PTB-style socket

d) Single-axis socket

16) What are the two main donning techniques for supracondylar suspension?

a) Detachable medial wall and supracondylar wedge

b) Elastic straps and magnetic clasps

c) Hydraulic joints and suction cups

d) Springs and rubber bands

MCQ

17) How does a detachable medial wall facilitate easier donning?

a) By adding cushioning

b) Opening to allow limb insertion, then reattaching

c) Using suction technology

d) Providing a fixed hinge

18) What role does the supracondylar wedge play in suspension?

a) Increases socket weight

b) Provides a comfortable and secure fit

c) Enhances aesthetic design

d) Adds springs to the socket

MCQ

19) Why is a specific fit around the knee important for supracondylar suspension?

a) To reduce production costs

b) Ensures proper function and comfort

c) Increases aesthetic appeal

d) Simplifies fabrication

20) What might be a concern for some users with supracondylar suspension?

a) Increased production cost

b) High walls visible through clothing

c) Reduced weight-bearing capacity

d) Complex fabrication process

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Thank
you