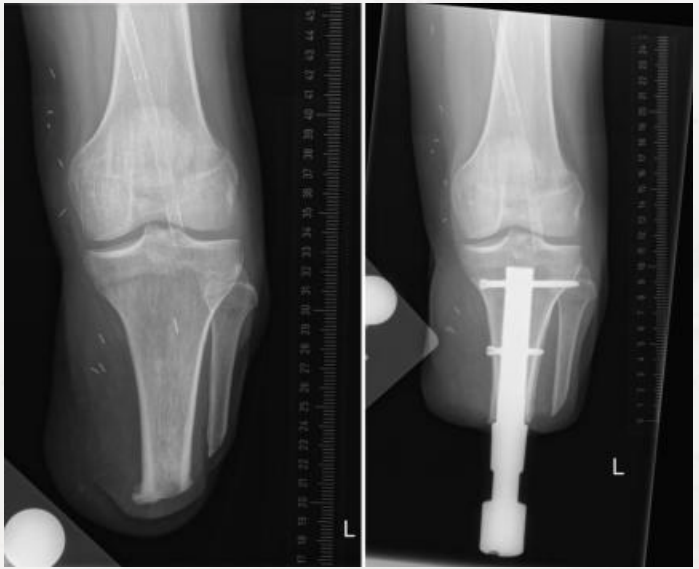
Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

PRINCIPLES OF PROSTHETICS AND ORTHOTICS



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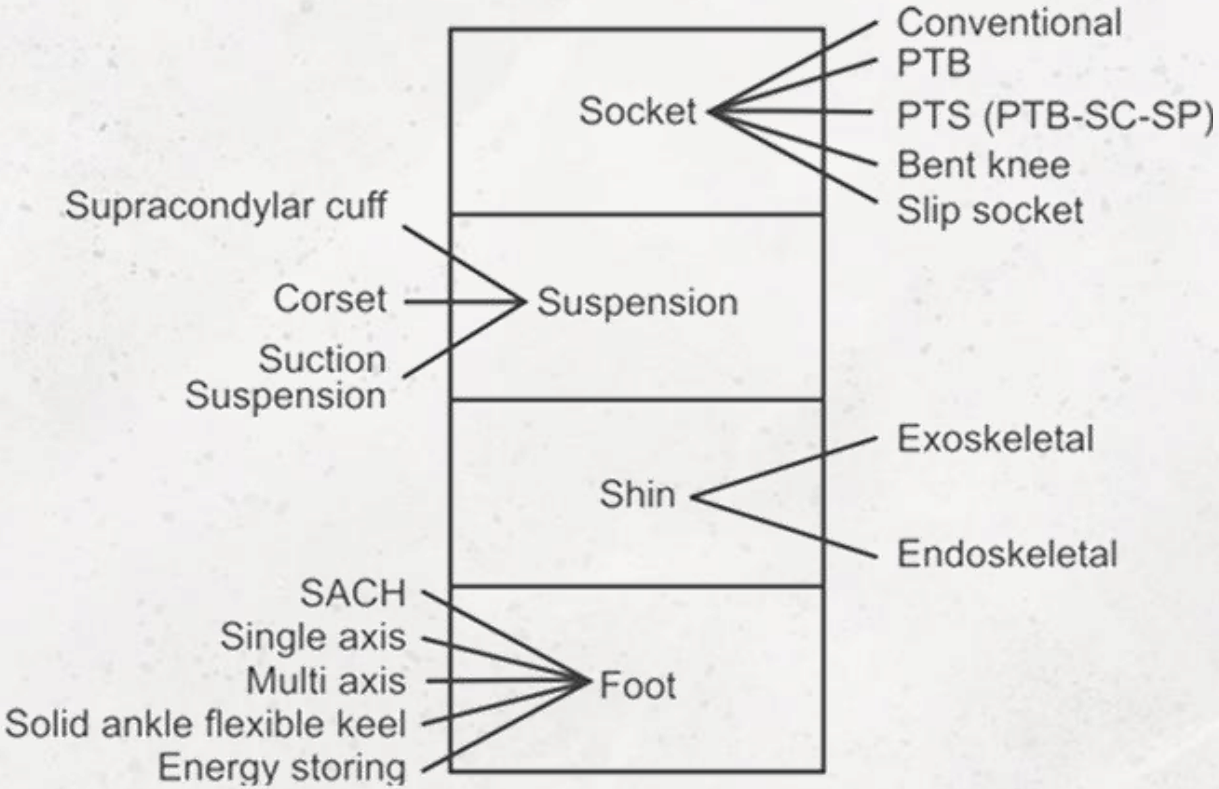
1

Parts of Transtibial Prosthesis

1. **Socket**
2. **Suspension**
3. **Shin piece**
4. **Foot piece**



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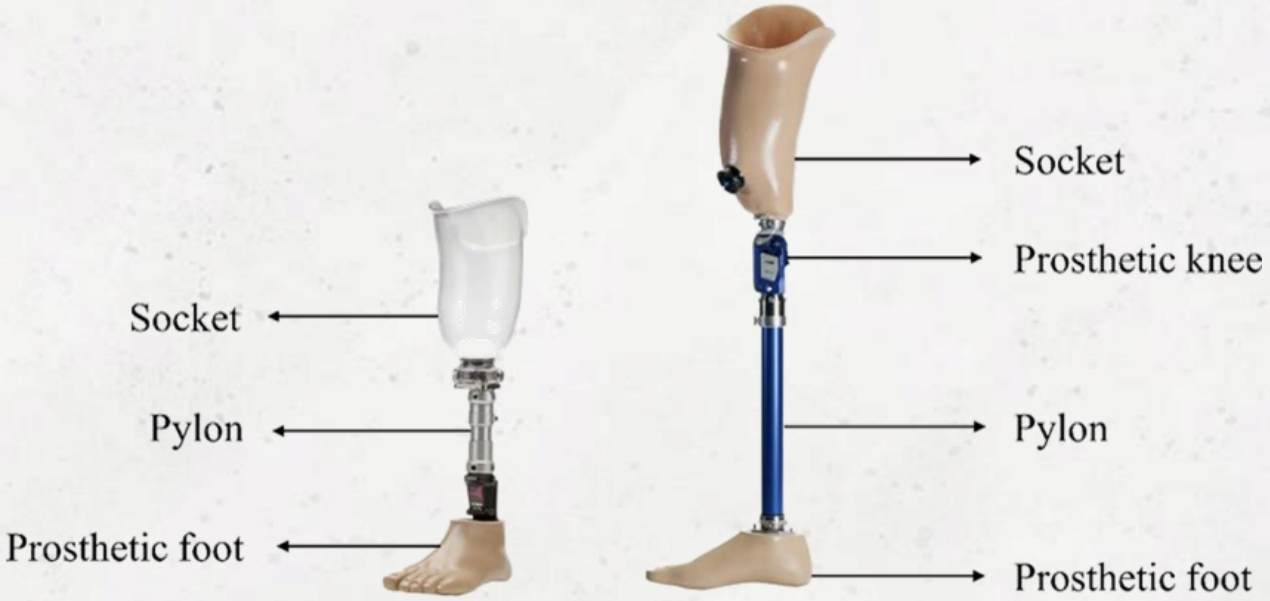
TT vs TF Prosthetics



A **prosthetic socket** is the custom-fitted part of a prosthesis that connects the residual limb to the device, ensuring comfort, stability, and efficient force transfer.

3

Weight Bearing in Prosthetics

Suspension means how the prosthesis is held onto the residual limb.

Common suspension systems:

Sleeve suction – uses vacuum and a sleeve for secure fit.

Pin/lock system – a liner with a pin locks into the socket.

Suction liner (silicone) – creates negative pressure to hold the limb.

Straps or belts – older method, less common now.

Good suspension = more stability, less movement inside socket, and better control.

4

Weight Bearing in Prosthetics

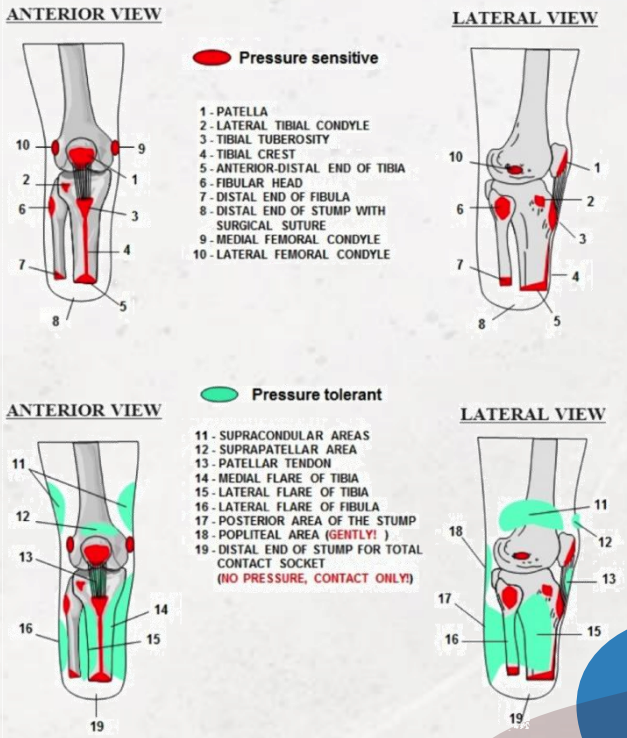
Weight bearing means how body weight is transferred to the prosthesis through the residual limb.

In above-knee (AK) prostheses:

Weight is distributed on the ischial tuberosity and surrounding soft tissues.

In below-knee (BK) prostheses:

Weight is mainly on the patellar tendon, medial tibial flare, and calf muscles, while pressure is relieved at sensitive areas (fibular head, tibial crest, distal end).



Proper weight distribution prevents pain, skin damage, and improves walking.

5

Shin Piece in Prosthetics

Exoskeletal (Crustacean Type)

A hard outer plastic shell, molded to the shape of the leg.

Advantages:

- Very durable.

Disadvantages:

- No alignment changes possible after final finishing.
- If damaged, the whole prosthesis usually needs replacement.

6

Shin Piece in Prosthetics

Endoskeletal (Modular Type)

A modular shin with a central pylon acting like the skeleton, covered by cosmetic foam shaped like a leg.

Advantages:

- Lighter in weight.
- More cosmetic (natural appearance).
- Alignment adjustments can be made even after finishing.
- Individual parts can be replaced without changing the whole prosthesis.

Disadvantages:

- Less durable than exoskeletal in very heavy-duty use.
- Requires more regular maintenance.

Osseointegration Prosthesis

Osseointegration Prosthesis: A type of limb prosthesis that is directly attached to the bone of the residual limb using a custom titanium implant, allowing better stability and control without a socket.

Bones where Osseointegration can be done:

- Femur (thigh bone)
- Tibia (shin bone)
- Humerus (upper arm)
- Radius and Ulna (forearm bones)

Osseointegration Prosthesis

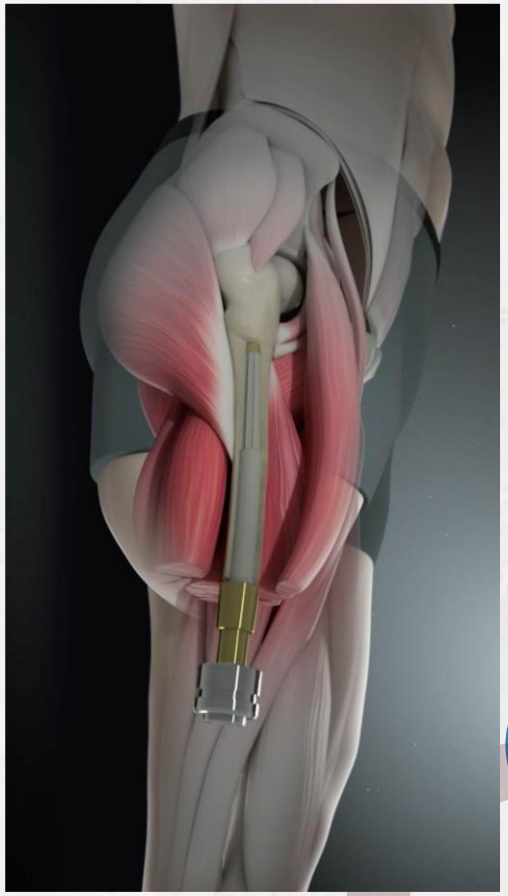
Advantages of Osseointegration Prosthesis

- **Better fit** – accommodates stump volume changes.
- **No skin irritation** – allows longer wear without pain.
- **Unrestricted clothing** – no bulky socket edges.
- **Stable prosthesis** – no daily adjustments needed.
- **Improved gait and mobility** – natural movement and range of motion.
- **Lighter and better weight perception.**
- **Reduced phantom limb pain.**
- **Cost-saving** – no frequent socket replacements.
- **Practical daily activities** – easier to sit, including on the toilet.

Challenges of Osseointegration Prosthesis

Functional / Daily Life

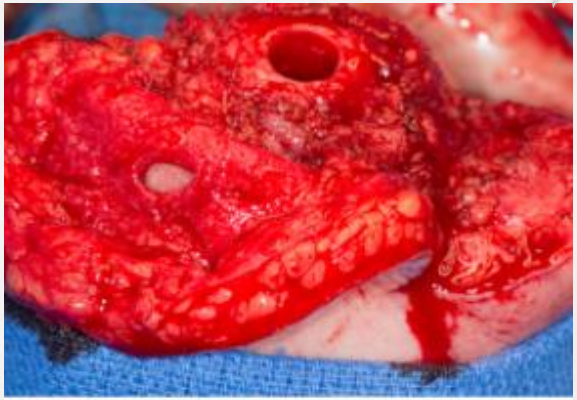
- Limited impact and torque tolerance.
- Swimming is limited.
- Visible metal abutment.
- Requires precise prosthetic alignment.
- Long rehabilitation; some implants no weight bearing for 6 months.
- High risk of deep infection (up to 41%).
- Less cosmetic appearance.

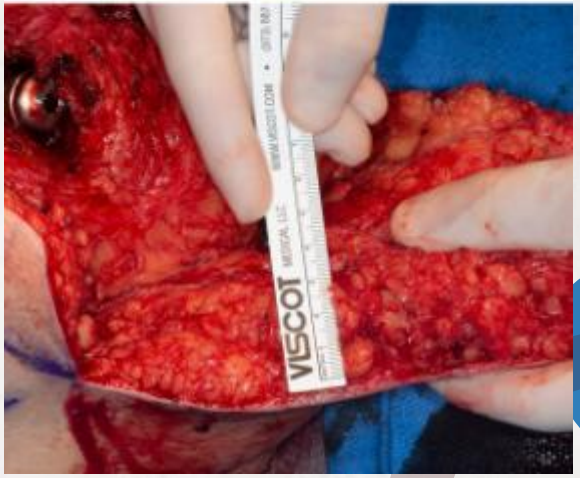


Challenges of Osseointegration Prosthesis

Surgical / Medical

- Implant or bone fractures; implant loosening.
- Risk of infection.
- Stoma care required.
- Pain during recovery or use.
- High cost of surgery and follow-up care.



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