Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

# PROSTHETICS I

## Asst. Lec. Muntadher Saleh Mahdi

## 2st term – Lecture 4

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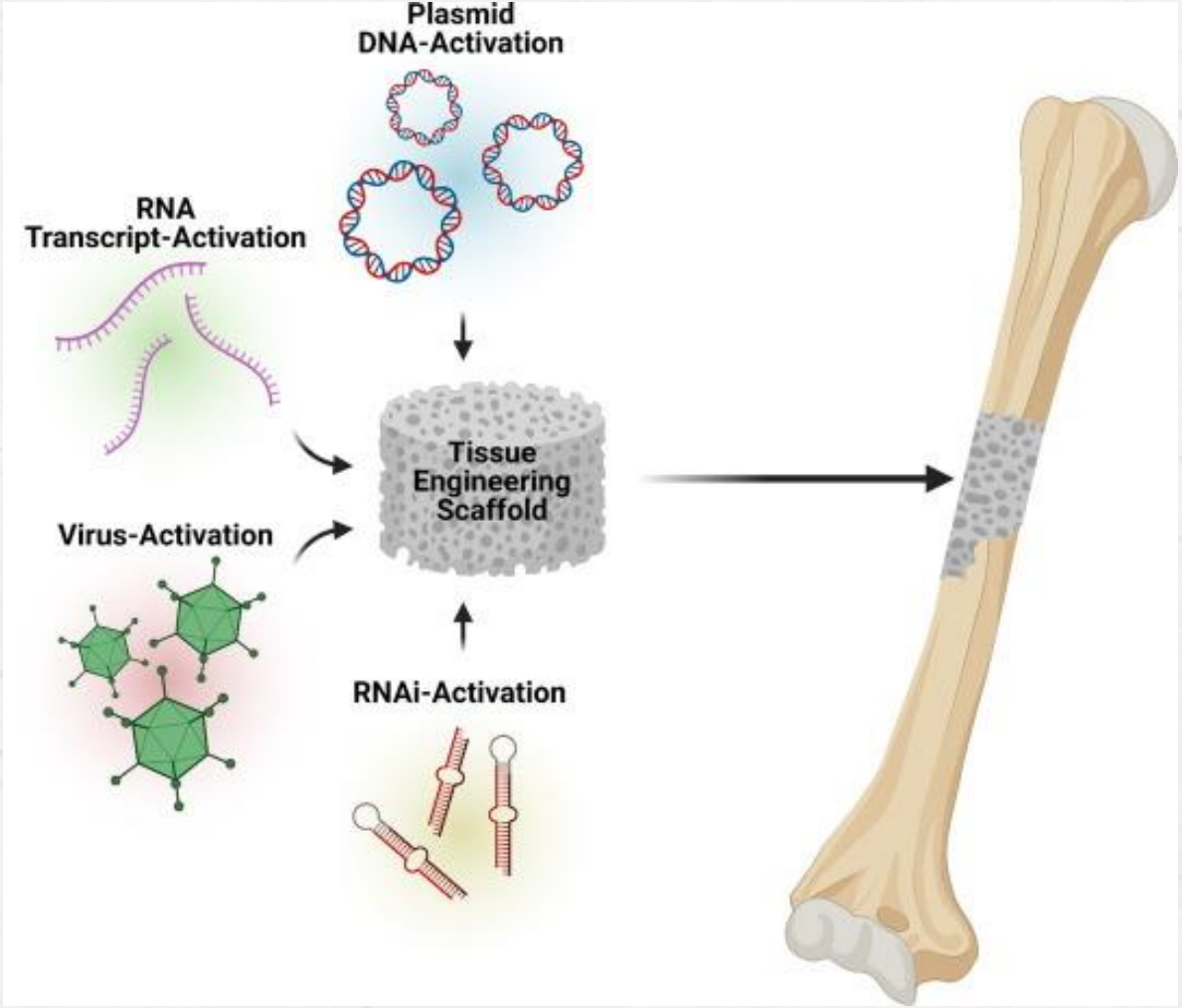
Muntadher.saleh.mahdi@uomus.edu.iq
UOMU013041


Plasmid
DNA-Activation
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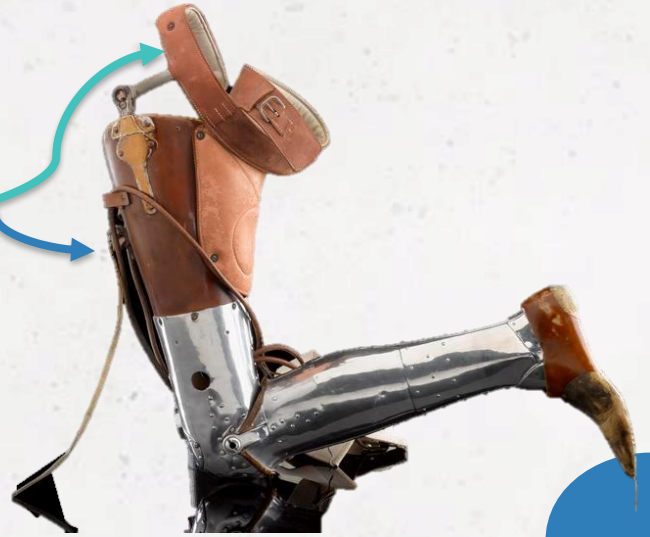
# Socket Designs in Prosthetics

## (1) Early Transtibial Prostheses: The "Plug-fit" Era

**Design:**

- Made from hollowed-out wood blocks with metal knee joints.
- Used leather thigh corsets for support.



# Socket Designs in Prosthetics

## (1) Early Transtibial Prostheses: The "Plug-fit" Era

**Characteristics:**

- Called "plug-fit" sockets because of their open-ended design.
- Used the thigh's conical shape to transfer weight and manage side forces.

**Limitations:**

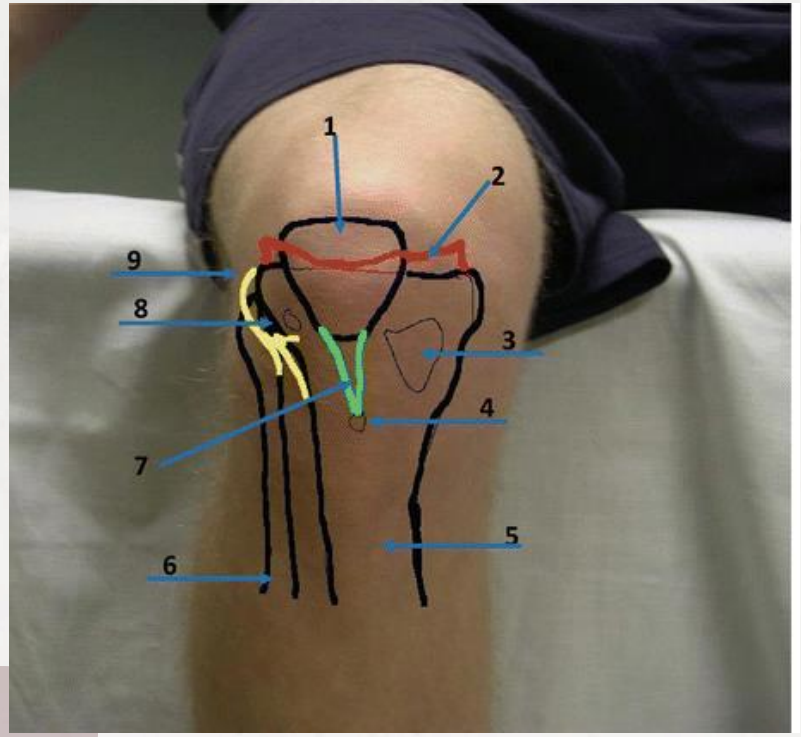
- The open design often caused painful swelling (edema) at the end of the limb.
- Added bulk from joints and corsets
  limited knee movement.

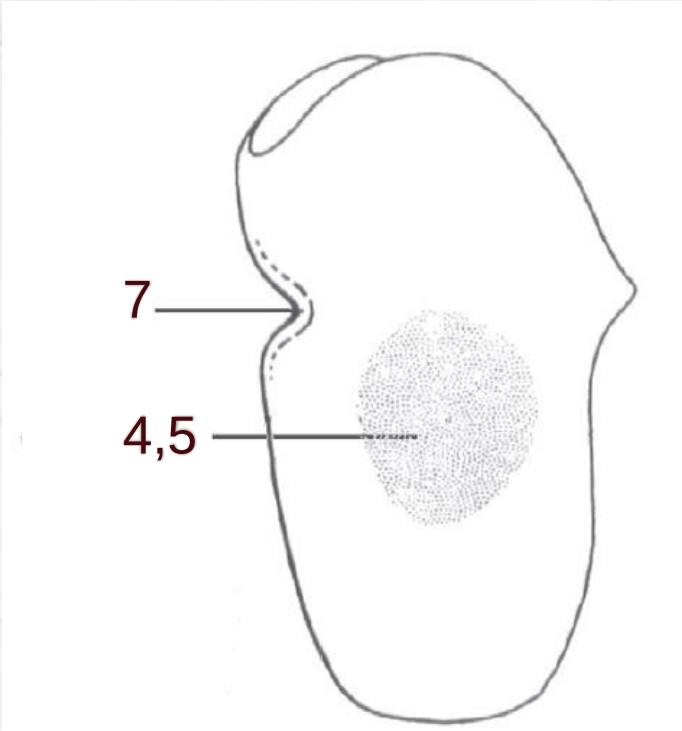
# (2) Patellar Tendon-Bearing Socket: A Revolutionary Turn

**Development:**

- Post-World War II focus on prosthetics led to innovations.
- In 1959, the Patellar Tendon-Bearing (PTB) socket was developed at a significant symposium by the University of California Biomechanics Laboratory.
- Designed to optimize weight distribution over the patellar tendon and medial tibial flare.

# (2) Patellar Tendon–Bearing Socket: A Revolutionary Turn



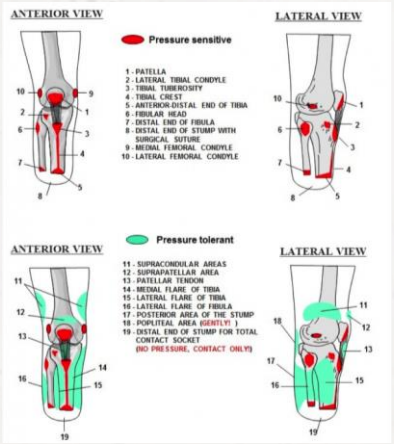

4,5- medial tibial flare
7- patellar tendon

# (2) Patellar Tendon-Bearing Socket: A Revolutionary Turn

**Characteristics:**

1- Eliminated the need for knee joints and thigh corsets by increasing the weight-bearing surface.

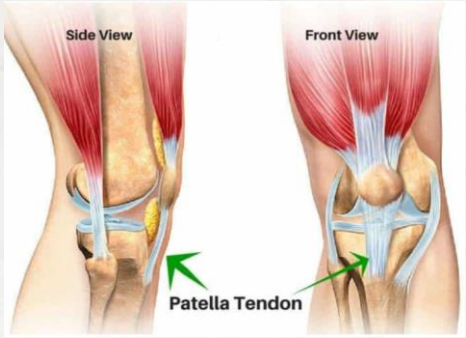
2- "Total contact" design reduced gaps between the limb and socket, evenly distributing weight.



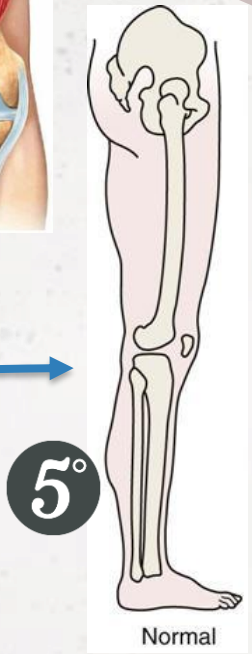
# (2) Patellar Tendon–Bearing Socket: A Revolutionary Turn

**Characteristics:**

3- Featured a patellar "bar" between the patella and tibial tubercle.




4- Socket positioned at approximately 5 degrees of knee flexion for effective weight-bearing.




5- Main weight-bearing areas: patellar tendon bar and medial tibial flare, ensuring a comfortable fit.

# (3) Total Surface-Bearing (TSB) Socket: The Pursuit of Greater Comfort

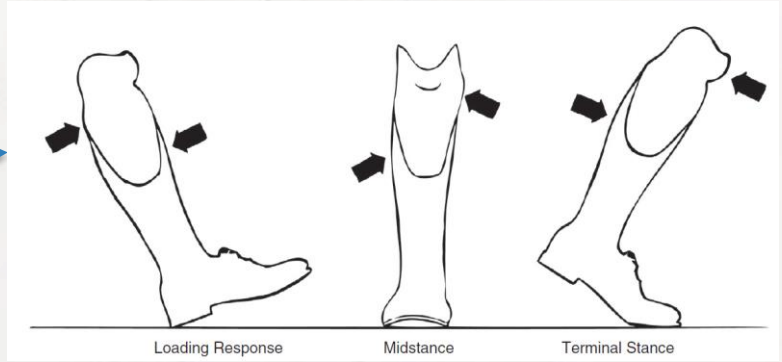
**Design Principles:**

- Distributes weight evenly across the entire limb's surface.

- Compresses soft tissue while relieving pressure on bony areas.

- Ensures uniform pressure throughout the limb.

- Adapts to changes during walking (gait cycle).

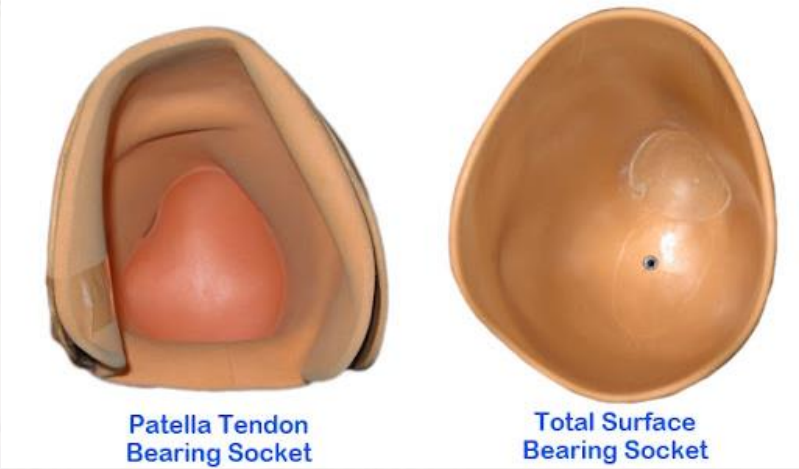


# (3) Total Surface-Bearing (TSB) Socket: The Pursuit of Greater Comfort

**Complexities:**

- Managing pressure changes to ensure comfort and prevent tissue damage.

- Considering different tissue types and their responses to pressure and movement.



# MCQ

**1) What era is known for the initial simple form of transtibial prostheses?**

a) Modern Era

b) Digital Era

c) "Plug-fit" Era

d) Post-War Era

**2) How were the early transtibial prostheses crafted?**

a) Using 3D printing

b) Hollowing out wood blocks

c) Forging metal joints

d) Molding plastic

# MCQ

**3) What additional components were used with early transtibial prostheses?**

a) Hydraulic knees

b) Elastic bands

c) Leather thigh corsets

d) Rubber straps

**4) Why were early transtibial sockets known as "plug-fit"?**

a) They were electrically powered

b) The limb fit like a plug into the socket

c) They had a removable plug

d) They used plug-shaped components

# MCQ

**5)What issue was common with early transtibial sockets' open-ended design?**

a) Increased flexibility

b) Painful edema

c) Enhanced mobility

d) Improved durability

**6) Which components added unnecessary bulk to early transtibial prostheses?**

a) Socket liners

b) Digital sensors

c) Joints and corsets

d) Carbon fibers

# MCQ

**7) What event brought attention to the prosthetic needs of veterans and led to innovation?**

a) World War I

b) World War II

c) Vietnam War

d) Korean War

**8) When was the Patellar Tendon-Bearing (PTB) socket developed?**

a) 1940

b) 1959

c) 1975

d) 1989

MCQ

**9) Where was the PTB socket developed?**

a) Harvard University

b) Stanford University

c) University of California Biomechanics Laboratory

d) MIT

**10) What was the primary focus of the PTB socket design?**

a) Aesthetic appeal

b) Weight distribution optimization

c) Cost reduction

d) Lightweight materials

# MCQ

**11) Which areas bear the primary pressure in the PTB socket design?**

a) Ankle and foot

b) Patellar tendon and medial tibial flare

c) Hip and thigh

d) Lower back and pelvis

**12) What was the goal of eliminating knee joints and thigh corsets in the PTB socket design?**

a) Enhance the weight-bearing surface area

b) Reduce production costs

c) Improve aesthetic design

d) Increase weight of the prosthesis

# MCQ

**13) What is meant by "total contact" in the PTB socket design?**

a) Socket is fully covered in soft material

b) Socket reduces voids, allowing weight distribution across any capable surface

c) Socket is open-ended

d) Socket has extra components

**14) Where is the patellar "bar" located in the PTB socket?**

a) Midway between the patella and tibial tubercle

b) Below the ankle joint

c) Above the hip

d) Along the shinbone

# MCQ

**15) At what degree of knee flexion is the PTB socket aligned?**

a) 0 degrees

b) 2 degrees

c) 5 degrees

d) 10 degrees

**16) What are the major weight-bearing zones in the PTB socket?**

a) Thigh and knee

b) Medial tibial flare and patellar tendon bar

c) Hip and lower back

d) Ankle and foot

# MCQ

**17) What socket design aimed for even weight distribution across the entire limb?**

a) Plug-fit socket

b) PTB socket

c) TSB socket

d) Single-axis socket

**18) What did the TSB socket optimize to improve comfort?**

a) The color of the socket

b) Compression of soft tissue while relieving bony prominences

c) Cost of materials

d) Thickness of the socket walls

# MCQ

**19) What is a primary goal of the TSB socket design?**

a) Ensuring uniform pressure across the limb

b) Increasing aesthetic appeal

c) Reducing weight of the prosthesis

d) Enhancing durability

**20) How does the TSB socket accommodate changes during the gait cycle?**

a) By using digital sensors

b) By designing for dynamic changes

c) By adding extra components

d) By using elastic materials

# MCQ

**21) What is a major complexity in designing TSB sockets?**

a) Reducing production time

b) Managing dynamic pressure variations

c) Enhancing the color

d) Increasing weight

**22) Why is it important to account for tissue properties in TSB socket design?**

a) To improve aesthetic appeal

b) Because tissue properties can differ significantly and respond differently to pressures and movements

c) To reduce the cost of production

d) To simplify the manufacturing process

MCQ

**23) What material was used to craft early transtibial prostheses?**

a) Carbon fiber

b) Wood blocks

c) Stainless steel

d) Plastic

**24) What historical event led to the development of the PTB socket?**

a) The Industrial Revolution

b) The end of World War II

c) The Great Depression

d) The Space Race

# MCQ

**25) What does the term "medial tibial flare" refer to in the context of prosthetics?**

a) A special type of knee joint

b) The flat surface on the inside of the upper tibia

c) The top part of the ankle

d) A component of the prosthetic foot

**26) How did early transtibial prostheses transfer weight and manage lateral forces?**

a) By using hydraulic systems

b) By leveraging the conical shape of the thigh

c) By adding extra padding

d) By increasing the socket length


Thank
you