PRINCIPLES OF PROSTHETICS AND ORTHOTICS

2nd year 1st semester

Lecture 8

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Early Prosthetic Management

Rehabilitation and Prosthetic Prescription for Transtibial Amputees

I. Postoperative Goals for Transtibial Amputees

For the transtibial amputee, postoperative management seeks to:

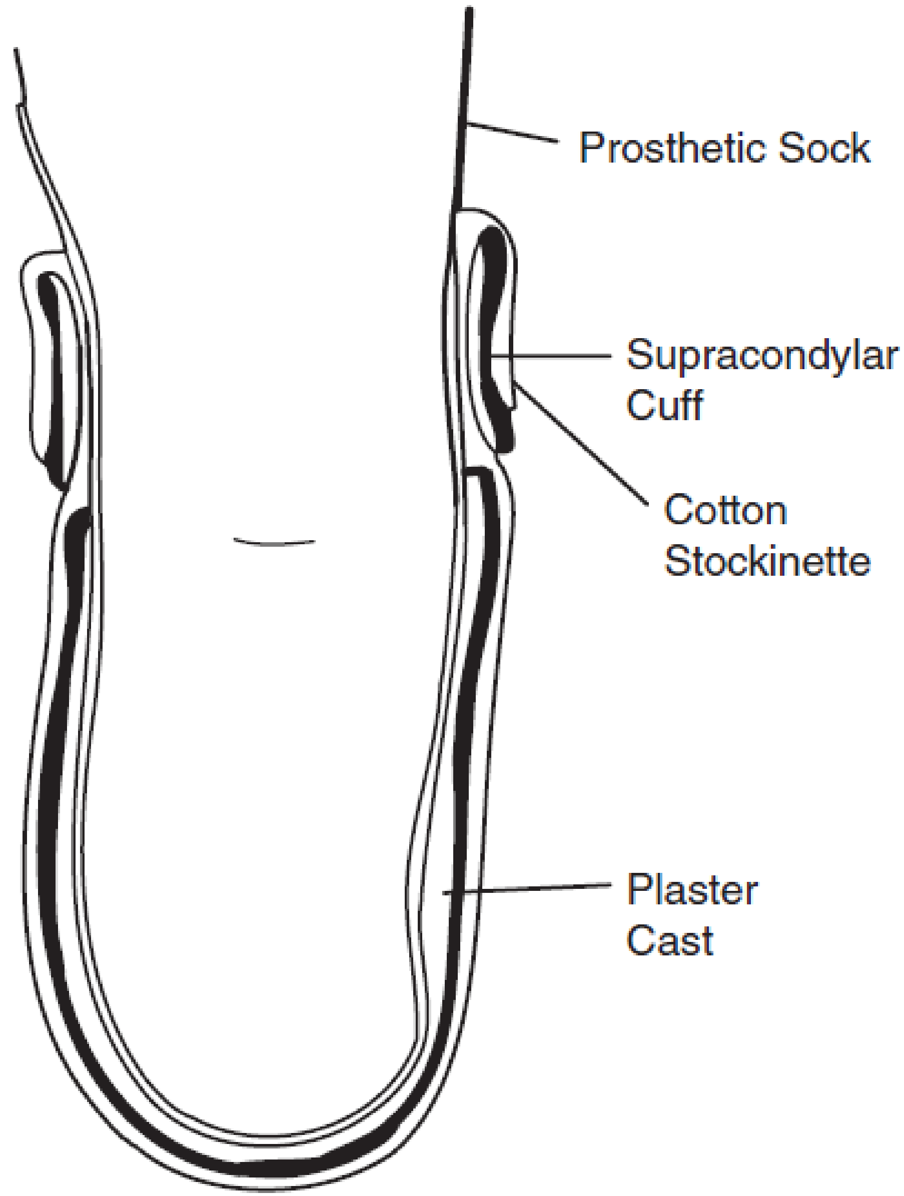
Maintain Full Range of Motion (ROM) This ensures flexibility and mobility at the hip and knee.

Facilitate Rapid Healing The swift healing of the suture line can expedite prosthetic fitting.

Maintain or Improve Cardio-Pulmonary Conditioning Optimal cardiovascular and pulmonary conditioning assists in overall recovery and preparation for a prosthesis.

Enhance Balance Both static and dynamic balance is crucial for functional mobility and safety.

Facilitate Functional Strength Strengthening the remaining musculature ensures optimal functionality with a prosthesis.


Prosthetic Sock
Supracondylar Cuff
Cotton Stockinette
Plaster Cast

II. Lifelong Rehabilitation of the Amputee

The provides a detailed breakdown of the lifelong rehabilitation journey of the amputee. This journey is classified into nine distinct stages, each with its specific goals. To name a few:

- **Preoperative phase** This involves assessing the patient’s medical and body condition, discussing surgical levels, and managing expectations.
- **Amputation surgery and wound dressing** Residual limb length determination, myoplastic closure, soft-tissue coverage, nerve handling, rigid dressing application, limb reconstruction.
- **Preprosthetic** Wound healing, pain control, proximal body motion, emotional support, phantom limb discussion.
- **Acute postsurgical phase** Focuses on limb shaping, muscle strengthening, and restoring the patient's sense of control.
- **Vocational rehabilitation** Ensures the amputee is equipped and trained for vocational activities, further education needs, or job modifications.

III. Classification of Functional Potential of Patients with Lower-Limb Amputations

The *K-Level Medicare Functional Classification Level* classifies patients based on their ability and potential to use a prosthesis:

- **K0** No potential for ambulation.
- **K1** Ability to ambulate on level surfaces.
- **K2** Can traverse low-level environmental barriers.
- **K3** Capable of variable cadence ambulation, overcoming most environmental barriers.
- **K4** For those who exceed basic ambulation skills, typically seen in active adults, children, or athletes.

IV. Complications and Prosthetic Fitting

Post-surgical complications like the loss of full knee extension can delay prosthetic fitting. A permanent joint contracture can further alter the prosthetic fitting process. Clinical teams, therefore, advocate for rigid dressings that ensure the knee remains in full extension.

Immediate postoperative prostheses (IPOP) can facilitate early mobility. However, care must be taken as full weight bearing can cause damage to the healing surgical construct.

V. Prosthetic Prescription

A prosthetic prescription describes all features of the completed prosthesis. This includes:

Socket Design The main interface between the limb and the prosthesis, it's vital for the proper transfer of forces during movement.

Skin-Socket Interface & Suspension Strategy These elements are interdependent. For instance, a soft liner can serve as both an interface and a suspension for the prosthesis.

Additional Modular Components These can include feet, shock absorbers, and torque absorbers.

Socket Designs in Prosthetics

1. Early Transtibial Prostheses: The "Plug-fit" Era

In the initial phases, transtibial prostheses took a simple form. They were crafted by hollowing out wood blocks, with metal single-axis knee joints. These were then supplemented with leather thigh corsets.

Characteristics and Limitations

- Known as "plug-fit" sockets due to their open-ended design, allowing the limb to fit like a plug.
- Leveraged the conical shape of the thigh to transfer weight and mediate lateral forces.
- The lack of contact on the limb's distal end often led to painful edema.
- The joints and corset added unnecessary bulk, limiting knee movement.

2. Patellar Tendon-Bearing Socket: A Revolutionary Turn

The aftermath of World War II brought attention to the prosthetic needs of veterans. It set the stage for exploration and innovation.

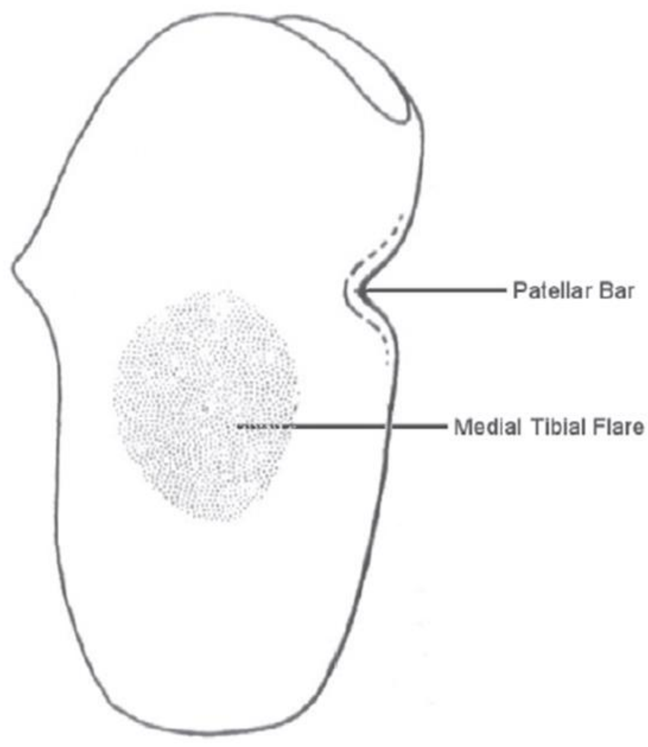
Development

- In 1959, the University of California Biomechanics Laboratory held a significant symposium. The outcome? The Patellar Tendon-Bearing (PTB) socket.
- With a history spanning over five decades, the PTB design optimized weight distribution. The primary areas bearing the pressure were the patellar tendon and medial tibial flare.

Characteristics

- Aimed to eliminate the requirement for knee joints and thigh corsets by enhancing the weight-bearing surface area.
- Defined as "total contact", it reduced voids between the limb and socket, allowing weight distribution across any capable surface.

- It incorporated a patellar "bar" situated midway between the patella and tibial tubercle.
- The socket aligned in a knee flexion of approximately 5 degrees, facilitating the bar as a weight-bearing surface.
- The medial tibial flare and the patellar tendon bar became major weight-bearing zones, offering an effective and comfortable fit.



3. Total Surface-Bearing Socket: The Pursuit of Greater Comfort

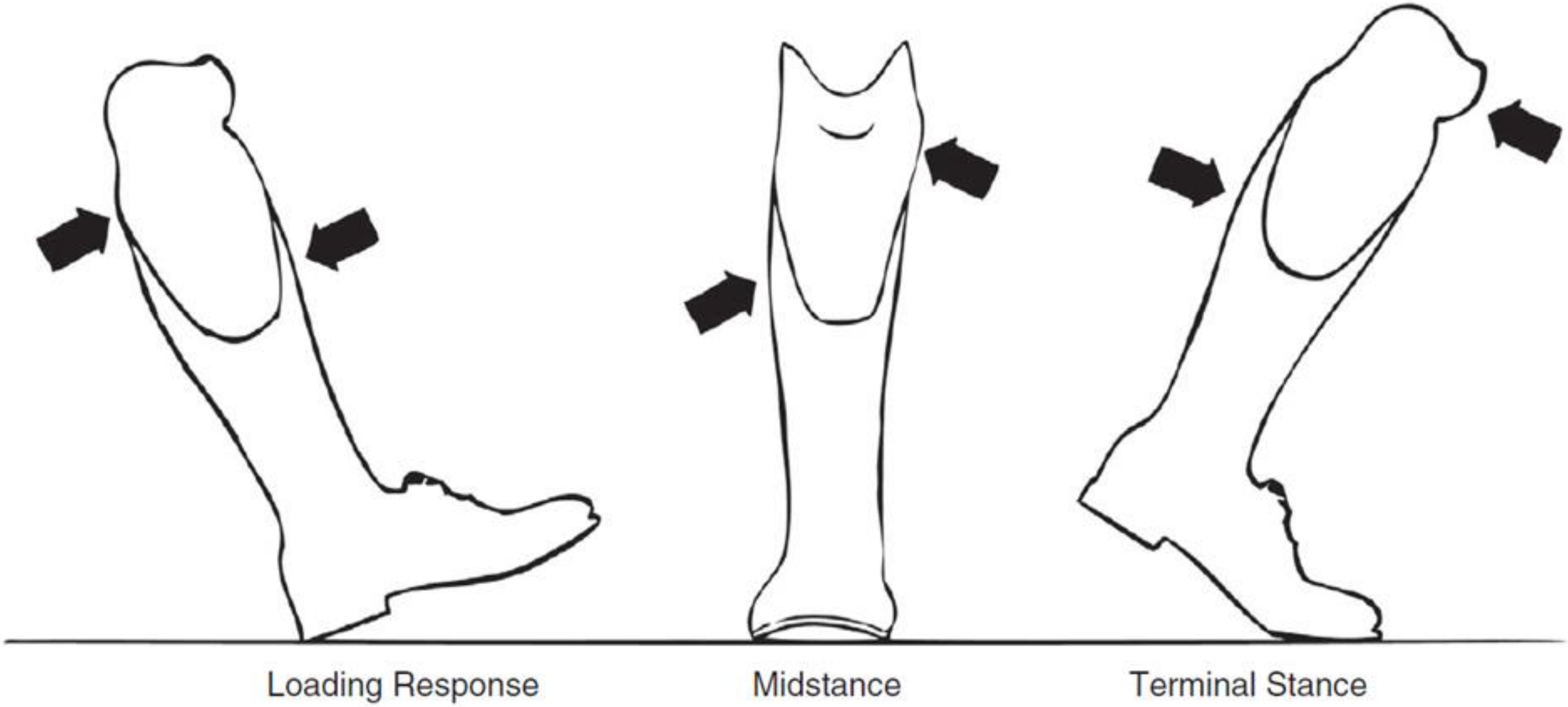
With continuous advancements, the TSB socket emerged. It aimed at even distribution of weight-bearing load across the entire limb's surface.

Design Principles

- Optimized the compression of soft tissue while providing relief to bony prominences.
- Aimed to ensure uniform pressure across the limb.
- The design accommodated dynamic changes during the gait cycle.

Complexities

- Anticipating the dynamic pressure variations to ensure comfort and protection against tissue damage.
- Accounting for tissue properties, as they can differ significantly and respond differently to pressures and movements.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