Prosthesis after Amputations

Learning objectives

- Post operative and preprosthetic care
- Overview of prosthesis available for amputees
- Basics of evaluation of patients
- Prosthetic prescription

Postoperative and Preprosthetic Care

Individuals with New Amputation

- Likely to experience acute surgical pain
- Grieving the loss of his or her limb- requires significant psychological adjustment.

Early Goals

- Healing of suture line and overall health status.
- Enhancing early single limb mobility and self -care
- Control of edema and pain management
- Optimal shaping of the residual limb for prosthetic wear
- Assessment of the potential for prosthesis

Assessing Residual Limb Length and Volume

- Important determinants of readiness for prosthetic use, as well as socket design
- Stump length needs to be documented
- Limb volume and shape of a transtibial residual limb is assessed by taking successive circumferential measures

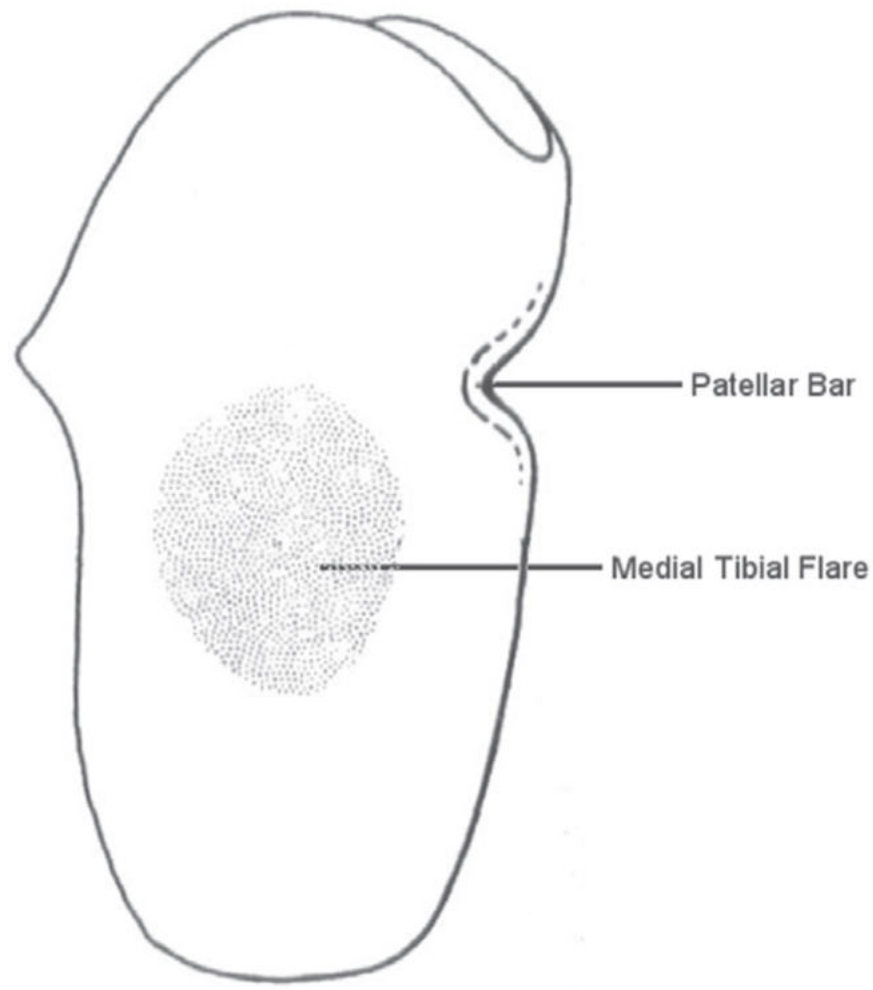
REHABILITATION

- **Prosthesis**
  - **Conventional- Cheaper to produce but are heavy.**
  - **Endolite - composite carbon fiber is used.**
- **Has to be custom made and tailored to be useful to the patient.**
- **A large number of patients do not use their prosthesis if it is cumbersome or heavy**

Immediate postoperative prosthesis

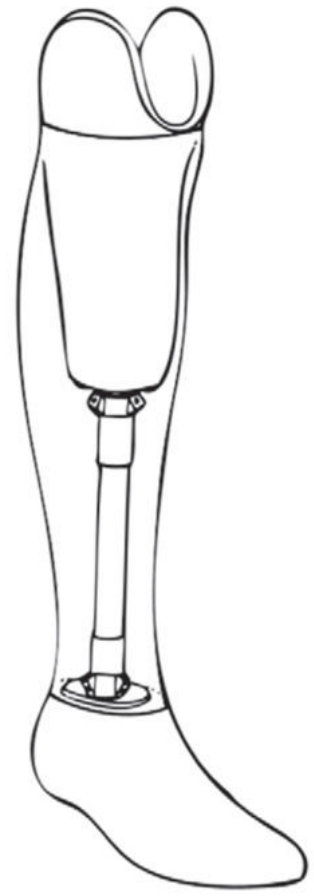
The socket

- Interface between the residual limb and the prosthesis
- All the forces from the ground during gait are transferred to the limb
- Forces from the limb needed to control the motion of the prosthesis are transferred to the prosthesis



Extra component that is mounted directly under the socket to reduce amount of torque and shock

socket and pylon are concealed to within a cosmetic cover.



Potential of Use

Level K 0

- No potential to ambulate or transfer safely with assistance .

Level K1

- Potential to use a prosthesis for ambulation on level surfaces at fixed cadence.
- Limited and unlimited household ambulator.

K1- Solid-ankle, cushion-heel (SACH) foot

- Most basic prosthetic foot available.
- Immovable ankle and soft heel give it the ability to absorb the impact of heel strike
- Provides minimal energy return.
- For limited functional ability and potential to ambulate.

Level K 2

- Potential for ambulation with the ability to traverse low-level environmental barriers such as curbs, stairs or uneven surfaces.
- Typical of the limited community ambulator
- lightweight, have a flexible keel, a multiaxial ankle, and provide some energy return

Level K 3

- Potential for ambulation with variable cadence.
- Ability to traverse most environmental barriers
- Have vocational, therapeutic, or exercise activity beyond simple locomotion
- ~~Hydraulic ankle/Microprocessor~~

Level K 4

- Potential for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress, or energy levels.
- Typical of the child, active adult, or athlete.

Selection of Foot- Importance?

- Ground reaction forces are transmitted
- Can be damaging to the person's residual limb, knee, hip, or back.
- Proper prosthesis - expand their capabilities and motivation dramatically and allows them to improve range of activities
- At least design for one level above

A J- 20 years old

- A soldier, was when he endured traumatic injuries after driving his motor vehicle over a landmine
- Below knee amputee
- Determined to run again and plans to enrol at a local college

Which foot does he require?

- K1
- K2
- K3
- K4

Answer – K3 for daily use and K4 for running

Prolite System

- High grade Aluminium System.
- Choice of bonded pyramid ankle adaptor or bonded light duty multi-flex ankle available.
- Universally popular pyramid alignment.
- Polypropylene or laminated socket adaptor.
- Structurally tested for up to 100 kgs user weight.

Lower Limb Prostheses - Below Knee Systems

Standard System

- Trusted Endolite carbon fibre components.
- Highly functional ankle.
- Superior quality, Light weight, Proven strength.
- Strong quality engineering.
- Natural function.
- Multi-flex ankle provides natural motion in each plane.

Atlas System

- Simple and sophisticated design.
- Injection moulded, advanced reinforced thermoplastic.
- Foot based on SACH principle.
- Water proof.
- Suitable for use in water & rough terrain.
- Light weight.
- Cost effective.

T T Pylon

- Torsional & Telescopic pylon.
- Increases wearer comfort by limiting stress at socket.
- Absorbs vertical shock and torque stresses.
- Component stiffness can be varied to match user preference.
- Provides both axial compression and torque absorption.
- Ensures more comfort, more energy return and greater reliability.
- Movement of 13 mm ensures smooth vertical deceleration at heel strike.

Jaipur foot BK Prosthesis

- The shank is fabricated from locally manufactured, durable, high-quality, high-density polyethylene pipes (HDPE).
- The socket design used is either total contact, which is vacuum-formed using a polypropylene sheet, or open-ended, using HDPE.
- This custom-made shank / socket is fitted with the Jaipur Foot.

- Dorsi-flexion,
- Inversion / Eversion
- Transverse rotation
- Enables amputees to walk, run, trek, swim, squat, sit cross legged,
- walk on uneven terrain, work in wet muddy fields

AMPUTATIONS OF THE HIP AND PELVIS

- **Through the femur from 5cm distal to the lesser trochanter .**
- **Disarticulations of the hip.**
- **Hindquarter amputations.**

AMPUTATIONS OF THE UPPER LIMB

- Hand
  - **Preserve as much function as is possible.**
  - **Salvage procedure**
  - **Preserve length**
  - **Mobility and sensibility**
  - **Functions of pinch and grasp are very important.**

AMPUTATIONS OF THE UPPER LIMB

- **Wrist Disarticulations-** Separate the carpal bones from the radius
- **Forearm amputations-** substance of the radius and ulna
- **Elbow disarticulations-** Humerus is preserved
- **Arm amputations-** 30% of humeral length
- **Disarticulation of shoulder-** less than 30% of humerus
- **forequarter amputation- Shoulder and scapula**

AMPUTATIONS OF THE UPPER LIMB

- **Wrist amputations-preserve supination and pronation may be transcarpal or disarticulation through wrist.**
- **Transcarpal – Flexion and extension of radiocarpal joints should be preserved**
- **Can be fitted with thin prosthetic wrist units.**
- **Long lever arm increases the ease and power to use the prosthesis.**

FOREARM AMPUTATIONS

- **Preserve as much length as possible.**
- **A small stump is preferable to a through elbow**
- **Can be fitted with a good prosthesis.**

DISARTICULATION ELBOW

- **Broad flair can be firmly grasped by the prosthesis socket**
- **Humeral rotation can be transmitted to the prosthesis.**
- **Preferable to a more proximal amputation**

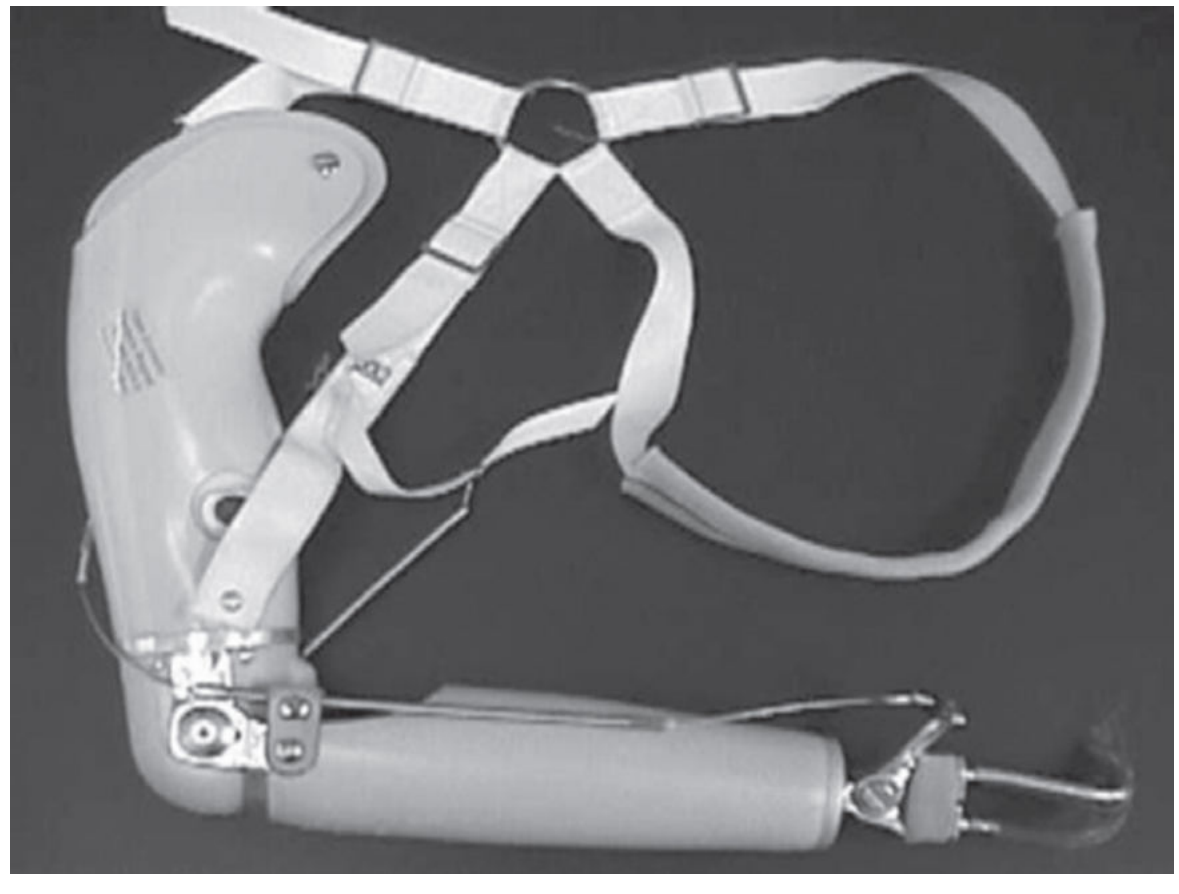
ARM AMPUTATIONS

- **Trans condylar after prosthetic fitting function as elbow disarticulations**
- **Proximal level amputations require and inside elbow lock mechanism and an elbow turntable**
- **Preserving the proximal humerus is valuable-cosmetically the contour of the shoulder is preserved and the grip of the socket is better .**

SHOULDER AMPUTATIONS

- **Surgical neck**
- **Disarticulation of the shoulder**
- **Forequarter amputation**
- **With prosthesis function is so severely impaired that the prosthesis can only be used as a holding device when performing activities with both hands.**

Conventional (body-powered) transhumeral prosthesis



Upper Limb Prostheses

Cosmetic Hands

- These products are intended for restoration of body image.
- For infants a range of cosmetic glove filled with foam are produced.
- These have no internal structure and are intended to assist balance and the ability to hold objects against the body.
- These are designed for dress purpose only and are intended for use with cosmetic gloves.

Mechanical Hands

- Wide range is available.
- Two sizes are available for children covering the age range from 2-8 years.
- A further four sizes provide hands suitable for juvenile and adults.

Myo Electric Hand

- Available in five sizes.
- Combines optimum control funtion with a good cosmetic restoration.
- Electronics are located within a rugged chassis and the hand is complete with a soft foam cosmesis.
- Electronics provide efficient control and power conservation.

Terminal Devices

PROSTHETIC PRESCRIPTION

- socket design
- skin-socket interface
- suspension strategy
- Additional modular components

SUMMARY

- Prosthetic rehabilitation of persons with amputations is both challenging and rewarding.
- Success is often difficult to measure purely in clinical terms
- Maximizing individual functional potential
- Appropriate amount of technology to assure acceptable outcomes are highly predictive of success.