PROSTHESIS

Lec#7-8

PROSTHESIS

- Derived from Ancient Greek prósthesis, "addition, application, attachment“
- replaces a missing body part,
- which may be lost through trauma, disease, or congenital conditions.

DONE BY....

- Prosthetic amputee rehabilitation is coordinated by an inter-disciplinary team of health care professionals including physiatrists and prosthetists.

PROSTHETIC DEVICE

- designed according to the patient's appearance and functional needs.
- need to choose between an aesthetic functional device,
- a myoelectric device,
- a body-powered device,
- or an activity specific device.
- Depending on the patient's economical capabilities, she/he may have the option to choose more than one device.

TYPES

- Craniofacial prostheses
- Prostheses of the neck
- Somato prostheses
- Limb Prostheses

CRANIOFACIAL PROSTHESES

includes

- intra-oral and
- extra-oral prostheses.

EXTRA-ORAL PROSTHESES

are further divided into

- hemifacial,
- auricular (ear),
- nasal,
- orbital and ocular.

INTRA-ORAL PROSTHESES

include dental prostheses such as

- dentures,
- obturators,
- and dental implants.

PROSTHESES OF THE NECK

include larynx substitutes,

- trachea and
- upper esophageal replacements.

SOMATO PROSTHESES

include breast prostheses

- which may be either single or bilateral,
- full breast devices or
- nipple prostheses.

LIMB PROSTHESES

include

- upper and
- lower extremity prostheses.

UPPER EXTREMITY PROSTHESES

used at varying levels of amputation:

- shoulder disarticulation,
- **transhumeral prosthesis**,
- elbow disarticulation,
- **transradial prosthesis**,
- wrist disarticulation,
- full hand,
- partial hand,
- finger,
- partial finger.

TRANSHUMERAL PROSTHESIS

- referred as a "AE" or above the elbow prosthesis
- artificial limb that replaces an arm missing above the elbow
- experience some of associated with the movement of the elbow
- makes mimicking the correct motion with an artificial limb very difficult

TRANSRADIAL PROSTHESIS

- referred to as a "BE" or below elbow prosthesis
- artificial limb that replaces an arm missing below the elbow
- Two main types
- **Cable operated limbs**
- **myoelectric arms**

CABLE OPERATED LIMBS

- work by attaching a harness and
- cable around the opposite shoulder of the damaged arm.

MYOELECTRIC ARMS

- work by sensing,
- via electrodes,
- muscles in the upper arm moves, causing an artificial hand to open or close.

LOWER EXTREMITY

Lower extremity prosthetics describes artificially replaced limbs located at the hip level or lower.

- include hip disarticulation,
- **transfemoral prosthesis,**
- knee disarticulation,
- **transtibial prosthesis,**
- symes,
- foot,
- partial foot,
- and toe.

TRANSFEMORAL

- referred to as an "AK" or above the knee prosthesis
- artificial limb that replaces a leg missing above the knee.
- difficult time regaining normal movement
- use approximately 80% more energy to walk than a person with two whole legs
- due to the complexities in movement associated with the knee

TRANSTIBIAL

- referred to as a "BK" or below the knee prosthesis
- artificial limb that replaces a leg missing below the knee
- able to regain normal movement more readily

CURRENT TECHNOLOGY/MANUFACTURING

- carbon fiber (stronger and lighter),
- important for transfemoral amputees,
- artificial limbs to look much more realistic,

MYOELECTRIC LIMBS

- use of electronics has become very common in artificial limbs
- control the limbs
- common than cable operated limbs
- signals are picked up by electrodes

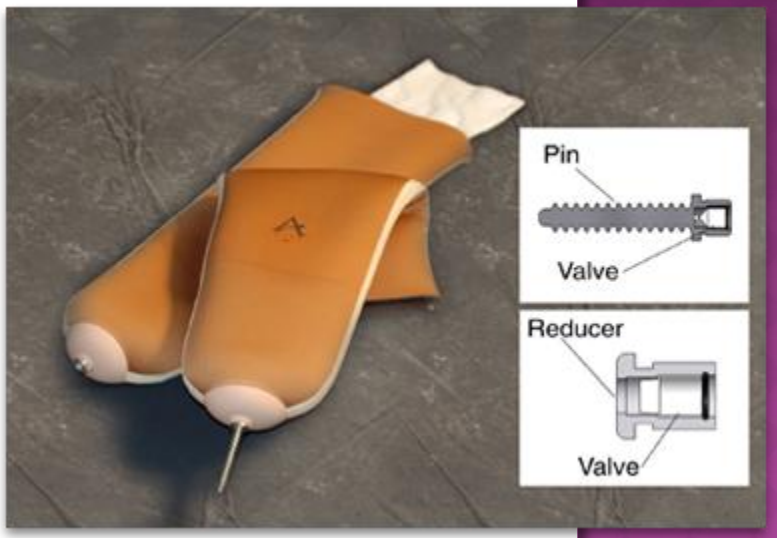
MYOELECTRIC ARMS

- work by sensing,
- electrodes,
- muscles in the upper arm moves, causing an artificial hand to open or close.

- Most modern artificial limbs are attached to the stump of the amputee by belts and cuffs or by suction.
- The stump either directly fits into a socket on the prosthetic, or—more commonly today—a liner is used that then is fixed to the socket either by vacuum (suction sockets) or a pin lock.

LINERS

- soft
- create a far better suction fit than hard sockets
- standard sizes, mostly with a circular (round) cross section
- stump shape



PROBLEM WITH THE STUMP AND SOCKET

- attachment is that a bad fit will reduce the area of contact between the stump and socket or liner, and increase pockets between stump skin and socket or liner
- Pressure then is higher, which can be painful.
- Air pockets can allow sweat to accumulate that can soften the skin
- cause for itchy skin rashes
- it can cause breakdown of the skin.

BODY-POWERED ARMS

- Current high tech, allows body powered arms to weigh around half to only a third of the weight that a myoelectric arm has.

VOLUNTARY OPENING AND VOLUNTARY CLOSING

- Two types of body powered systems exist,
- voluntary opening
- voluntary closing
- "split hook" prostheses operate with a voluntary opening type.

TERMINAL DEVICES

Terminal devices contain

- hooks,
- prehensors,
- hands or other devices.

HOOKS

- simple,
- convenient,
- light,
- robust,
- versatile and
- relatively affordable.

HANDS

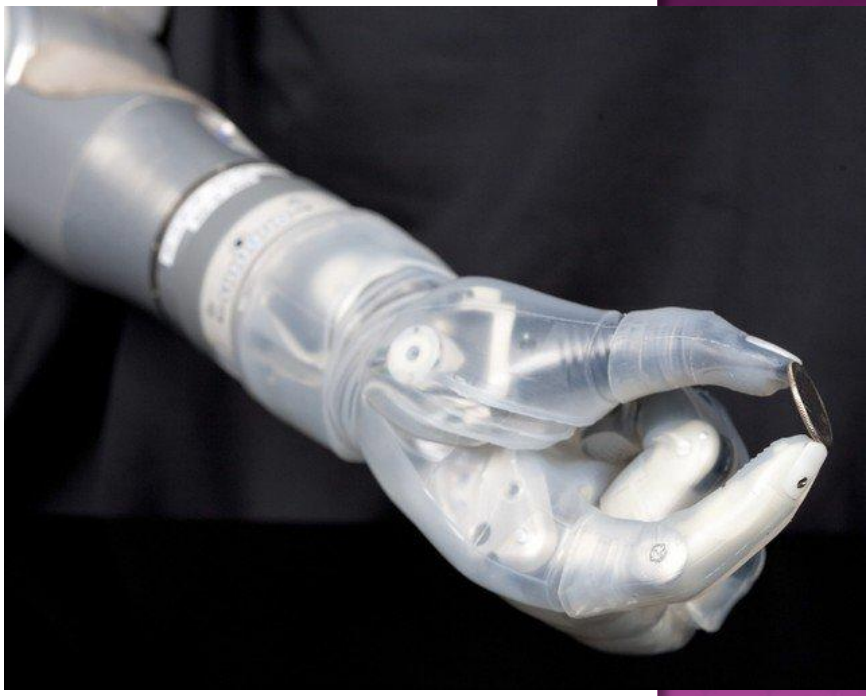
- available in both voluntary opening and voluntary closing
- more complex mechanics
- cosmetic glove covering
- require large activation force
- may be uncomfortable.

ROBOTIC PROSTHESES

- uses the sensors that monitor its user's motion. It has microprocessors programmed to use this data to predict what the person is trying to do and operate the device in ways that facilitate these movements.

ROBOTIC ARMS

- allow to perform delicate tasks and movements
- manipulating keys, holding a grape, cleaning, cooking etc



ROBOTIC LEGS

- Robotic legs have also been developed: targeted to replace the wheelchair.
- It is marketed as a "robotic pants".

DIRECT BONE ATTACHMENT / OSSEO INTEGRATION

- method of attaching the artificial limb to the body. This method is also sometimes referred to as exoprosthesis (attaching an artificial limb to the bone), or endo-exoprosthesis.

Robotic

- Robotic or motor-powered prosthetic limbs make use of microprocessors to carry out the movements intended. They are pre-programmed with commands that allow the movements of some digits and the elbow.

Body Powered

- This type of prosthetic is powered solely by body movements, they are very durable and versatile. The opposite arm of the amputee is attached to the prosthetic by a strap. When the opposite arm moves, the strap moves, and this causes the prosthetic to move.

Brain-Controlled

- Brain-controlled prosthetics attempt to sense electrical signals sent from the brain to the microprocessor in the prosthetic arm. These prosthetics are not actually connected to the brain. This technology is very inaccurate.

Myoelectric

- Myoelectric prosthetics utilize electrical signals from muscle contraction to determine the movement the amputee desires to make. Contracting a certain muscle or muscle group will trigger a certain movement. This type of prosthetic requires much thought to execute even the simplest of movements.

DISADVANTAGES

Robotic

- The amputee has to activate each command manually.
- Water and electricity don't mix.
- The prosthetic is very heavy because the power source adds extra weight to the arm.
- The arm has to be charged to work.

Body Powered

- The arm only moves accurately when the wearer is standing upright.
- Abnormal body movements are required to make the prosthetic move.
- Weaker amputees may not be able to make the arm move.

Brain-Controlled

- It is hard for the prosthetic to sense the signals.
- They are not very accurate.
- These prosthetics require a heavy power source to operate.

Myoelectric

- These are very expensive.
- The amputee has to learn the trigger movements.
- The arm requires different attachments for different jobs.
- Myoelectric arms are heavy.
- Water and electricity don't mix.

THANKS