

Introduction to Prosthesis & Orthotics



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Orthotics

- The word **orthosis** derives from the Greek expression “making straight.”
- An **orthosis** is an orthopedic appliance used to support, align, prevent, or correct deformities of a body part or improve the function of movable parts of the body.
- The term brace is synonymous with orthosis.
- A splint is a temporary orthosis.

Orthotics

- Orthoses range from a **prefabricated** wrist splint to a **custom fabricated** reciprocating gait orthosis.
- Orthoses are tools used to help the patient become more independent and functional with tasks such as ADLs and ambulation.
- Selecting the proper device is crucial in providing the patient with optimal support, results, care, and outcome results.

Orthotics

- An **orthotist** is the health care practitioner who designs, fabricates, and fits patients with orthoses for any portion of the body.
- A **pedorthist** designs, fabricates, and fits patients with foot orthoses.
- **Orthotics** refers to the field of knowledge relating to orthoses and their use.

Orthotics

- Orthoses may be part of the treatment plan for patients who fall into a wide range of preferred practice patterns.
- These patients may have:
 - Musculoskeletal disorders, such as fractures, metatarsalgia, and scoliosis.
 - Neuromuscular disorders, including poliomyelitis, and stroke.
 - Integumentary disorders, particularly burns.
 - Cardiopulmonary disorders, such as limitation in vital capacity after spinal cord injury.

Orthotics

- Orthoses are often helpful for patients with weakness, postural abnormalities, and poor control of motion; and lower extremity orthoses are commonly indicated for individuals with gait deviations.

Orthosis Function

- Orthoses apply forces to the body to resist motion, assist motion or transfer force from one area to another.
 - A trunk orthosis with pads strategically placed to resist motion may be used to prevent a thoracic scoliosis from increasing.
 - A person with quadriceps paralysis may wear a knee-ankle-foot orthosis (KAFO) that has a mechanical lock to resist knee flexion and maintain knee extension.

Orthosis Function

- Motion resistance is sometimes referred to as support. Two closely related functions are maintaining a particular alignment and protecting a body part from unwanted motion.
 - A KAFO may prevent the knee of an older adult with post-polio syndrome from hyperextending.
 - A wrist-hand orthosis (WHO) may protect the joints of a patient with rheumatoid arthritis from pain and development of deformity.

Orthosis Function

- The use of **an orthosis to assist motion** is illustrated by an ankle-foot orthosis (AFO) that assists dorsiflexion in the patient with foot drop. This orthosis may have a plastic or metal spring at the ankle area that compensates for the impairment by assisting ankle dorsiflexion during swing phase of gait.
- A foot orthosis that shifts load from subluxed metatarsal heads to the heel is an example of **an orthosis that transfers force**.

Design Factors

1) Comfort

- Regardless of its purpose, an orthosis must be comfortable.
- An uncomfortable orthosis will probably not be worn and, if it is worn, it may cause skin irritation or breakdown, and may injure underlying structures.
- A major element in ensuring comfort is minimizing pressure by maximizing the area covered by the orthosis.

Design Factors

1) Comfort

- The amount of subcutaneous fat and muscle tissue also influences orthotic fit and comfort. Therefore, the individual with atrophy will need an orthosis that covers a wider area than the person who has a normal amount of soft tissue.
- Covering a large portion of the body can also cause some discomfort because the skin under the orthosis cannot readily dissipate heat or perspiration.

Design Factors

1) Comfort

- Another way to improve comfort is to make the orthosis longer to provide greater leverage for the longitudinal segments of the orthosis to apply force through, but the orthosis must not be so long that it impinges on adjacent joints.

Design Factors

1) Comfort

- Some portion of an orthosis always touches the body. This contact should be snug but not constricting.
- An overly tight band will compress superficial blood vessels, causing pain and potentially tissue breakdown.
- Equally important, the contact should not be too loose, as this will likely result in friction with movement and may thus also cause skin irritation and breakdown.

Design Factors

1) Comfort

- For example, a loose calf band on an AFO will rub on the calf and irritate the skin as the individual passes through the stance phase of gait.

Design Factors

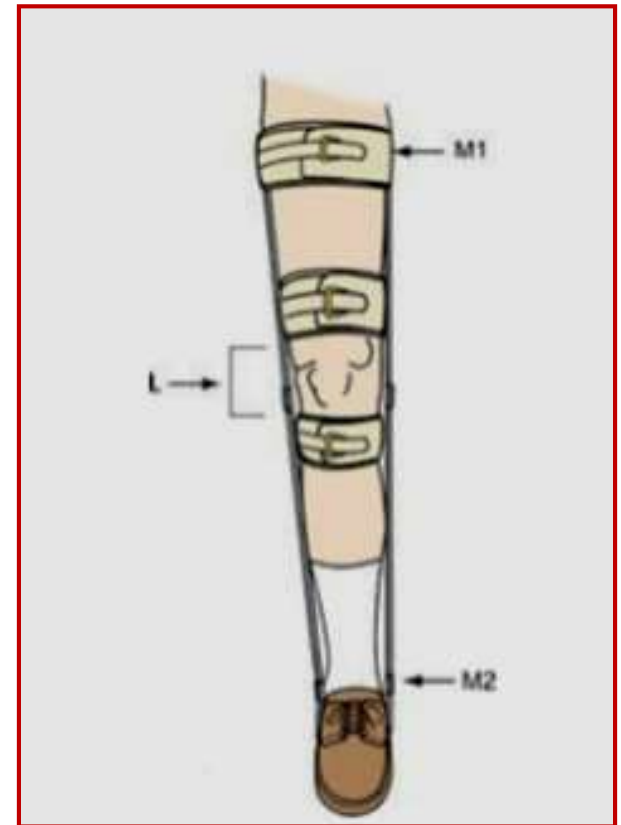
2) Pressure Systems

- Supportive systems involve a series of forces and counterforces, known as pressure systems.
- The basic pressure system for an orthosis is the **three-point force system**.
- A principal force acts in one direction, and two counterforces located proximal and distal to the principal force act in the opposite direction.

Design Factors

2) Pressure Systems

- For example, a man with genu valgum will have the deformity controlled by wearing an orthosis that exerts laterally directed force on the medial aspect of the knee and medially directed counterforces on the lateral aspect of the thigh and leg



Orthotics

- An orthosis, or brace, is an external device applied to body parts to provide one or more different functions, including:
 - 1) Reduction in pain/comfort.
 - 2) Prevention or correction of deformity.
 - 3) Support/stability.
 - 4) Improvement in function.
 - 5) Augmentation of weak muscles (assist motion).

Orthotics

- 6) Control of spastic muscles.
- 7) Limitation of ROM (restriction of motion).
- 8) Unloading of diseased or damaged joints.
- 9) A kinesthetic reminder (orthosis provides sensory/visual feedback that reminds the patient to adopt a more corrective or appropriate position, or to avoid some activities/movements).

Functions of an Orthosis

- 1) **To assist weak part or segment**, e.g. springs, rubber bands, flexor hinge hand orthosis.
- 2) **To resist movement at a joint or part**, e.g. foot drop stop to resist plantar flexion.
- 3) **To support**: To give rest or immobilize a joint or part to allow heal up, to prevent deformity or to maintain is functional position.

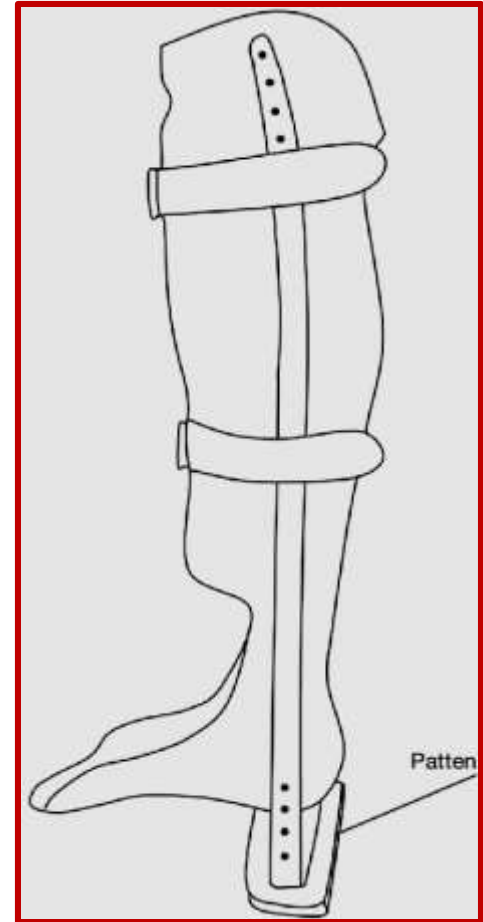
Functions of an Orthosis

- 4) **To substitute for absent motor function**: The patient moves hand in one direction and when relaxed the orthosis moves the segment in opposite direction, e.g. dynamic finger extension splint in radial nerve injury.



Functions of an Orthosis

5) To relieve weight: Weight relieving orthosis, e.g. ischial or PTB weight relieving orthosis.



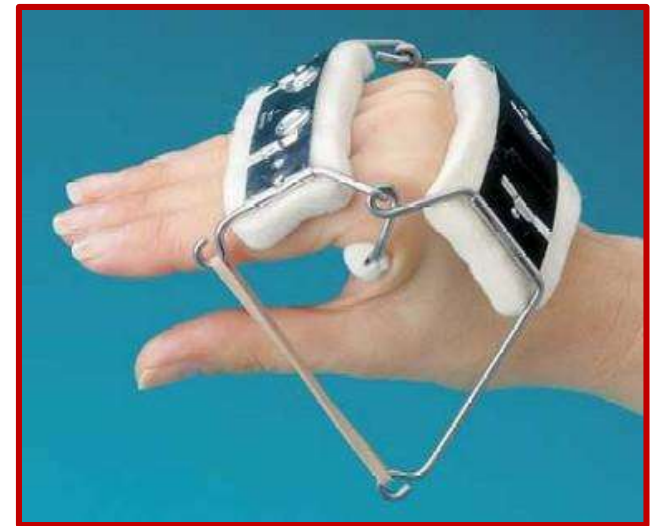
Functions of an Orthosis

- 6) **Attachment of Assistive devices**, e.g. universal cuff to which assistive devices can be attached.



Functions of an Orthosis

- 7) To block a particular segment to prohibit movement in one joint so that the other joints can be exercised, e.g. orthosis with finger MP stop to allow movements in IP joints. This allows strengthening of flexor digitorum sublimis, e.g. knuckle bender splint in claw hand.



Prescription of Orthosis

➤ Orthoses are given to the following conditions:

- 1) Post polio paralysis
- 2) Nerve injuries
- 3) Stroke and trauma brain injury
- 4) Spinal cord injury
- 5) Arthritis and soft tissue rheumatism
- 6) Deformities
- 7) Congenital limb deficiency
- 8) Burns
- 9) Sports

