Upper limb Orthoses

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Upper limb orthoses

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JOINTS

1. Between 1st metacarpal and trapezium there is a saddle condyloid joint that allows flexion, extension, adduction, abduction and rotation. The rotation is not free and depends on the degree of opposition.

2. All the other joints in the carpus are plane joints.

3. The carpometacarpal joints become progressively more mobile from thumb to little finger so that grip is more stable towards index finger and thumb.
The primary roles of the hand are grasping and manipulation.
Functional position of the hand

- The wrist is in 30° dorsiflexion.
- Normal transverse arch.
- MCP joints 30° flexed.
- Thumb in abduction and opposition and lined up with the pads of the four other phalanges (fingers).
- PIP joints are 45° flexed.
Neutral or resting hand position

- Midway between pronation and supination
- Twelve to 20° dorsiflexion of the wrist
- All phalanges and joints are slightly flexed.
- Good balance of bone and control of three muscle groups:
  - Long extensors
  - Long flexors
  - Intrinsics of the hand
- Thumb in partial opposition.
Upper limb Orthoses

are **distinct** from other orthoses because of the **complexity of the human hand.**

- There are **many simultaneous joint movements** that have to be considered for mobilization or immobilization (e.g. nine IP, five MCP, wrist, forearm, elbow, shoulder),
- **short digital lever** (which translates to high force, high pressures, and skin intolerance), and
- **little soft tissues padding** for bands and other components.
- Orthotic design for the upper limb must give equal focus to **mechanical efficiency** and **precision of fit** because comfort is critical for acceptance.
Upper limb orthoses can be organized categorically in several ways:

- **pathology** (e.g., spinal injury, arthritis, trauma, head injury),
- Arthrosegmentally according to the **joint** encompassed (e.g., shoulder, elbow, wrist, hand, fingers)
- treatment **objective** (e.g., promote healing, direct growth, prevent deformity, correct deformity, enhance function)
- **Function**: Static and **dynamic**: therapeutic or functional.
example of a static functional upper limb orthosis is a short opponens (static hand orthosis) with attachments for eating, reading, page turning, shaving, and grooming.
Treatment objective

➢ Protective Orthoses
  – Immobilize the joint, preventing any motion and promoting optional joint alignment.
  – Block the motion at a certain point, restricting the permitted range of the joint.
  – Prevent deformity by maintaining joint mobility
  – Stabilize an unstable joint or tendon or a fractured bone
  – Protect vulnerable or healing structures (e.g. bone, joint, tendon, blood vessel, and nerve, skin) to promote healing prevent (re)injury, and prevent subluxation of joints or tendons.

➢ Corrective Orthoses
  • Correct joint contracture
  • Correct subluxation of joints or tendons

➢ Assistive Orthoses
  • Assist movement of joints during functional activities when muscles are weak or paralyzed
  • Reduce muscle tone of spastic muscles to promote joint mobility
Static Upper-Limb Orthoses

Indications

• Immobilize, stabilize, and support a joint in a desired position
• Protect weak muscles from overstretch
• Prevent contractures
• Support structures following surgical repair
• Facilitate the healing of soft tissue injuries and fractures
Static WHO

• Clinical application:

The static WHO supports the wrist joint, maintains the functional architecture of the hand, and prevents wrist-hand deformities.

Occasionally the static WHO is used as a platform for other therapeutic attachments (e.g., MCP extension stop, IP extension assist, thumb extension assist).
**Static WHO**

*Patient population.* *Patients with severe weakness* or paralysis of the wrist and hand musculature

risk of developing the "claw hand" deformity and/or overstretching weak muscles (quadriplegics)
"claw hand" deformity

wrist flexed, MCPs hyper extended, and thumb extended and abducted
WHO

**Attachments.** Two of the most common attachments used with the static WHO are:

- MCP extension stop
- the IP extension assist

- **swivel thumb** : The thumb can be maintained in opposition while allowing a limited range of motion
Static hand orthosis (HdO)

Clinical application. The static HdO maintains the functional position of the hand and prevents deformities from developing. Occasionally the static HdO is used as a platform for other therapeutic attachments.
References


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