

Paper I: Upper Limb prosthetics and orthotics and Spinal orthotics

Chapter 8: Principal of prescription

Contents

1. General objectives for orthotic intervention
2. Orthotic consideration in joints positioning
 - Pathology
 - Joint biomechanics and tissue tension
 - Function
3. The basic group of the orthosis
4. Wrist Hand Position
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Objectives

- By the end of this section the student should be able to:
 - Describe the general objectives for orthotic intervention
 - Describe about orthotic consideration in joints positioning considered by necessary information

Why do we use an Orthosis?

- Correction
- Re-alignment
- Immobilisation
- Reduction of motion
- Prevention of deformity progression
- Protection against injury
- Improving level of function/mobility
- Reducing pain
- Support/compress
- Increase ROM

1. General objectives for orthotic intervention

■ Protection

- Immobilize the joint, preventing any motion and promoting optimal joint alignment

■ Correction

- Apply force system to correct deformity or joint contracture

■ Assist

- Assist movement of joints during functional activities when muscles are weak or paralyzed to promote function

2. Orthotic consideration in joint positioning

- Factors to be considered when positioning the joints with an orthosis
 - Pathology
 - Joint biomechanics and tissue tension
 - Function

Orthotic consideration in joint positioning

2-1. Pathology

- If the pathology dictates the position, should be considered first because joint position may worsen certain pathology
- For example, positioning the wrist in flexion or extension may irritate the median nerve in the carpal tunnel syndrome.

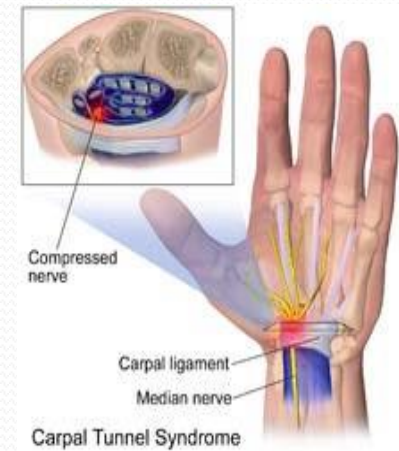
2-1. Pathology

Pathology Case 1

How to position the joints in carpal tunnel syndrome (CTS)?

Neuropathy, caused by *compression of the median nerve at the carpal tunnel*

In a carpal tunnel syndrome, the wrist should be positioned in ***neutral or slightly extension*** *to minimize the pressure in the carpal tunnel*



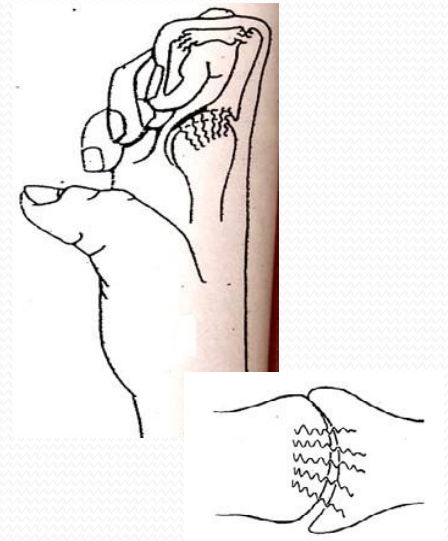
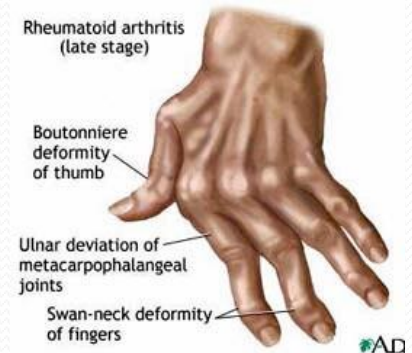
2-1. Pathology

Pathology Case 2

How to position the joints in RA of the hand?

RA result in *joint inflammation, chronic pain, joint destruction and deformity*

The Inflamed MCPs and IPs joints should be positioned in their *loose - packed position (intrinsic minus to minimize tensile forces in the joint capsule and collateral ligaments)*



Poor congruency of a joint~ slack of collateral ligaments

2-1. Pathology

Pathology Case 3

How to position the joints in a surgically repaired flexor



Penetrating injury to the tendons located on the palm-side of the hand resulting in *damage to soft tissue and*

loss of function (grasping and gripping)

The wrist and MCPs should be positioned in *flexion to prevent injury to sutured tendons from tensile forces*

A gentle stretching exercise should be applied to prevent contractures



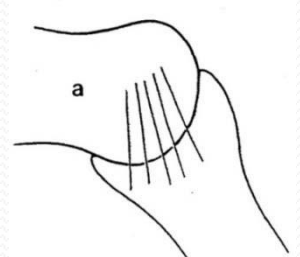
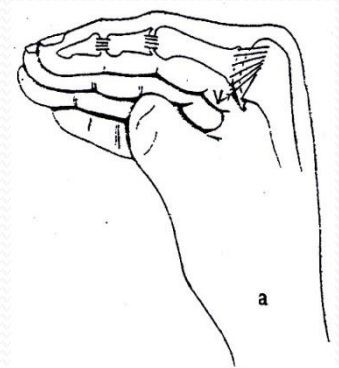
2-1. Pathology

Pathology Case 4

How to position a claw hand posture from burn on the dorsum of the hand

Burn on the dorsum of the hand may result from *hyperextension of the MCPs and flexion posture of the IPs joints*

To prevent tissue contractures in claw hand deformity, *MCPs and IPs* should be in ***closed pack position to preserve length of adult MCPs collateral ligament***



Joint congruent-collateral ligament₁ are maximally taut

Orthotic consideration in joint positioning

2-2. Joint biomechanics and tissue tension

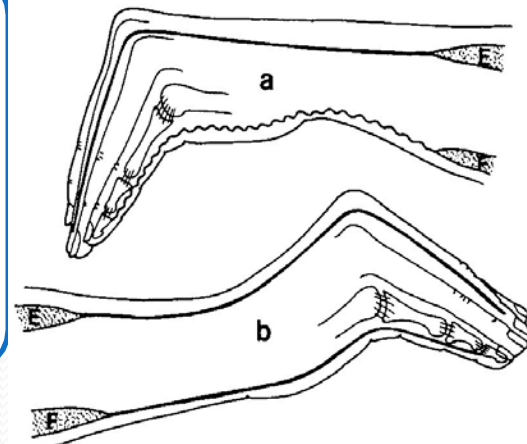
- If pathology does not dictate joint positioning then joint biomechanics can be considered
- **For example**, positioning the wrist in neutral MCP joint in flexion and IP joints in fully extension, keeps the extensor tendon in tension and flexor tendon will be slacken

2-2. Joint biomechanics and tissue tension

Example of Joint biomechanics and tissue tension

Burn on dorsum of the hand may result in *hyperextension of the MCPs joint and flexion at the IPs joints* of all or some of the digits

To balance the tension in the flexors and extensors tendons, *the wrist should be positioned in extension to counter balance the flexion tension*



Orthotic consideration in joint positioning

2-3. Function

- If neither pathology nor joint biomechanics is an influencing factor, then joint positioning should facilitate function
- What type of patient's ADL is needed?
 - gross power grasp or fine prehension grip?
- To enable function the position of the wrist, CMC of the thumb, MCPs and IP joints must be considered to enable the patient's ADL.

2-3. Function

Function

Example: For gross power for gross power grip

A study by O'Driscoll et al., More grip strength is

The wrist joint should be positioned in extension about 20 to 35 degrees to create tension the extrinsic finger flexors to grip tightly.



achieved with Wrist in 35° extension and 7° of ulnar deviation.

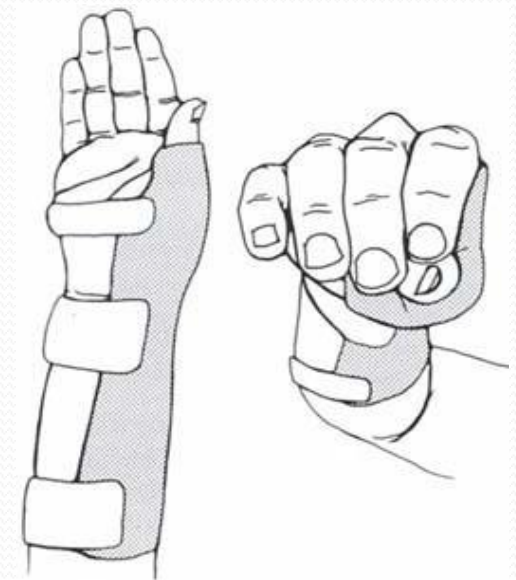
2-3. Function

Function

Example: *For De Quervain's tenodesis* (inflammation of abductor pollicis longus and extensor pollicis brevis at the wrist)

The objective of the orthosis is to *immobilize the wrist, thumb CMC joints* and *promote hand function*

The thumb should be immobilized in a position that will enable easy opposition



Prescription and considerations

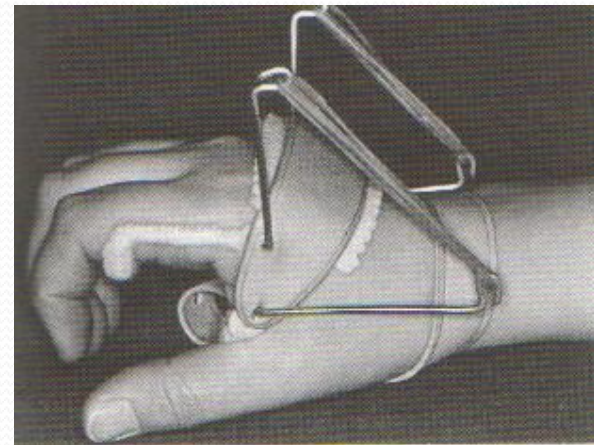
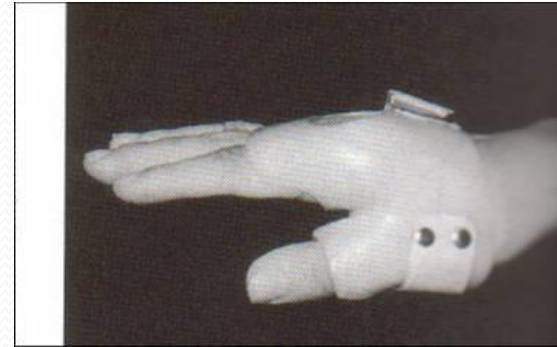
- Advantages vs disadvantages
- Indications vs contraindications
- Does orthosis have >1 function
- Orthosis often best with other treatment
 - Physiotherapy
 - Surgery
 - Assistive device, eg. Crutches
 - Any others you can think of?

Prescription and considerations

- Issues and external factors
 - Injury
 - Illness
 - Culture
 - Home
 - Hygiene
 - Compliance
 - Cost
 - Availability
 - Technology
 - Services
 - Previous treatment

Static vs Dynamic orthosis

- Static orthosis
 - Maintain position
 - Reduce movement
 - Immobilise
 - Prevent deformity
- Dynamic orthosis
 - Movement required to prevent loss of function, or assist function



Wrist Hand position

- Functional position
 - 30 deg wrist ext ± 5
 - MCP jt 30 deg. flex
 - PIP jt 45 deg. Flex
 - Thumb abd. And opposition
 - Neutral pro/supination
- Neutral/resting position
 - 12-20 deg. Wrist ext.
 - MCP/IP jts partially flexed
 - Thumb partial opposition
 - Neutral pro/supination



References

- John D. John W. and John R. (2008) AAOS Atlas of Orthoses and Assistive Devices
- Pat McKee and Leanne Morgan (1995) Orthotics in Rehabilitation, Splinting the Hand
- Bowker P. Condie D et al., Biomechanical Basis of Orthotic Management