

# **Upper Extremity Orthotics**

## **Pathology and Prescription**

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# Upper Extremity Orthotic Goals

- Substitute for absent strength
- Assist for weak muscles
- Support injured or diseased segments by limiting motion or load
- Prevention or correction of deformity
- Attachment of assistive devices

# Functional Goal = Prehension

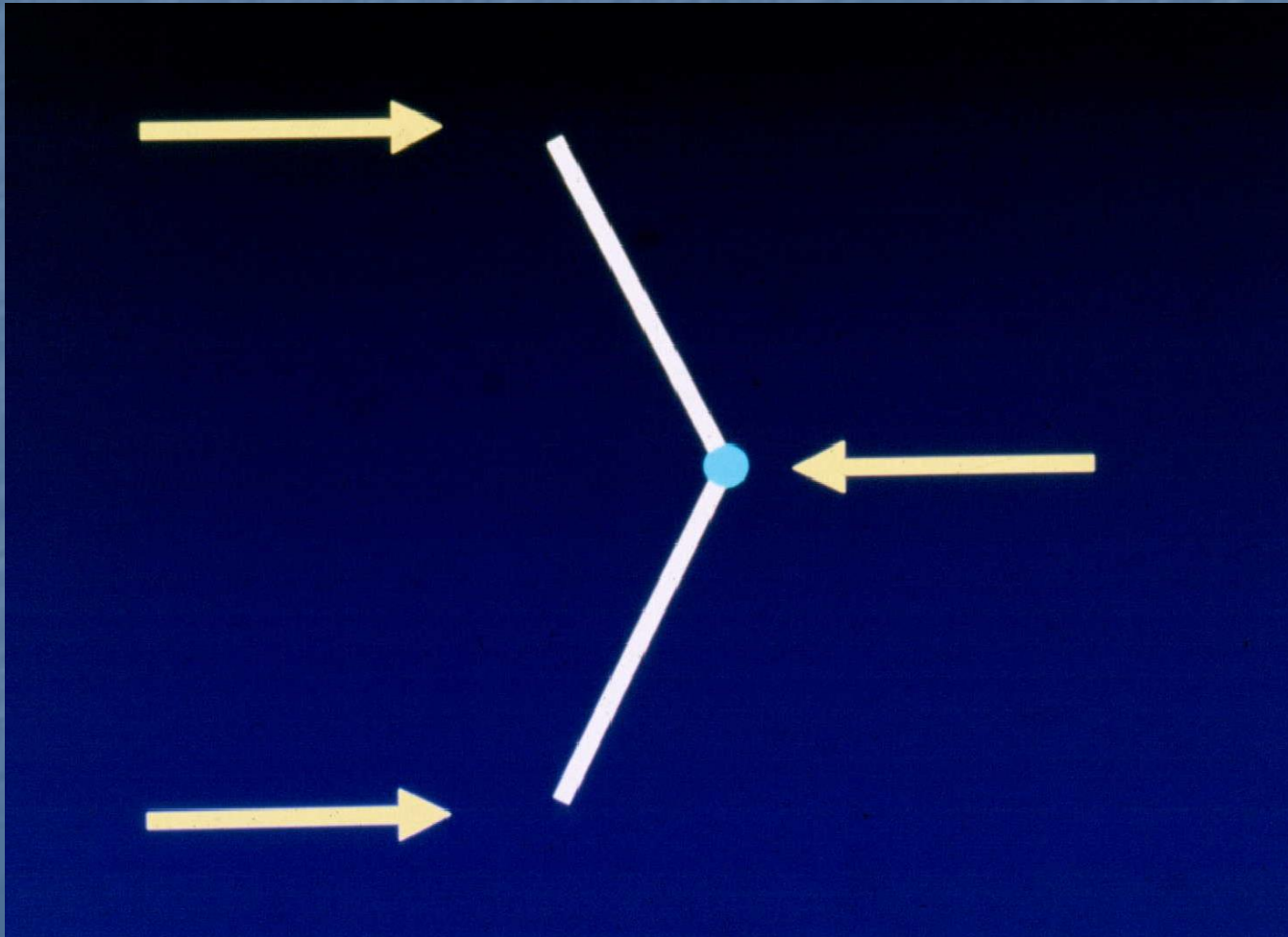
Primary Factors: Thumb opposing fingers

Effective pinch

Gross grasp

Positioning the hand in space

# 3 Point Control Concept





# Rheumatoid Arthritis IP Joints

Findings - "Swan Neck" deformity with hyperextension at PIP and flexion at DIP  
"Boutonnière's Deformity" with flexion at PIP and hyperextension at DIP

Orthosis - Metal ring finger orthosis

# Finger Ring Orthosis at DIP



# Finger IP Joint Contracture

Findings - Flexion contracture at IP joint due to collateral ligament shortening

Normal motor/sensory

Normal ROM at MCP

Orthosis - Dynamic springwire finger orthosis

Alternates - "Joint Jacks" and others

# Dynamic Finger Orthosis





# Hand Finger Orthoses

# Distal Median Nerve Injury

Findings - Weakness at thumb

Sensory loss on palmar surface

Loss of thumb opposition

Orthosis - Short opponens orthosis

# Short Opponens Orthosis



# Rheumatoid Arthritis Base of Thumb

Findings - Tender at CMC joint (base of thumb)

Synovial thickening

Strength normal

Sensation normal

ROM may be limited by pain

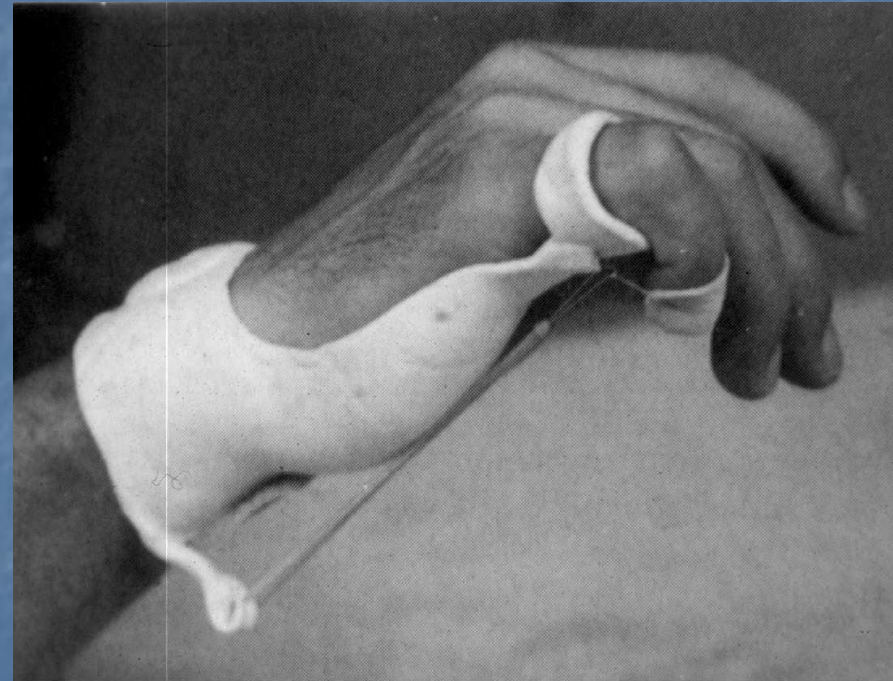
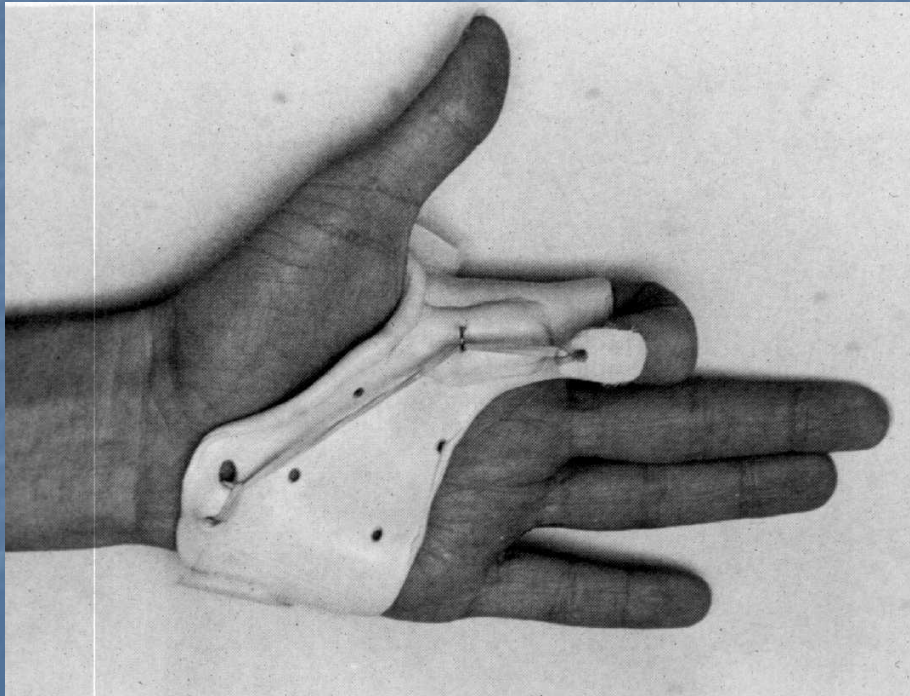
Orthosis - Static plastic thumb spica



# Thumb Spica



# Dynamic Hand-Finger Orthosis for extensor contracture



# MCP Joint Contracture

Findings - Extensor contracture at MCP joint

Orthosis - “Knuckle Bender” dynamic hand  
finger orthosis



# Knuckle Bender Orthosis





# Wrist-Hand-Finger Orthoses

# Rheumatoid Arthritis MCP Joint

Findings - Subluxation of MCP joints and wrist  
Ulnar deviation of fingers  
Synovial thickening of MCP joints  
Limited ROM of MCP  
Normal motor/sensory? (neuropathy)

Orthosis - Static wrist-hand-finger orthosis for later stage

# Severe RA Deformity



# Static WHFO





# Carpal Tunnel Syndrome

Findings - Compression of median nerve

Incomplete motor / sensory loss at  
thumb

Orthosis - Wrist – hand orthosis

“Cock-up splint”

# Wrist Cock-up Splint



# CVA with Spastic Hemiplegia

Findings - Flexor positioning of wrist and fingers  
Motor-voluntary control absent  
Sensation absent, edema present  
Tone increased

Orthosis - Static wrist-hand-finger orthosis with  
wrist in slight extension, MCP's in  
flexion, IP's extended, thumb in  
opposition

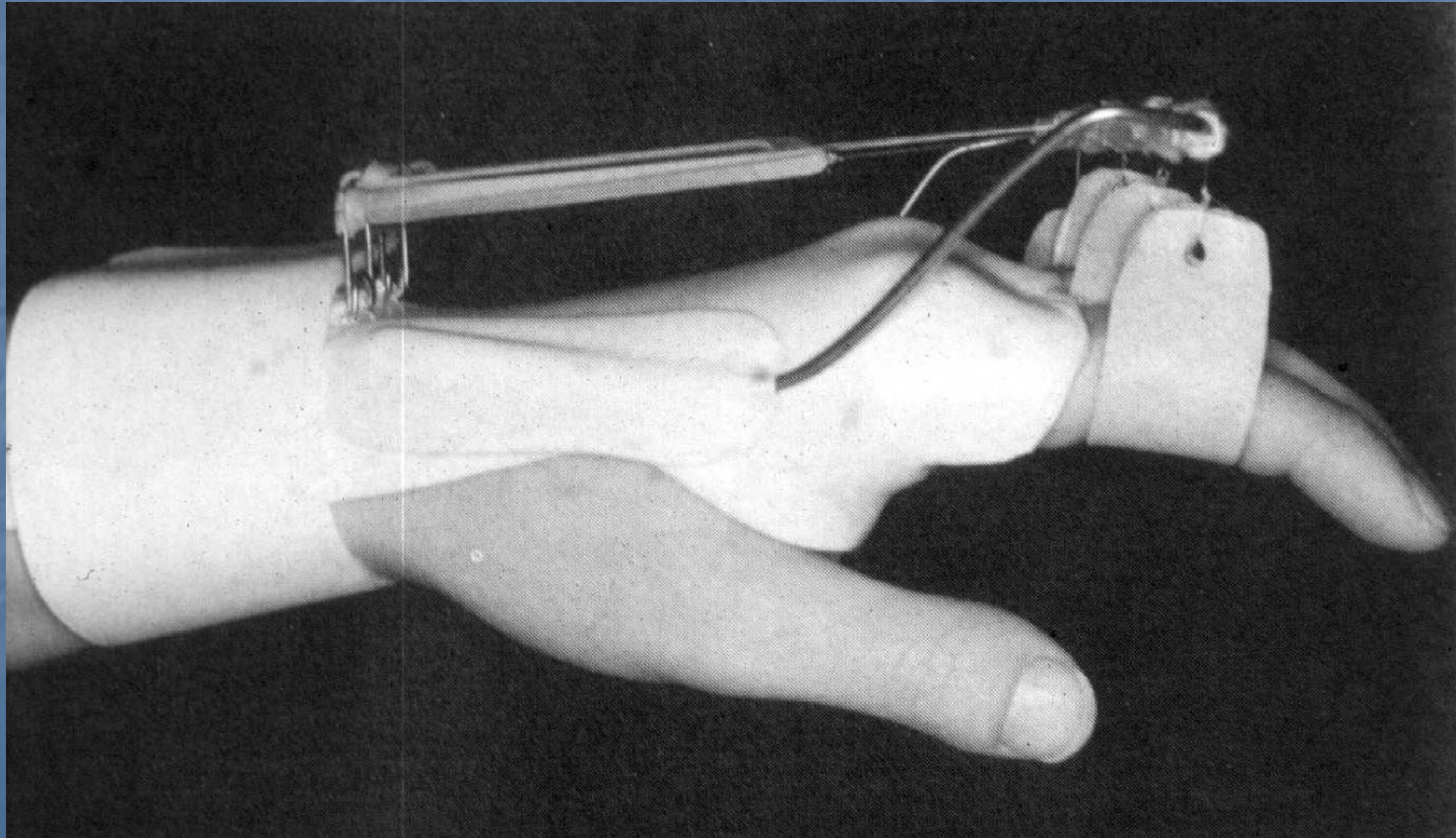


# Static Wrist-Hand-Finger Orthosis

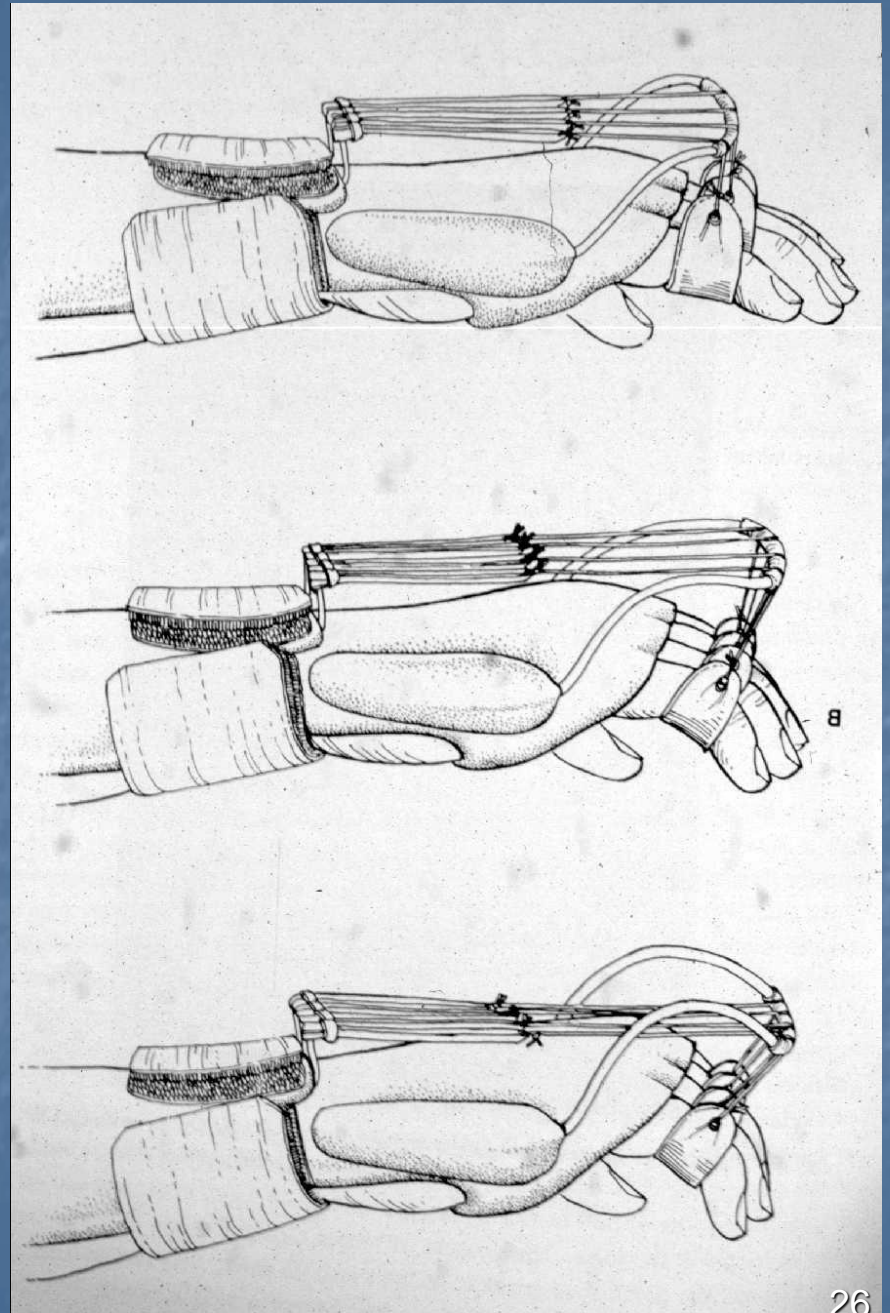




# Dynamic WHFO with PIP Extension for long flexor tendon contracture



**Progressive  
WHFO needs  
regular  
follow-up  
and  
adjustment**



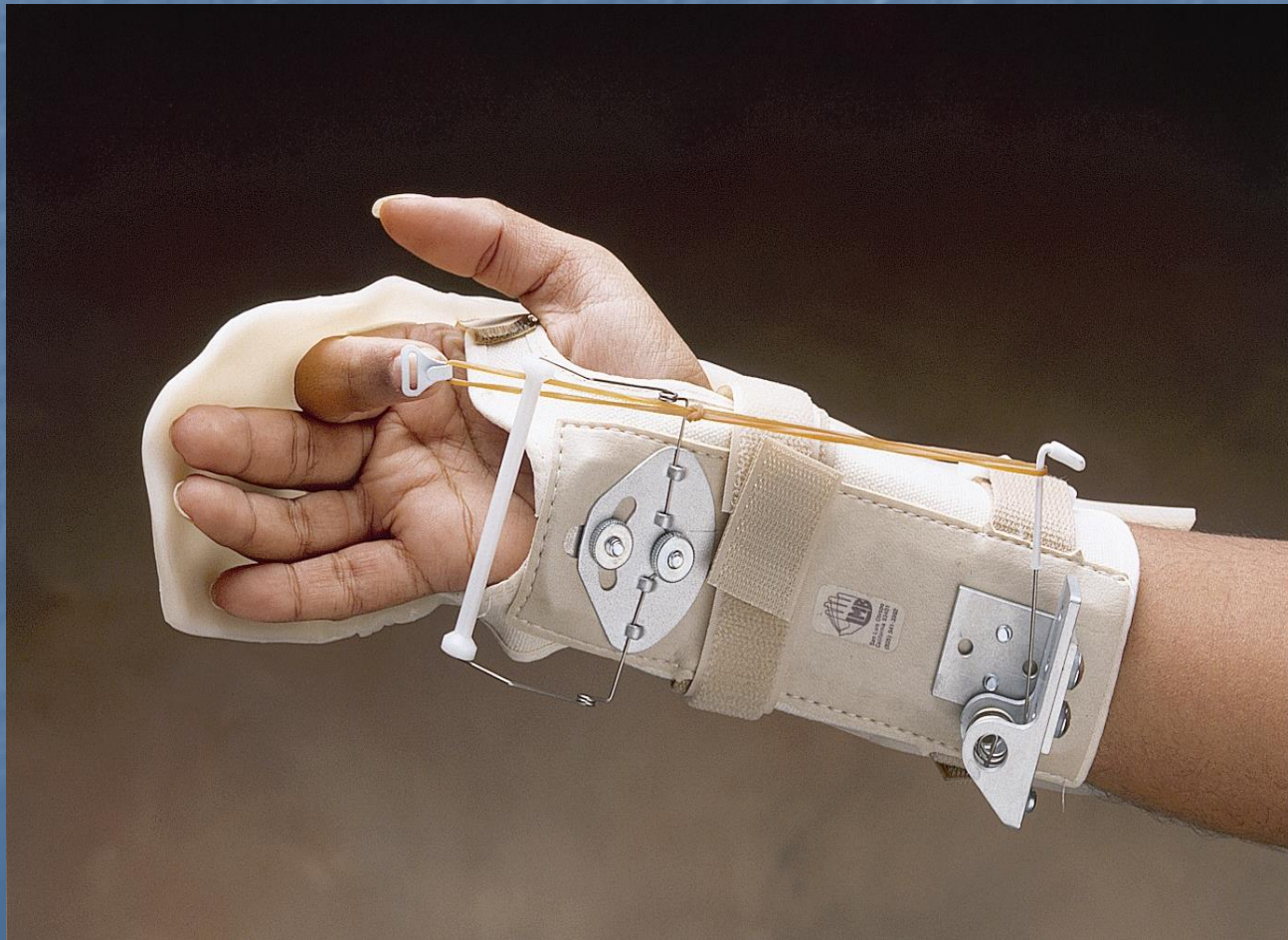


# Finger Flexor/Extensor Injury and Repair

Findings - Restrictions on ROM at wrist, MCP and IP joints per surgical protocol

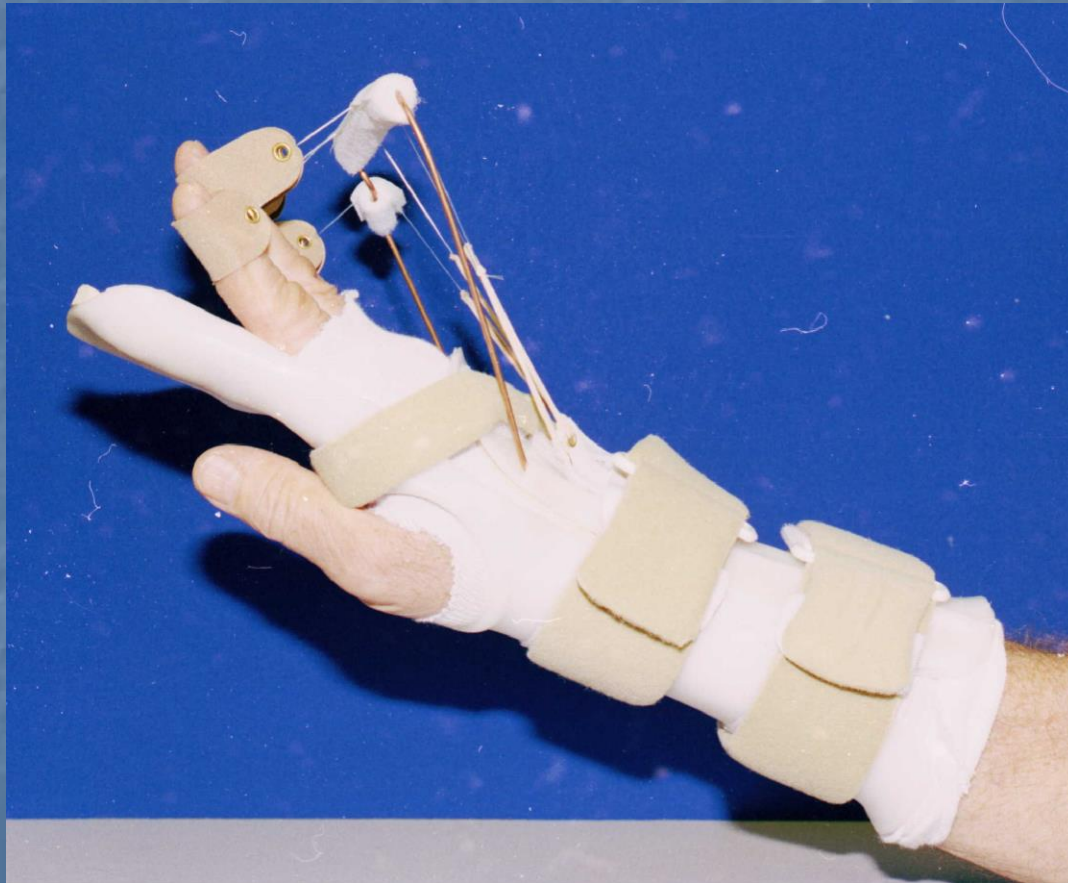
Orthosis - Hybrid wrist-hand-finger orthosis with static stabilization of wrist and limited dynamic control of MCP's and fingers

# Flexor Tendon Repair





# Extensor Tendon Repair



# Distal Ulnar Nerve Injury

Findings - “Intrinsic Minus” hand with hyperextension at MCP and flexion at IP joints

Sensory deficit on palmar surface

Motor deficit of intrinsic muscles

Orthosis – Hybrid Wrist-hand-finger orthosis with MCP block

# Hybrid WHFO



# Radial Nerve Injury at Elbow

## Findings - "Wrist Drop"

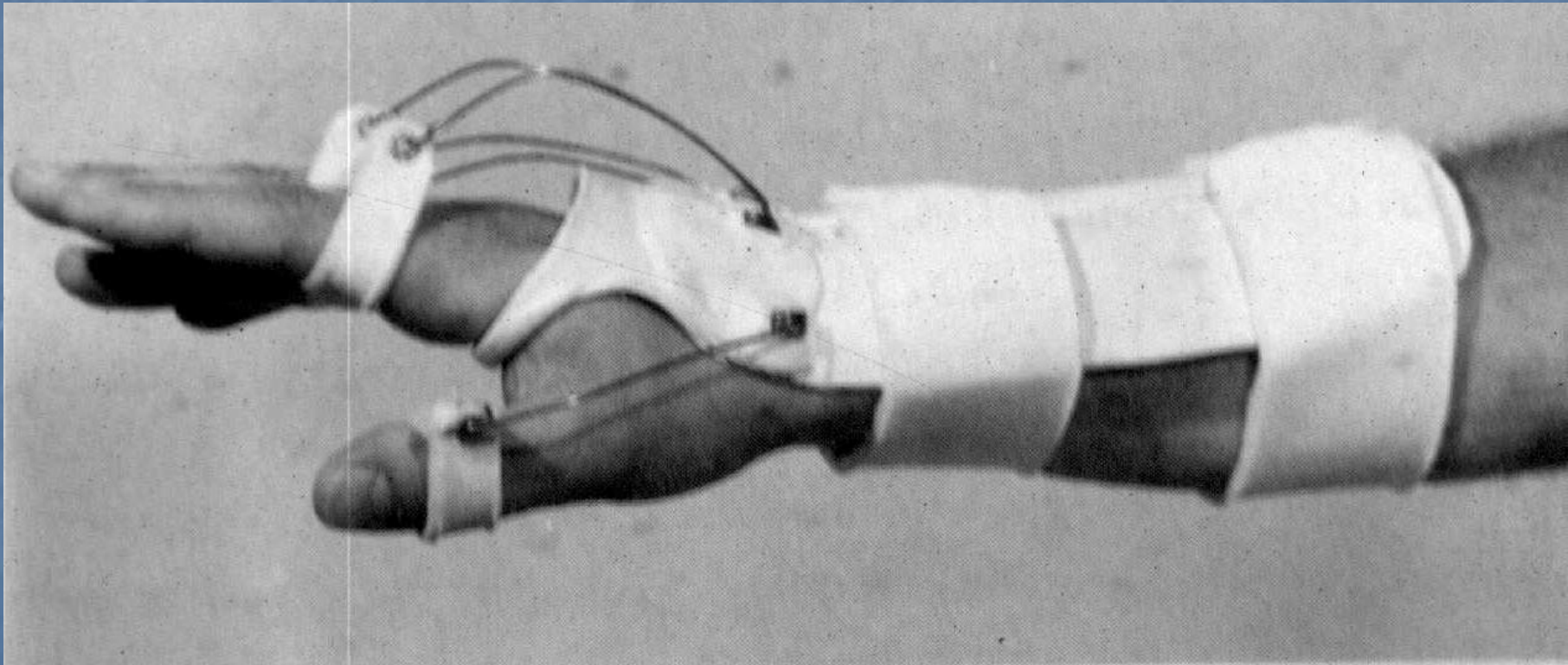
Motor deficit at wrist extensor and finger/thumb extensors

Sensory deficit at dorsum of hand

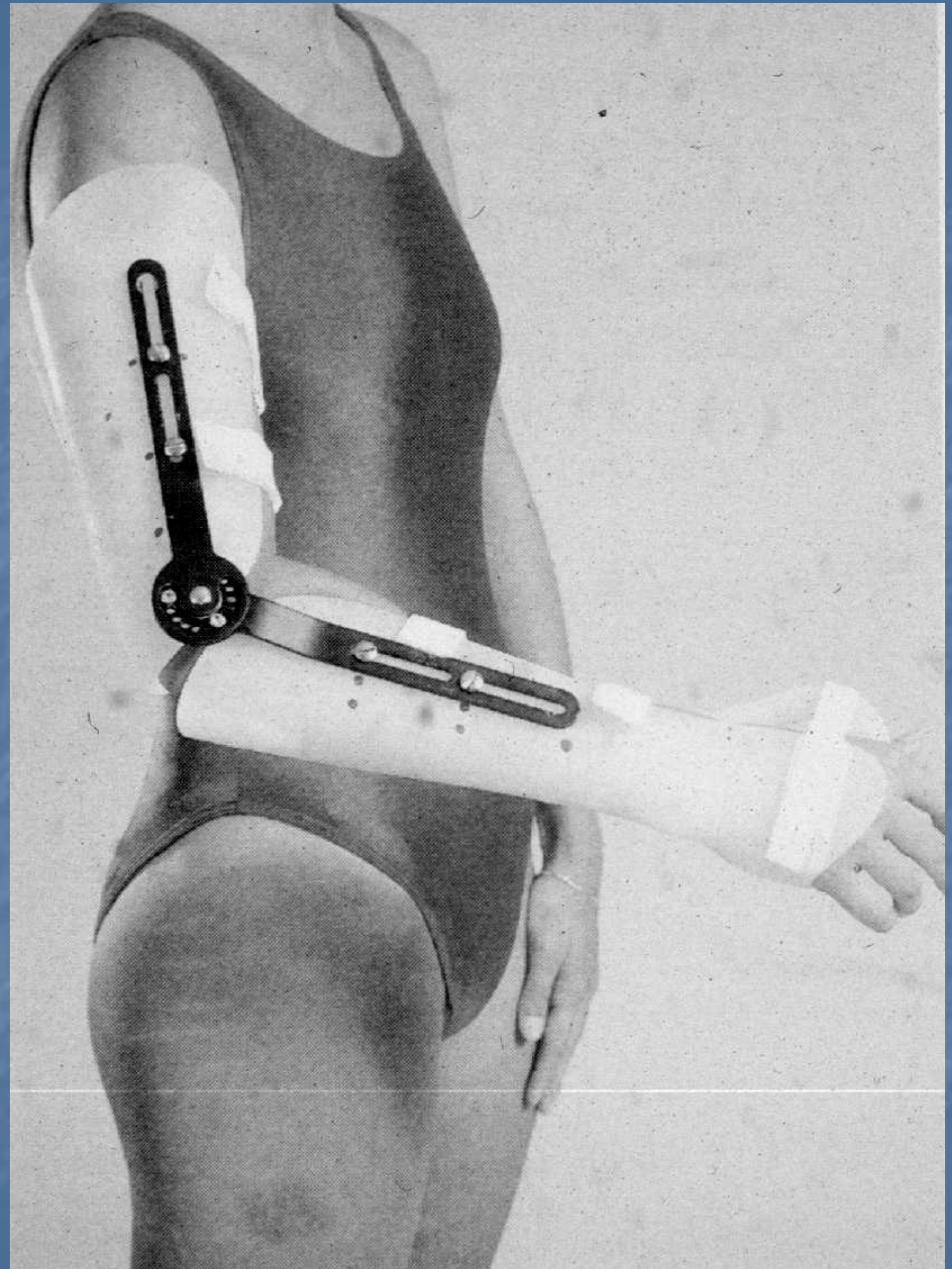
Orthosis - Dynamic wrist-hand-finger orthosis with extension assist at wrist and fingers using outriggers and bands



# Dynamic WHFO for Radial Nerve Injury



**Static  
Progressive  
Elbow  
Wrist Hand  
Orthosis for  
elbow  
fracture**





# Progressive EWHO for Humerus and Radius Fracture



# Shoulder Fracture or Surgery

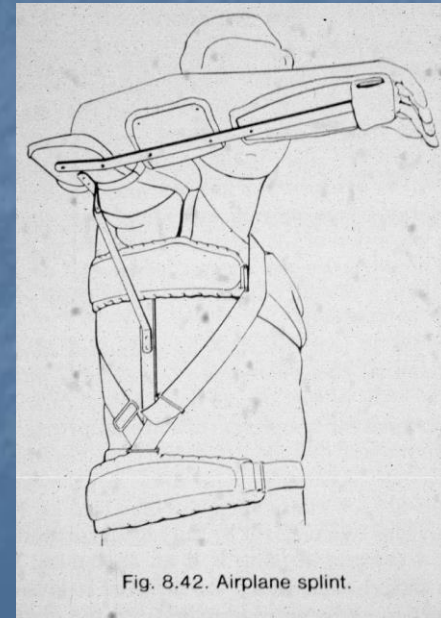
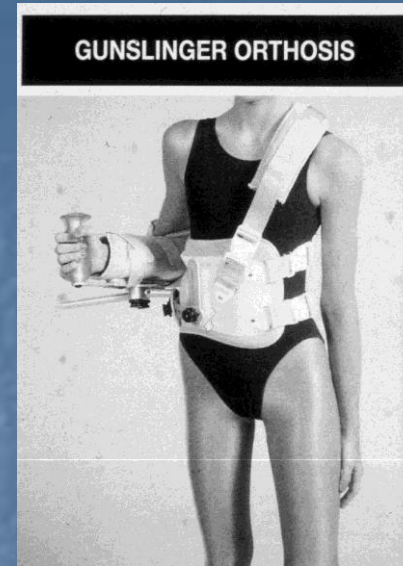
Findings - Restriction on ROM at glenohumeral joint per surgical protocol

Orthosis - "Airplane Splint"

Other static shoulder orthoses



# Static Shoulder Immobilizer



# Spinal Cord Injury C<sub>6</sub> Level

Findings – Wrist Extensors Intact  
Long Finger Flexors and  
intrinsic absent

Orthosis - RIC Tenodesis Orthosis

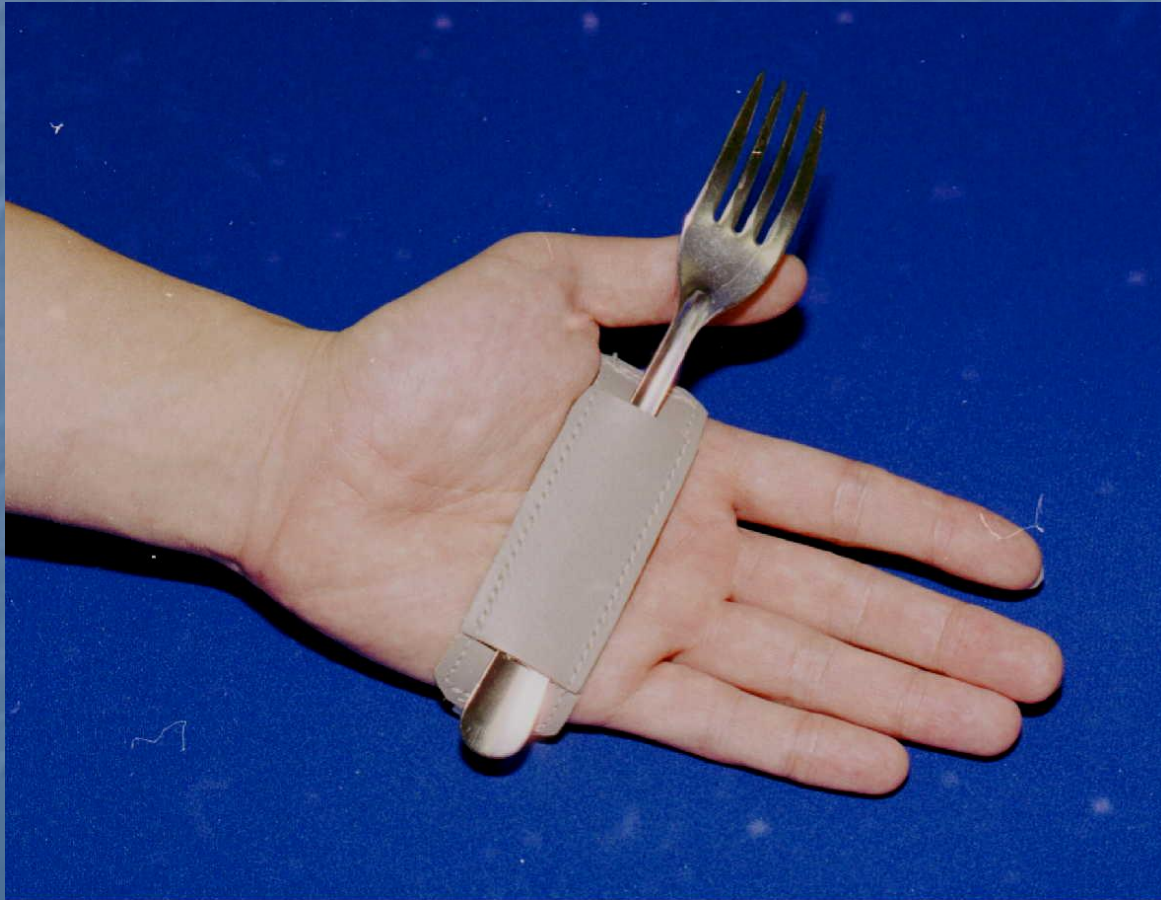
Alternate – Flexor Hinge Orthosis

# Tenodesis Effect





# Universal Cuff



# Lower Brachial Plexus Injury

- Findings - Motor deficits at hand and wrist with good strength at elbow/shoulder  
Sensory deficits in hand  
ROM limited due to contracture at hand
- Orthosis - Static wrist-hand-finger orthosis for protection
- Alternate - “Prosthesis” using prosthetic terminal device for prehension



# Prosthesis





**Thank You**