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

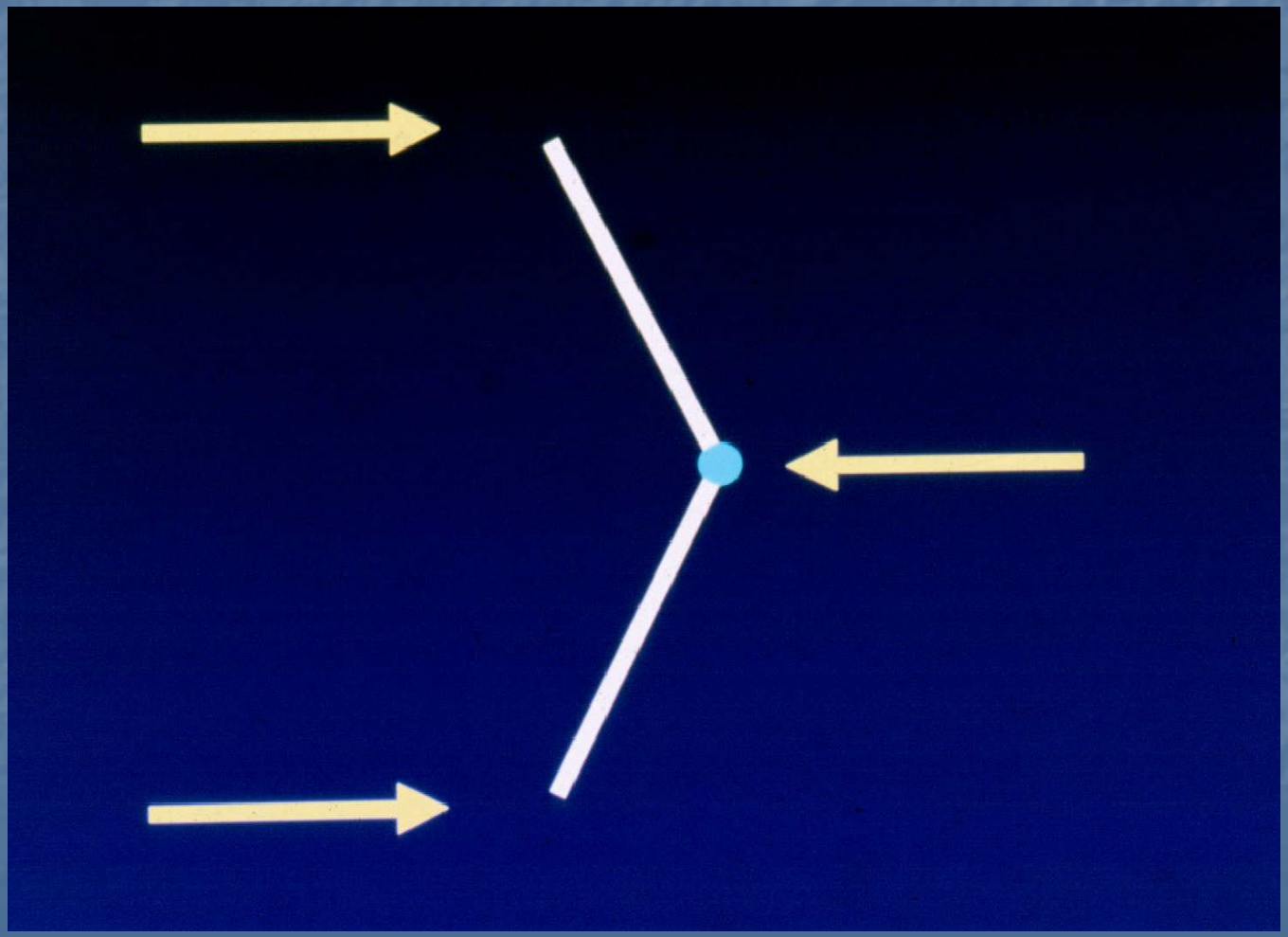
Primary Factors: Thumb opposing fingers

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

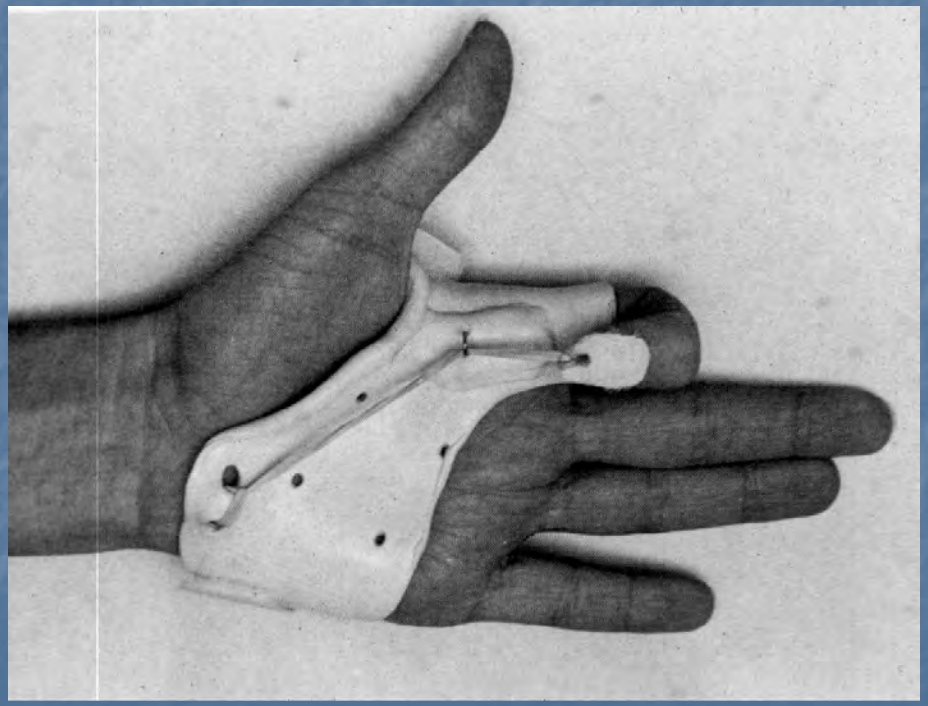
Sensation normal

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

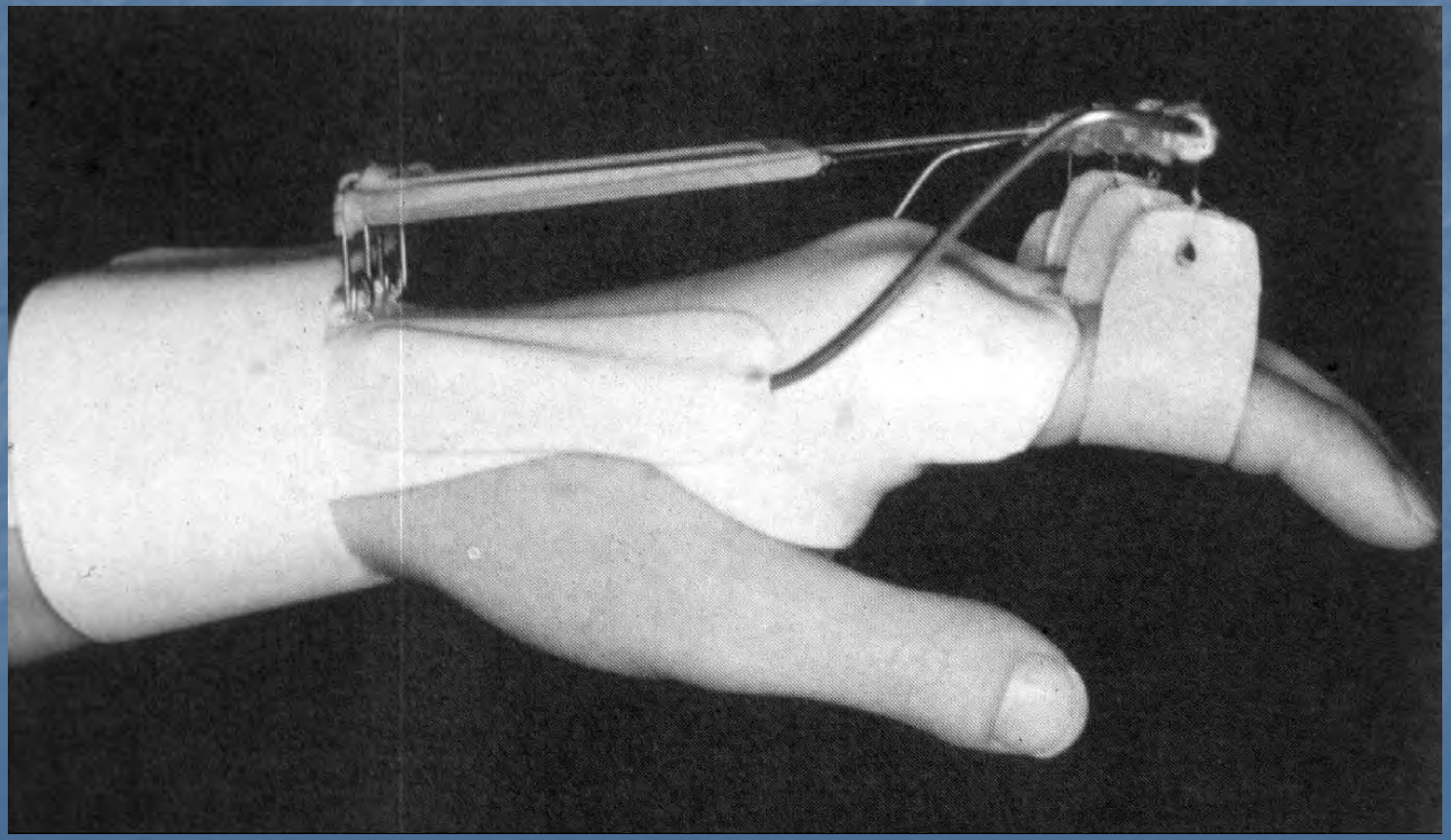
CVA with Spastic Hemiplegia

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

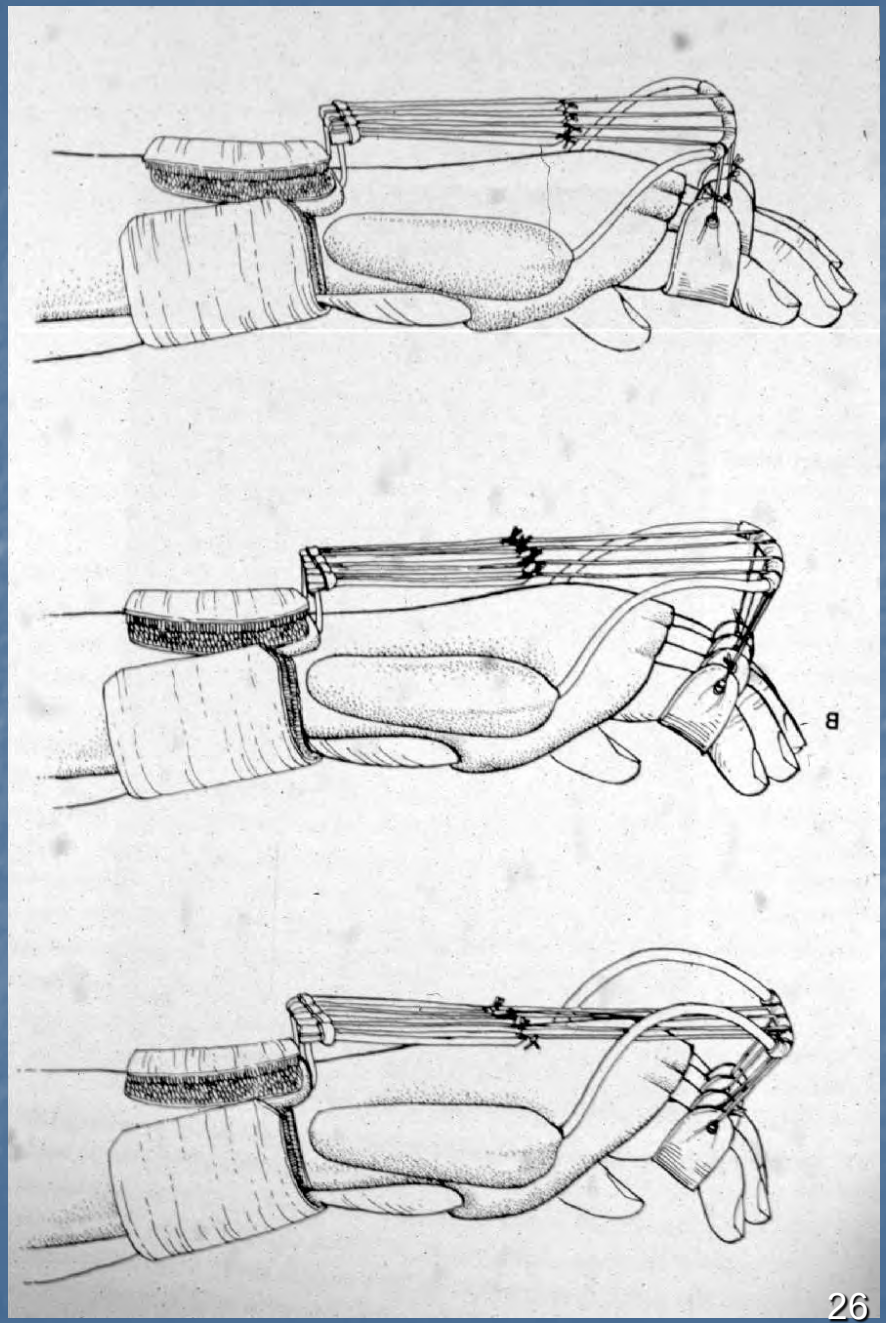
Orthosis - Static wrist-hand-finger orthosis with wrist in slight extension, MCP's in flexion, IP's extended, thumb in opposition

Static Wrist-Hand-Finger Orthosis

Dynamic WHFO with PIP Extension for long flexor tendon contracture



Progressive WHFO needs regular follow-up and adjustment



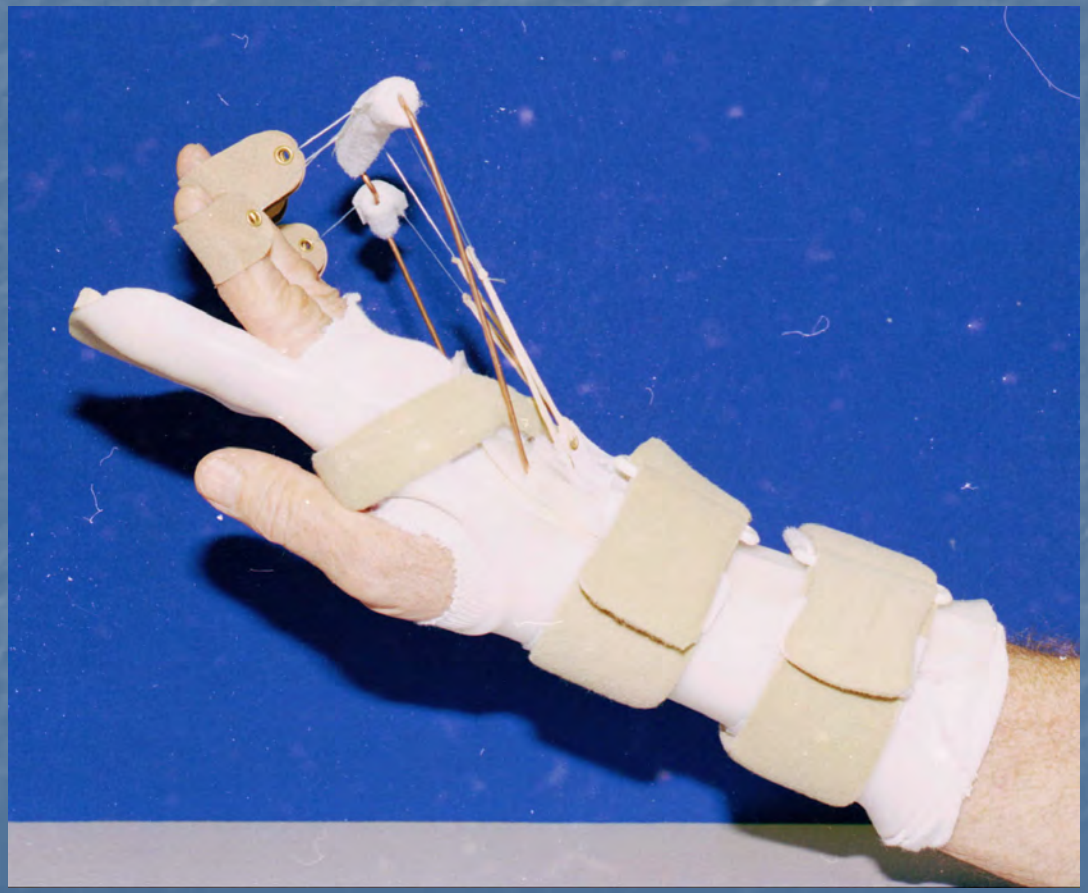
Finger Flexor/Extensor Injury and Repair

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

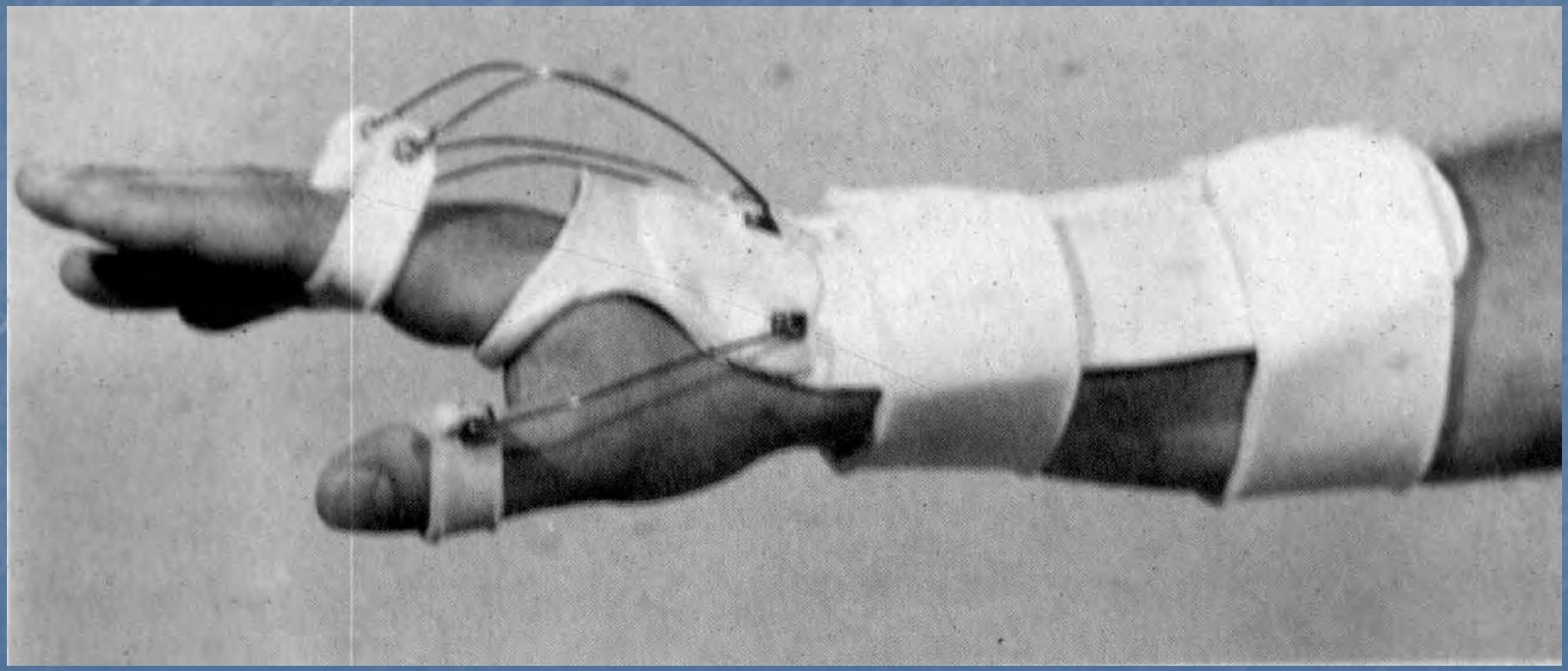
Radial Nerve Injury at Elbow

Findings - “Wrist Drop”

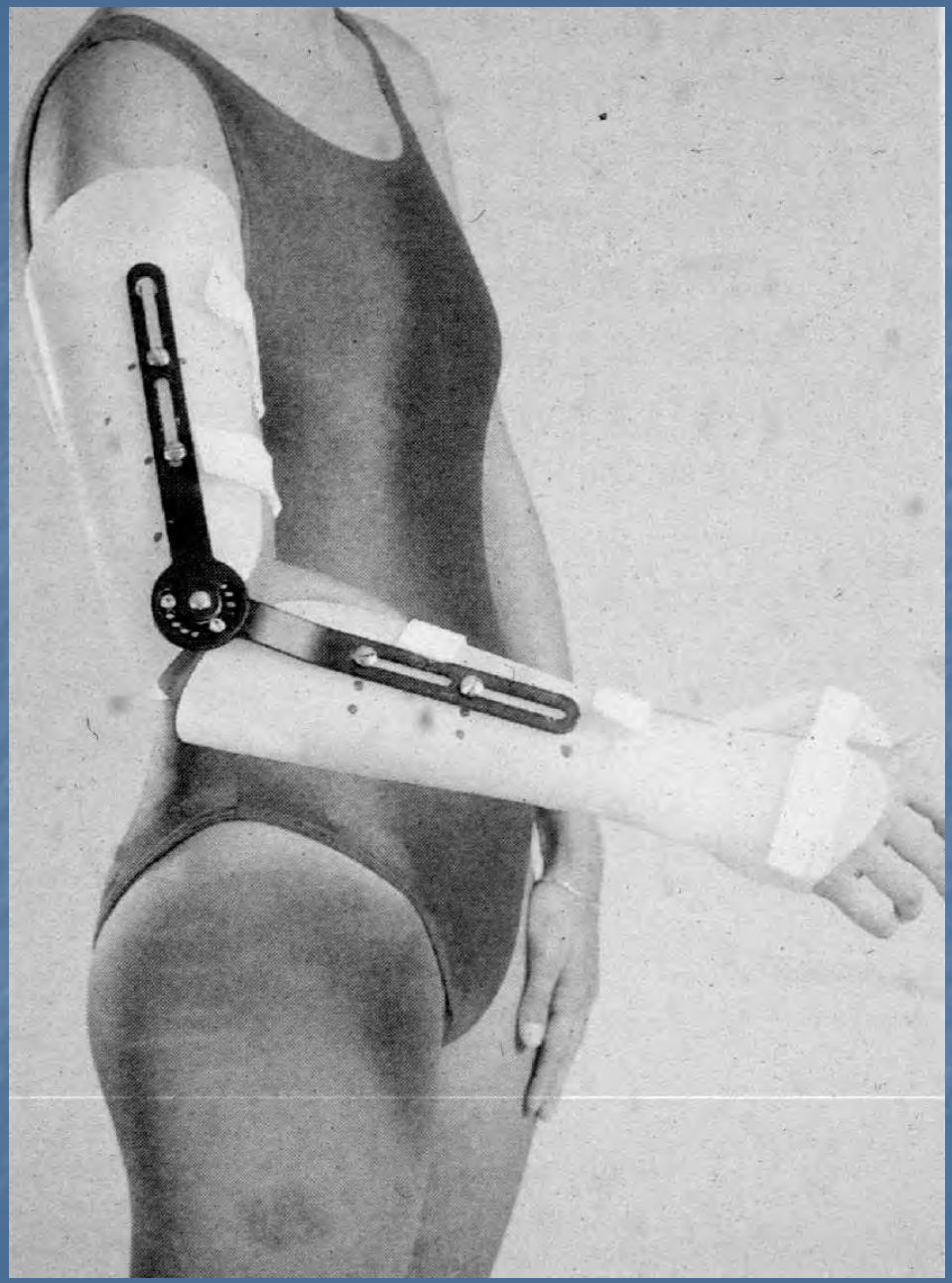
- Motor deficit at wrist extensor and finger/thumb extensors
- Sensory deficit at dorsum of hand

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

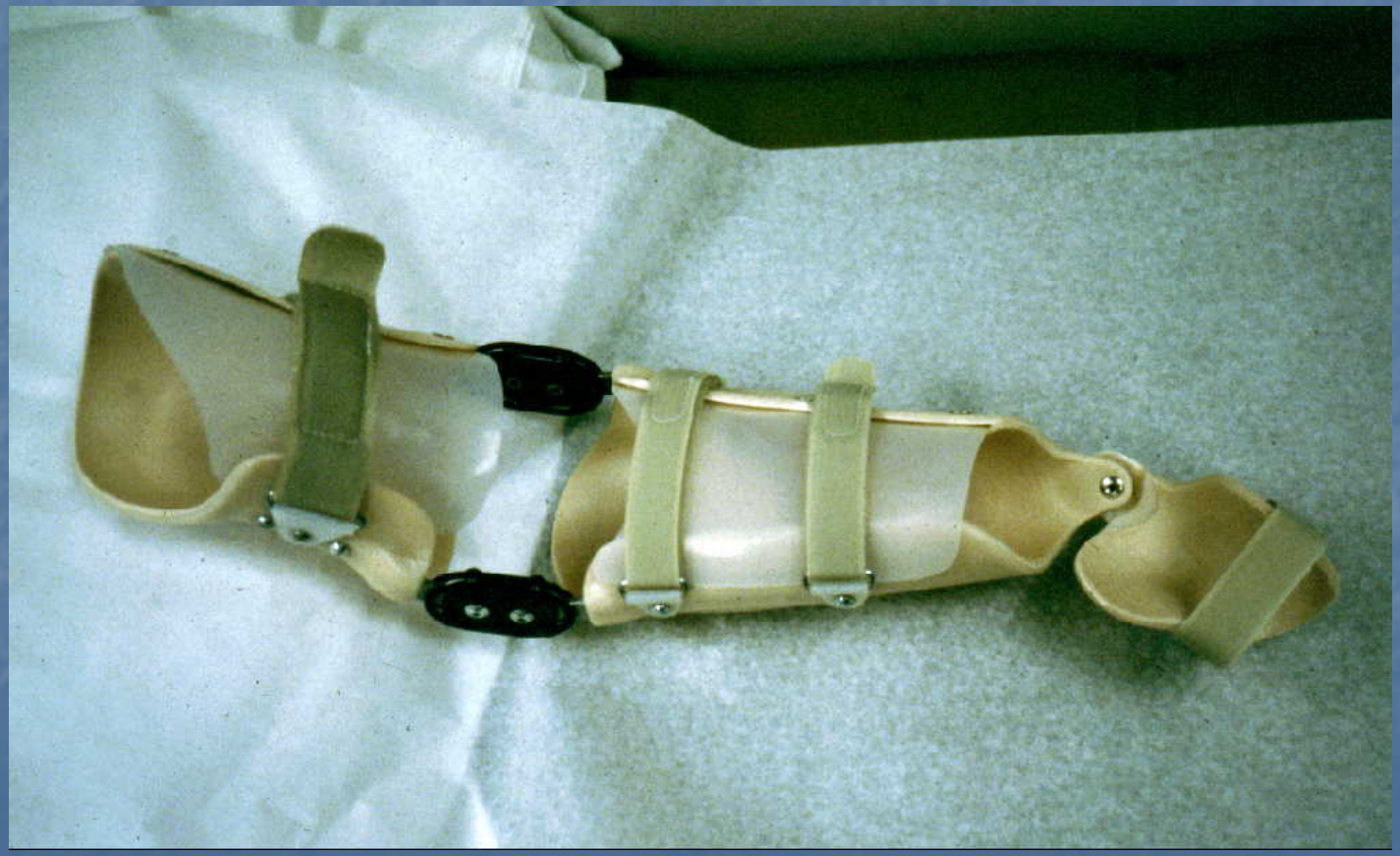
Dynamic WHFO for Radial Nerve Injury



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 gleno-
humeral joint per surgical protocol

Orthosis - “Airplane Splint”
Other static shoulder orthoses

Static Shoulder Immobilizer


Fig. 8.42. Airplane splint.

Spinal Cord Injury C_6 Level

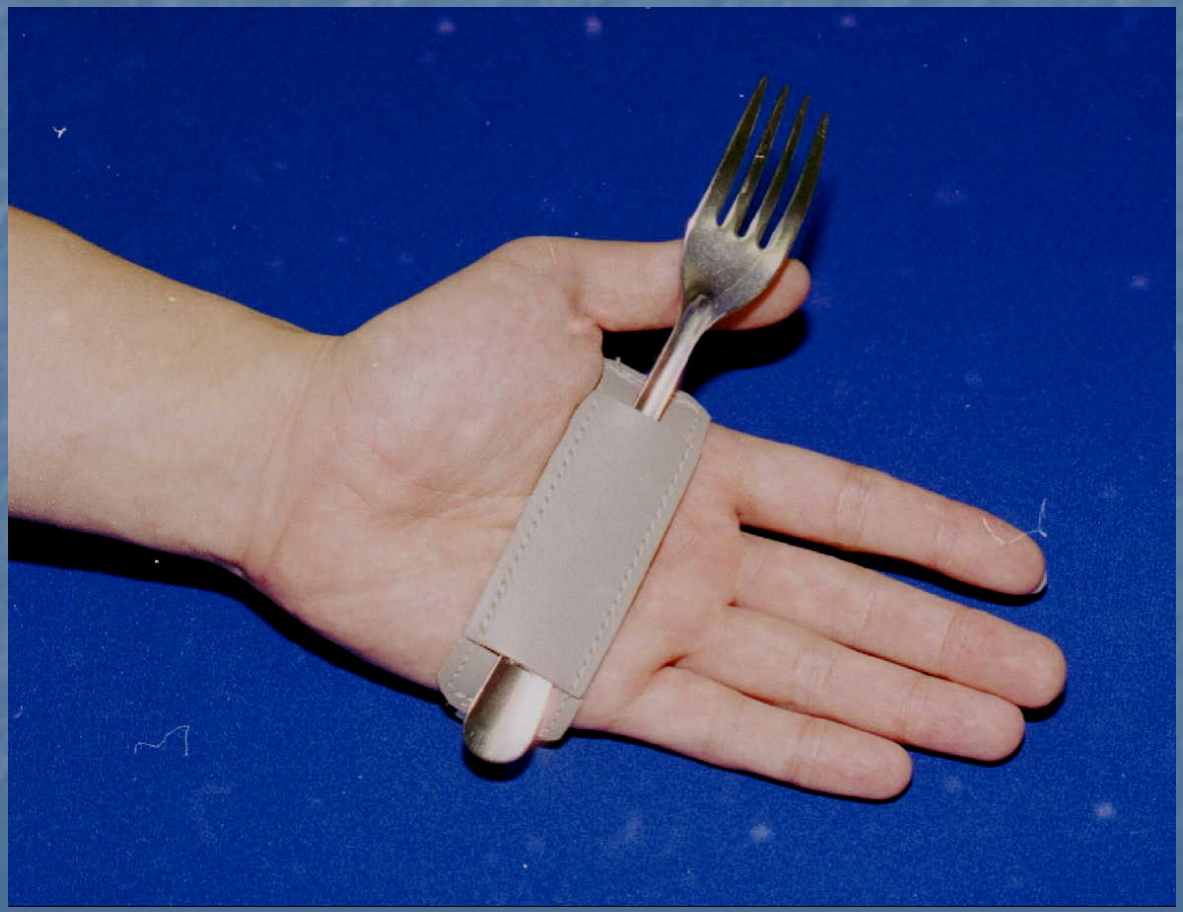
Findings – Wrist Extensors Intact
Long Finger Flexors and intrinsics absent

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 - “Prosthosis” using prosthetic terminal device for prehension

Prosthosis

Thank You