# Evaluation of the Upper Extremity Amputee and Levels of Amputation

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# Do I really need to see this?

# Etiology of Upper Limb Amputation

- Trauma
- Cancer
- Infection
- Burns
- Congenital

# Epidemiology -incidence

- Approx. 130,000 amputations per year in US
- 80-100,000 major amputations (>90% are lower limb BK 2/3, AK 1/3)
- Dysvascular disease= 82% (97% lower limb)
- Trauma = 16 % (68 % are upper limb)
- Cancer = <1 % (75% are lower limb)
- Congenital = < 1 % (60% are upper limb)
- 6-10,000 upper limb amputations per year

# Epidemiology-prevalence

- Approx 1.6 million amputee survivors in US (2005)
- Only 32% are diabetic/dysvascular with higher prevalence in males and African Americans
- The majority are trauma related
- Age groups?

# Morbidity- traumatic

- Revision surgery in trauma = 14 %
- Wound infection rate= 34%
- Risk of heterotopic bone/bone spurs is near 100% in thru bone amputations

# Evaluation of the Patient

**Injury History:**

- Cause of amputation
- Hospital course, time frame
- Repeated surgical procedure
- Skin grafts, muscle flaps
- Nerve injury (brachial plexus, peripheral nerve)
- Other injuries (ortho, spine, brain)

# Evaluation of the Patient

**Pain History:**

- Pain prior to amputation
- Pain related to surgery/procedures
- Phantom sensations
- Phantom pain
- Treatment for each of the above

# Evaluation of the Patient

**Social History:**

- Social support system
- Involvement of support system
- Work history
- Contact/Discussions with employer
- Patient concerns about family, friends, employer
- Financial issues
- Education level

# Evaluation of the Patient

**Psychological History:**

- Prior psychological issues (depression, previous disabilities)
- Current feelings about amputation
- Future concerns about function
- Body image issues
- Concepts about prosthesis
- Previous experience with prosthesis

# Evaluation of the Patient

**Avocational Activities History:**

- Family Responsibilities
- Sports / Fitness
- Intimacy / Sex
- Driving
- Outdoor activities (swimming)
- Hobbies

# Evaluation of the Patient

**Physical Exam:**

- Single limb vs. Multiple limb involvement
- Dominant vs. Non-Dominant limb loss
- Single limb loss – Examine remaining limb first in detail proximal and distal (makes exam of involved limb easier for doctor and patient)
- Check spinal alignment

# Evaluation of the Patient

**Physical Exam of the involved limb:**

- Level of amputation, bone length
- Skin and soft tissue integrity
- Skin grafting or scarring
- Adherent skin
- Tenderness to palpation
- Sensation throughout

# Evaluation of the Patient

**Physical exam of the involved limb:**

- Shoulder girdle muscles: (trapezius, rhomboids, pectoralis, latissimus, supraspinatus, infraspinatus, subscapularis, deltoid)
- Shoulder A/PROM: glenohumeral joint (FL, Ext, Abd, Add, IR, ER), scapulo-thoracic rotation and stability
- Cervical spine mobility

# Evaluation of the Patient

**Physical exam of the involved limb:**

- Elbow motor (Fl, Ext)
- Elbow A/PROM (Fl, Ext)
- Wrist motor/ROM (Flex, Ext, Pron, Sup)
- Any remaining segments of hand

# Introduce the P&O Team Concept

- Patient
- Physiatrist
- Prosthetist
- Physical Therapist
- Occupational Therapist
- Social Service
- Psychologist
- Vocational Counselor
- Case Manager

# Review the Rehab Issues and Plans

**Education – Pre-prosthetics Program:**

- Need for early therapy to mobilize joints and maintain strength
- Regain independence in self-care and mobility
- Residual limb shaping and shrinking
- Pain control
- Psychological issues
- Buddy system with other patients

# Review the Rehab Issues and Plans

**Education – Prosthesis:**

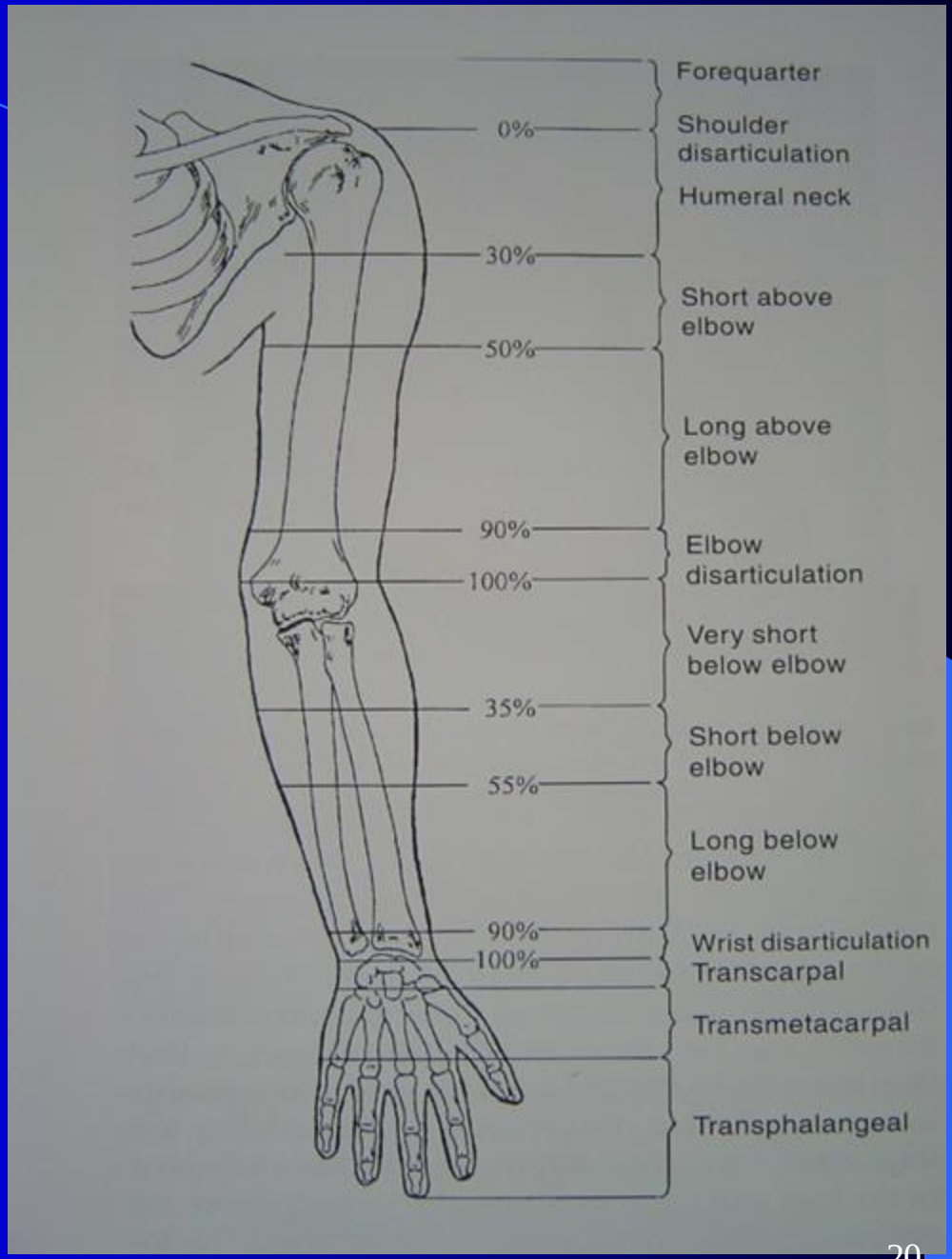
- Explain about fitting/fabricating prosthesis and component selection
- Explain cosmetic vs. functional issues
- Inquire about insurance coverage for prosthesis
- Clarify patient concerns or misconceptions about prosthesis

# Review the Rehab Issues and Plans

**Long term Management:**

- Lifetime comprehensive management by P&O Team
- Skin tolerance issues
- Return to driving
- Return to work/school
- Return to avocational activities and sports

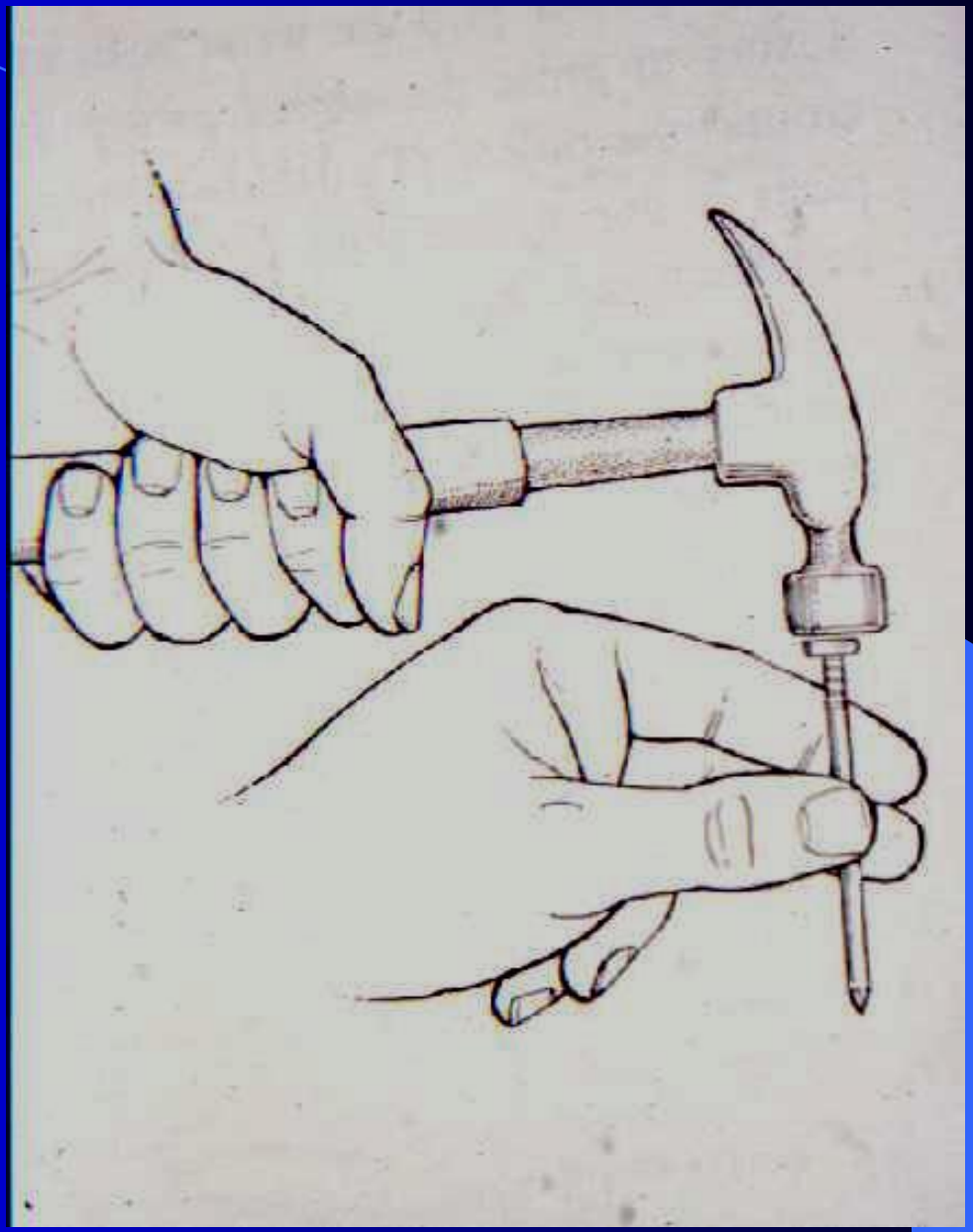
# Levels of Amputation



# Functional Impact of Finger Amputation

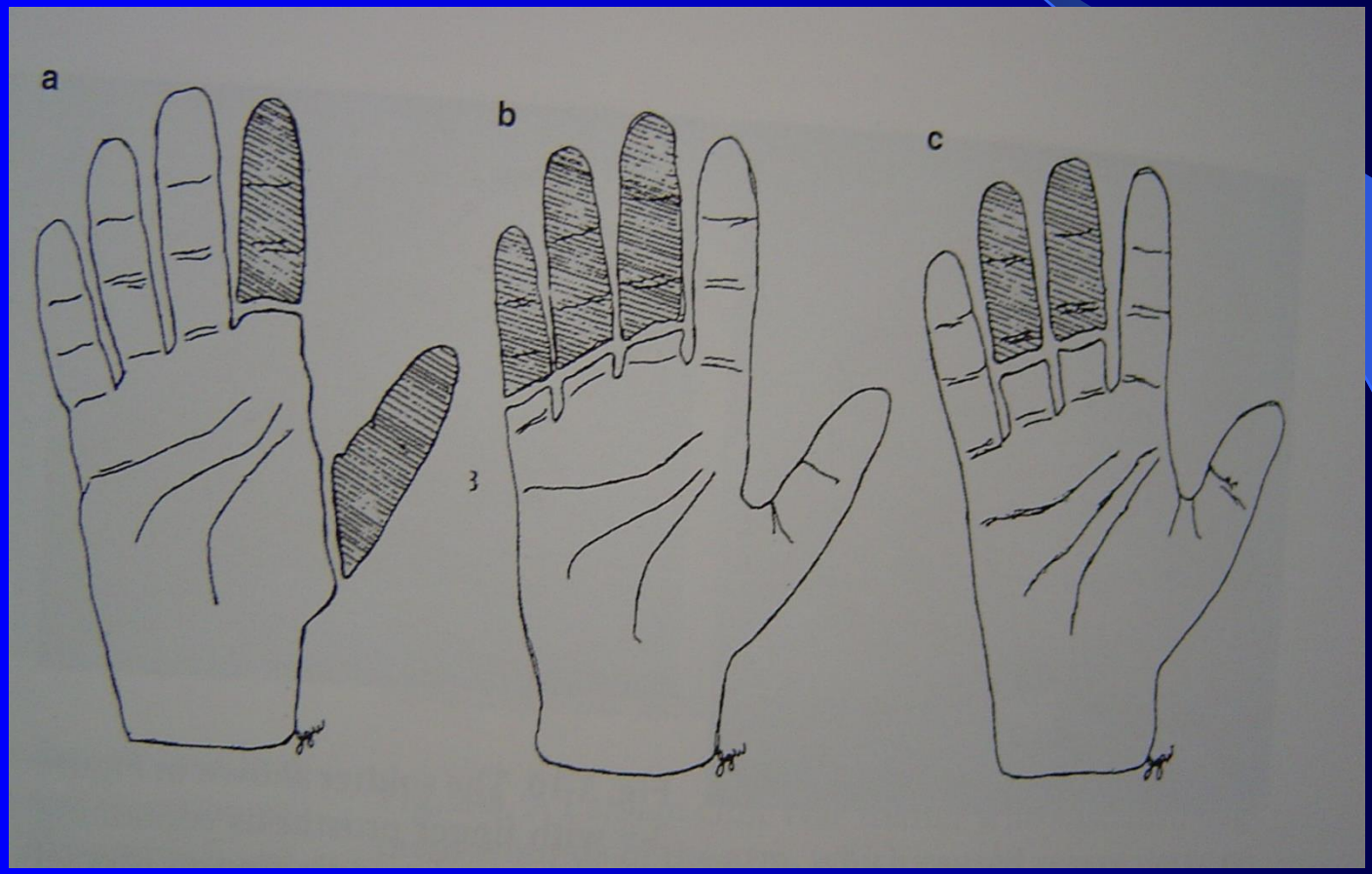
- Thumb ⇒ Opposition
- Index and Middle ⇒ Fine motor
- Fourth and Fifth ⇒ Power Grip

# Finger Pinch and Gross Grasp



# Single Digit Amputation

# Multiple Finger Amputations



# Multiple Finger Amputation

# Functional Hook Grasp

# Multiple Digit Burns

# Multiple Digit Amputation

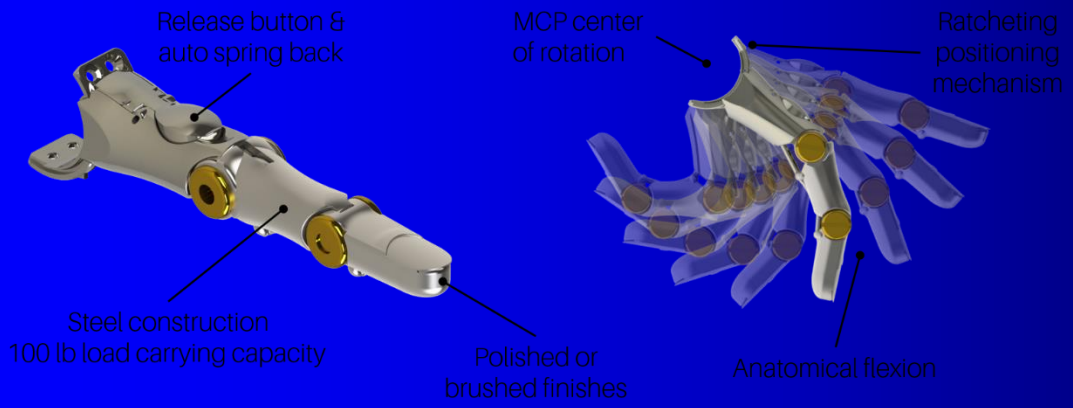
# Functional Tip pinch

# Functional Gross Grasp

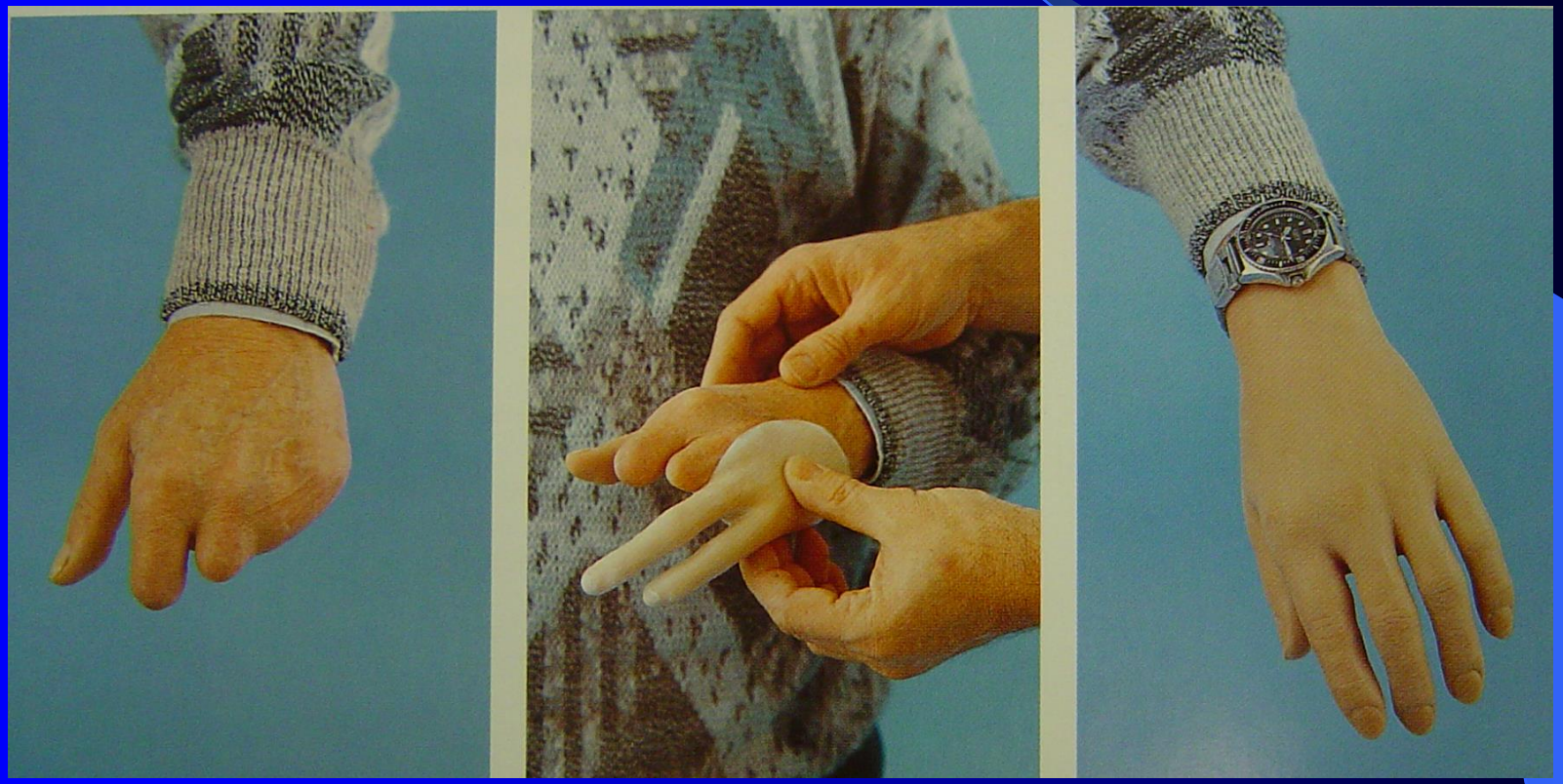
# PIP driver

# MCP driver

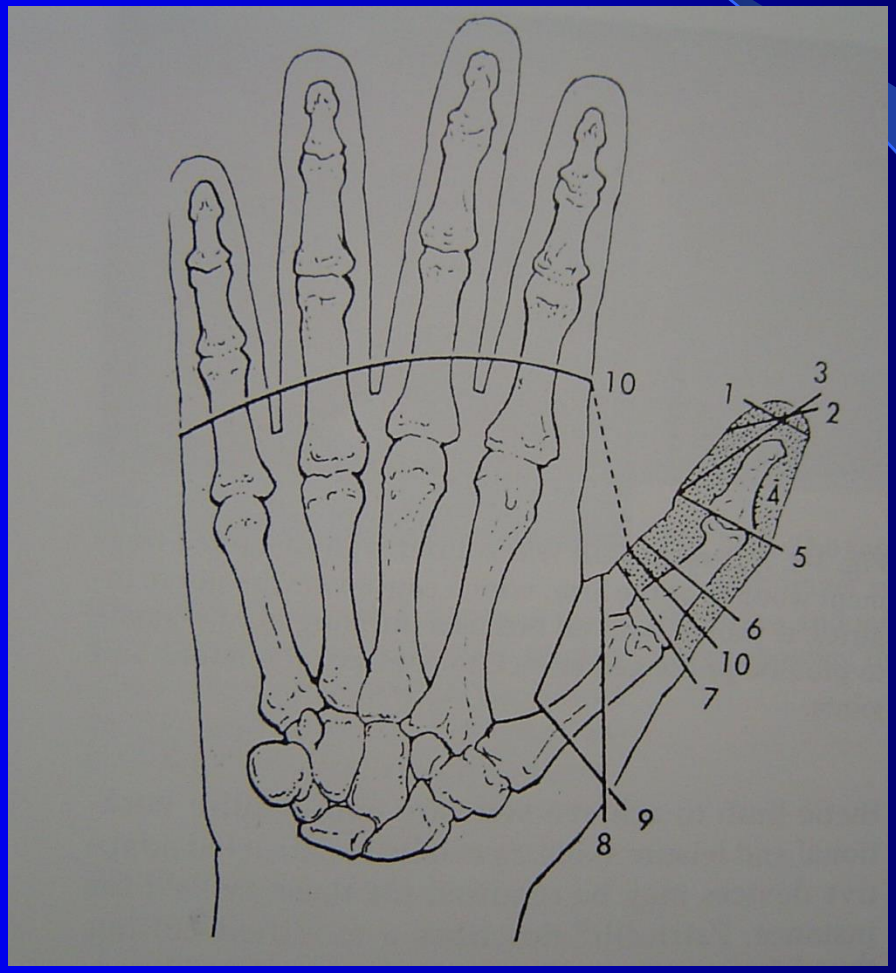
# Point Design ratcheting fingers



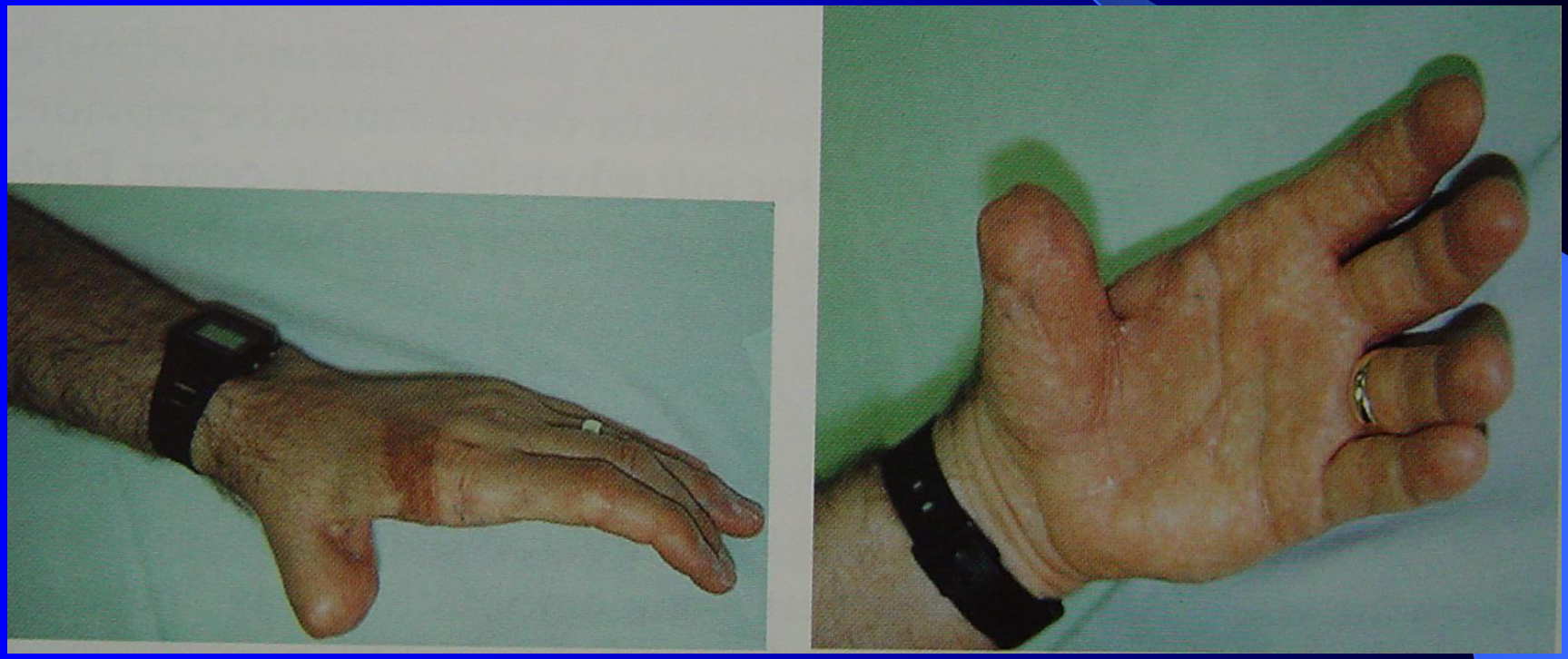

# Multiple Finger Amputation



# Levels of Thumb Amputation



# Partial Thumb Amputation Deepen First Web Space



# Functional Gross Grasp

# Finger Tip Pinch for Fine Motor Skills

# Partial Thumb Prosthesis

# Full Thumb Prosthesis

# Thumb Prosthesis

# Trans-metacarpal Amputation

# Myo-electric partial hand

# Trans-metacarpal Amputation

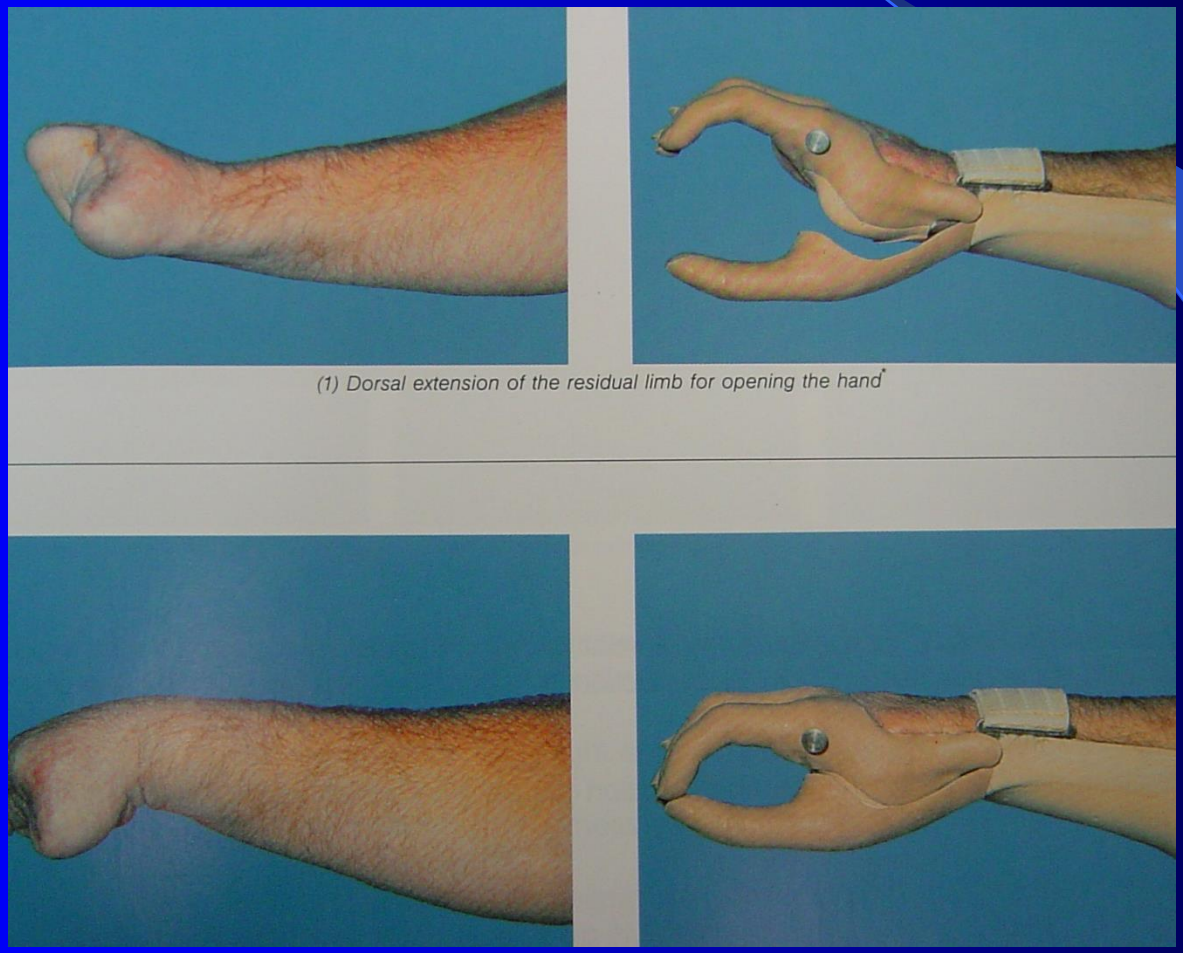
# Trans-metacarpal Amputation

# Electrocution Injury

# Partial Hand Prosthesis

# Mitt Amputation with Burns

# Mitt Amputation Prosthesis



(1) Dorsal extension of the residual limb for opening the hand

# Hand Amputation and Re-implantation


# Functional Hand?

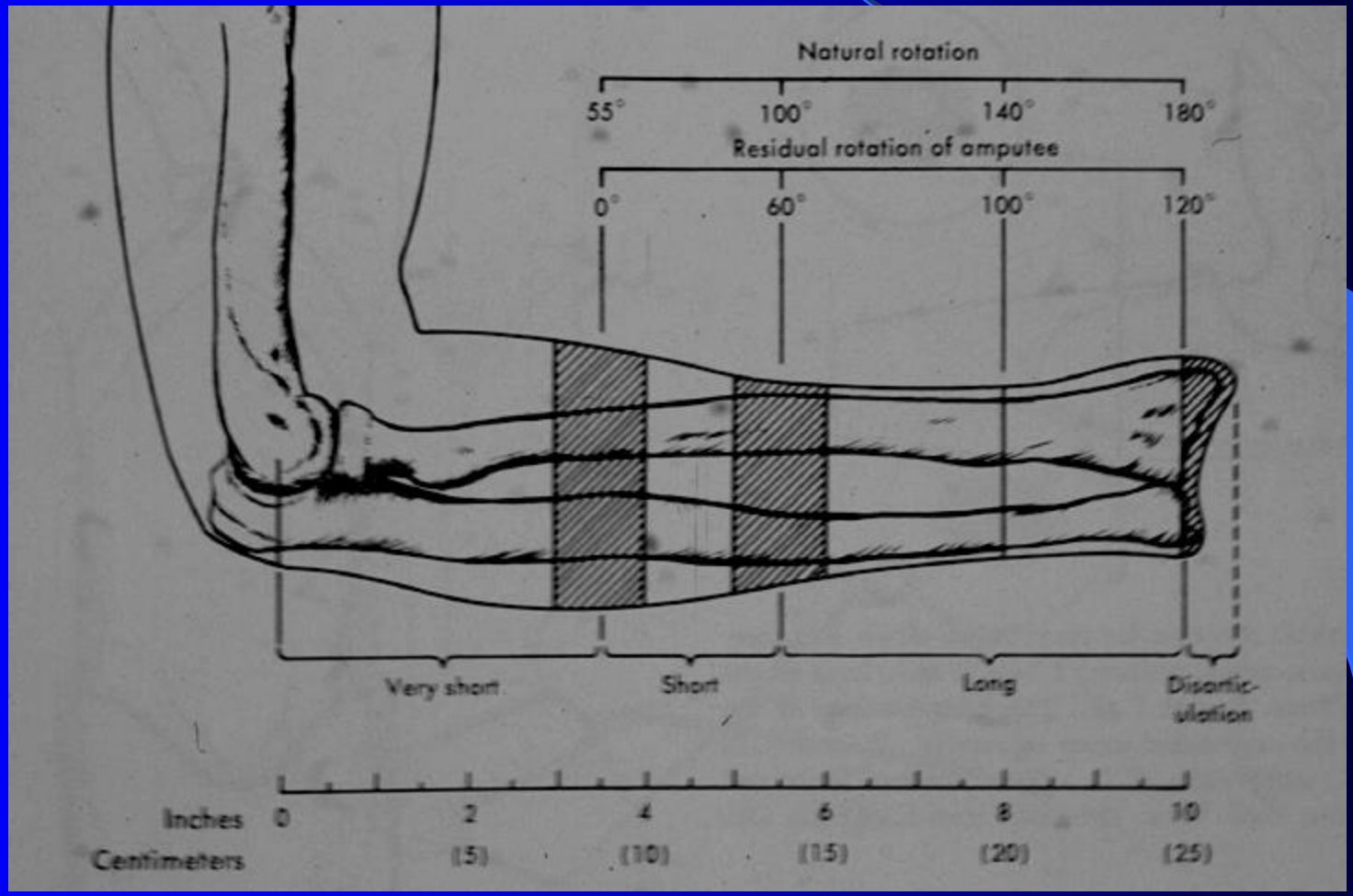
# Wrist Disarticulation Amputation

- Advantages: Maximum Pronation/Supination
  Maximum leverage for lift/push
- Disadvantages: Bulky distal end

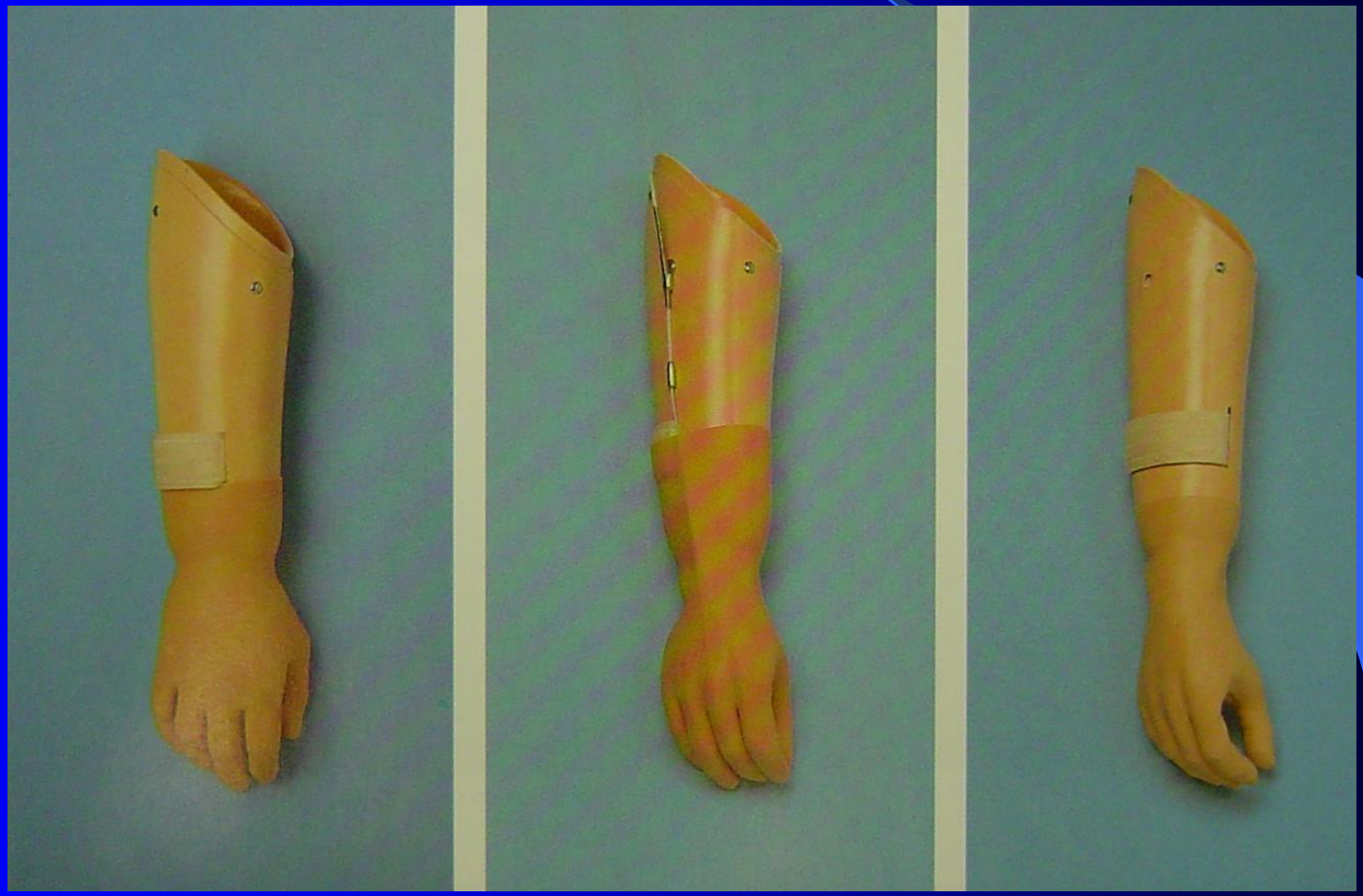
  Poor prosthetic cosmesis

  Need 3-4 cm for wrist unit

# Degrees of Pronation

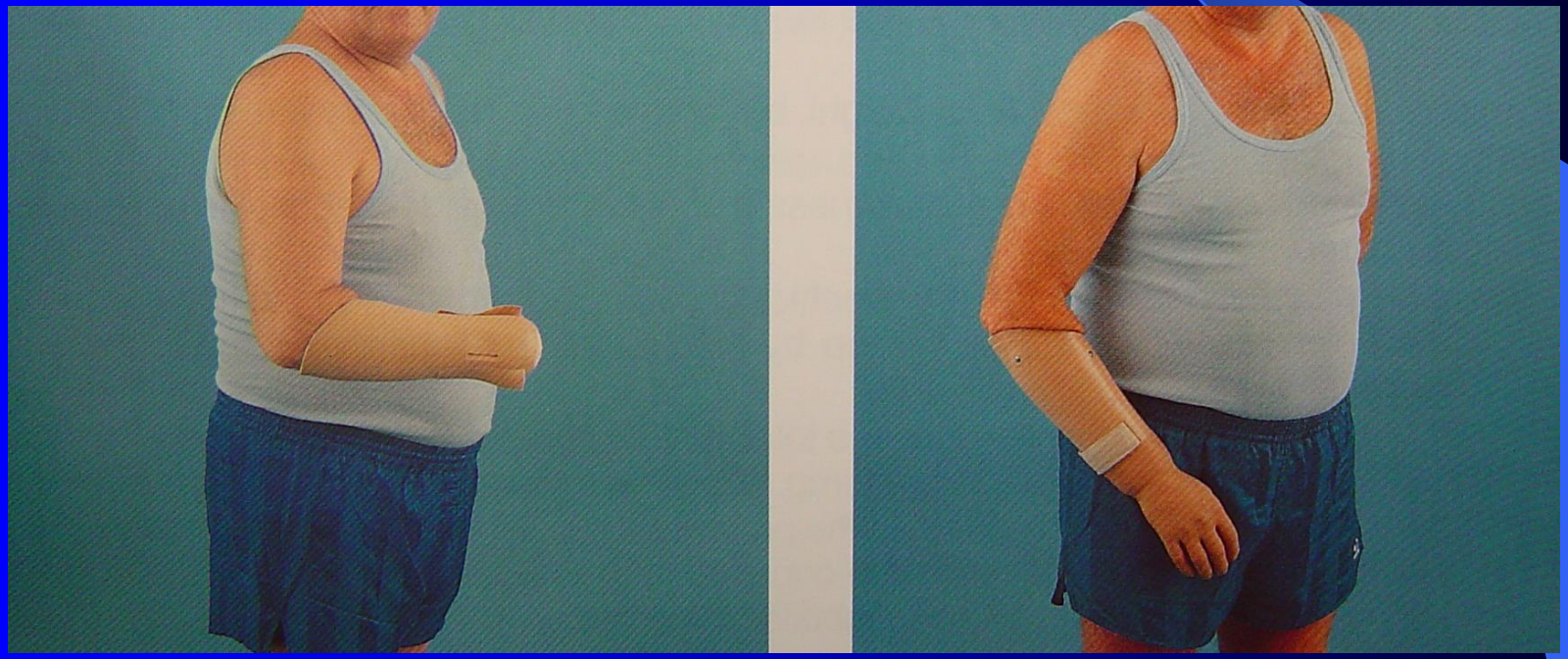


# Wrist Disartic Prosthetic Options (cosmetic, cable, myo)



# Wrist Disarticulation Amp

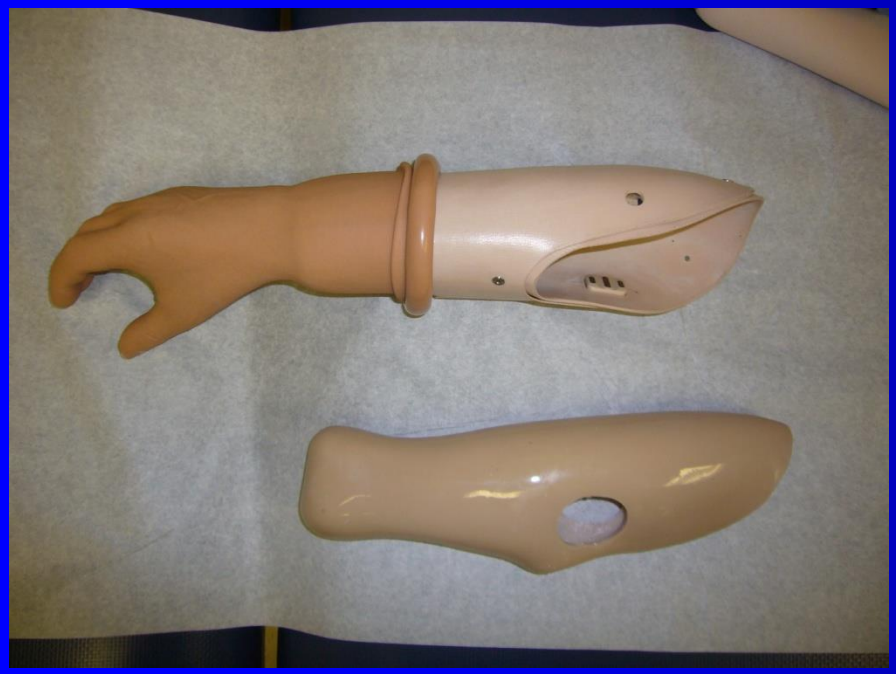
# Wrist Disartic Prosthesis Body-powered Socket Fitting



# Figure-9 Harness with Control Cable to Terminal Device

# Wrist Disartic Myo-electric Self-suspending Socket

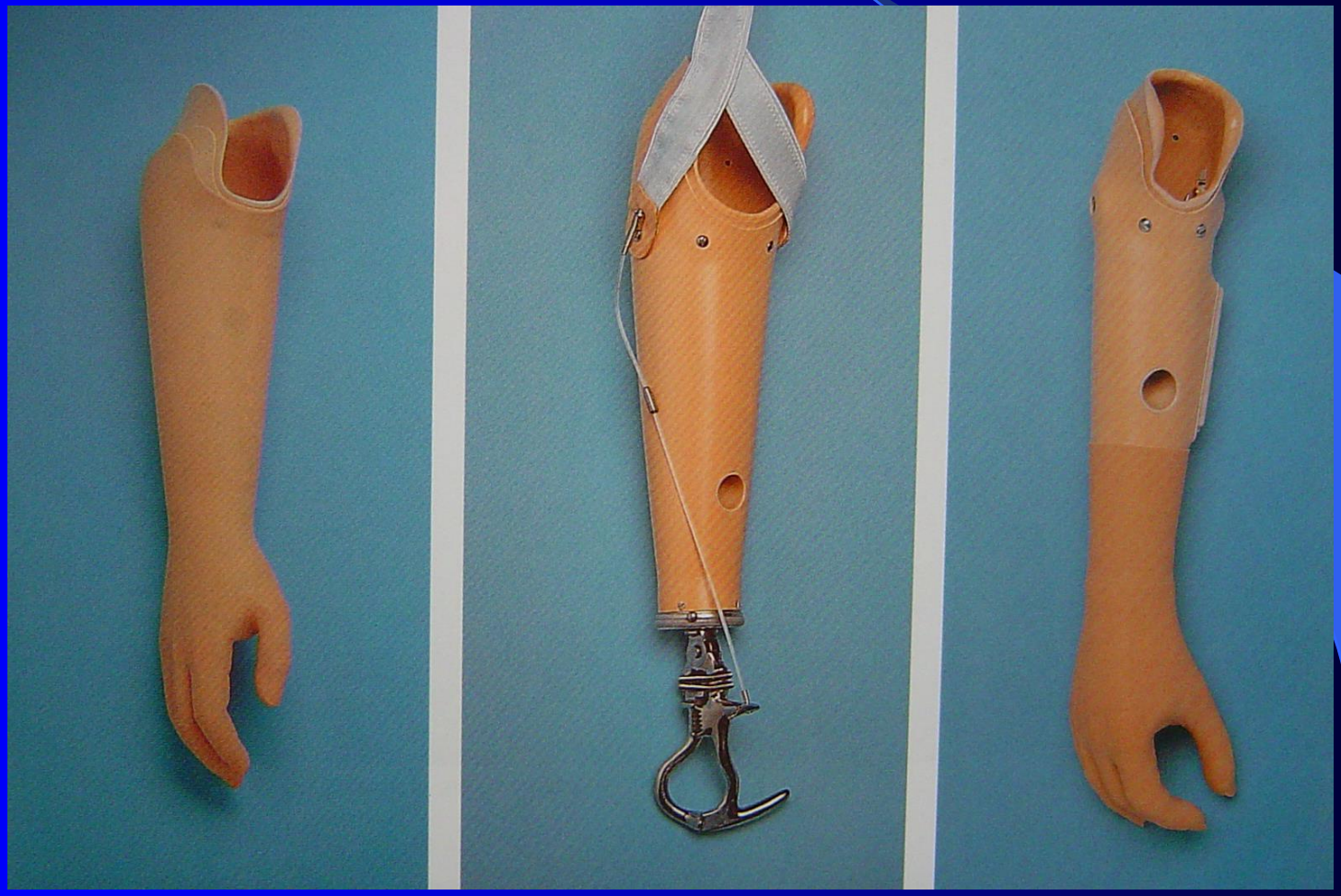
# Wrist Dis-artic Prostheses



# Trans-radial Amputation

- Long = 55-90 % of radius intact
  - Ideal length for function and cosmesis
  - Maintains most of pron/sup and leverage
- Short = 35-55 % of radius intact
  - Still very functional and fittable
- Very short = 0-35 % of radius
  - Difficult socket fit and limited function

# Trans-radial Prosthetic Options (cosmetic,cable,myo)



# Long Trans-radial Amputee

# Long Trans-radial Amputation

# Long Trans-radial Cable Prosthesis

# Figure-8 Harness

# Short Trans-Radial Amp

# Cable-Powered Trans-radial Prosthesis

# Very Short Trans-radial Amputee

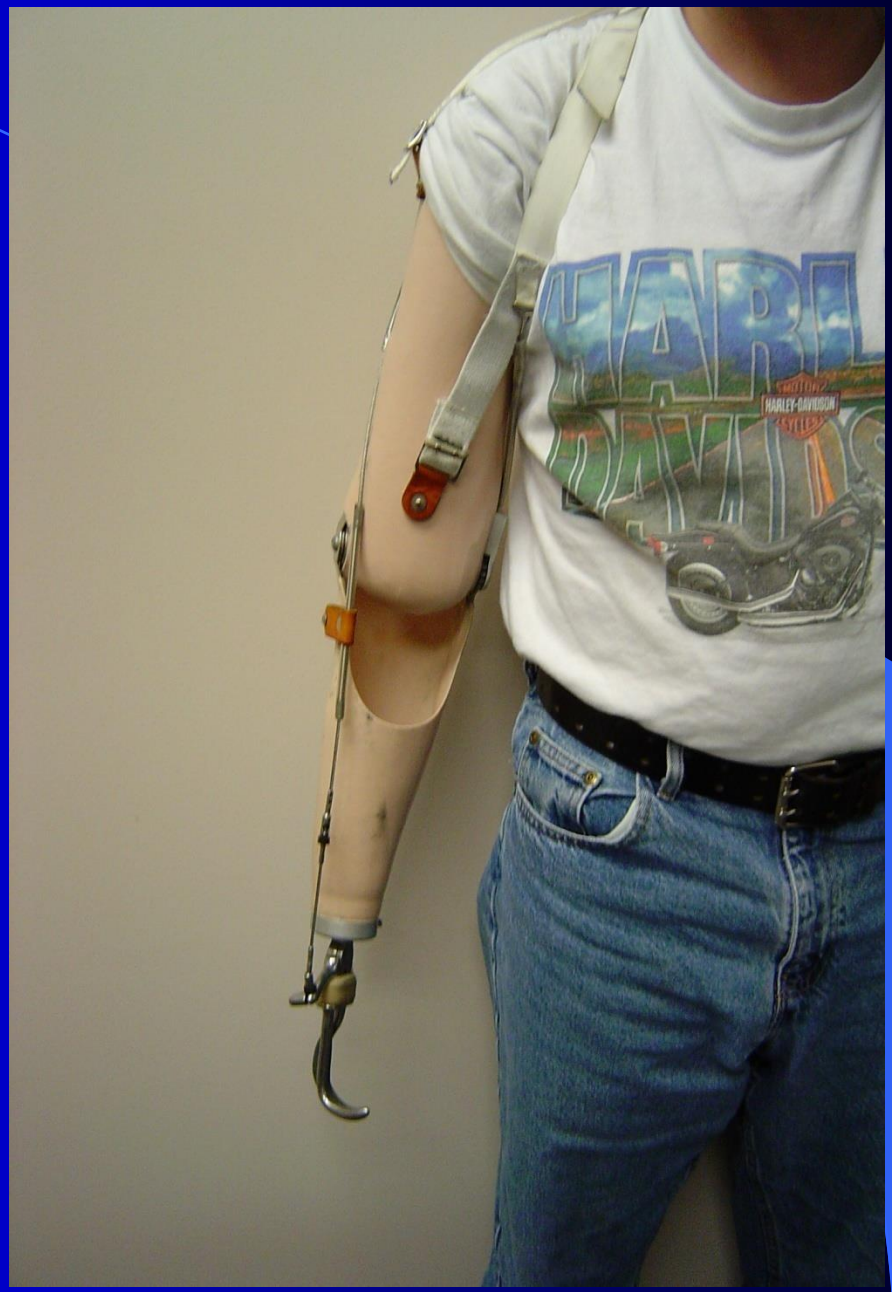
# Krukenburg Reconstruction

# Elbow Disarticulation Amputation

- Advantages: Maximum leverage for lift/push
  Humeral condyles assist with suspension
- Disadvantages: Bulky distal end
  Poor prosthetic cosmesis
  Must use external elbow joints
  Need 4-5 cm for electric elbow

# Elbow Disarticulation

# Elbow Disartic Cable-powered Prosthesis



# Elbow Disartic Prosthesis with Harness

# Elbow Disartic Myo-electric Prosthesis with test socket

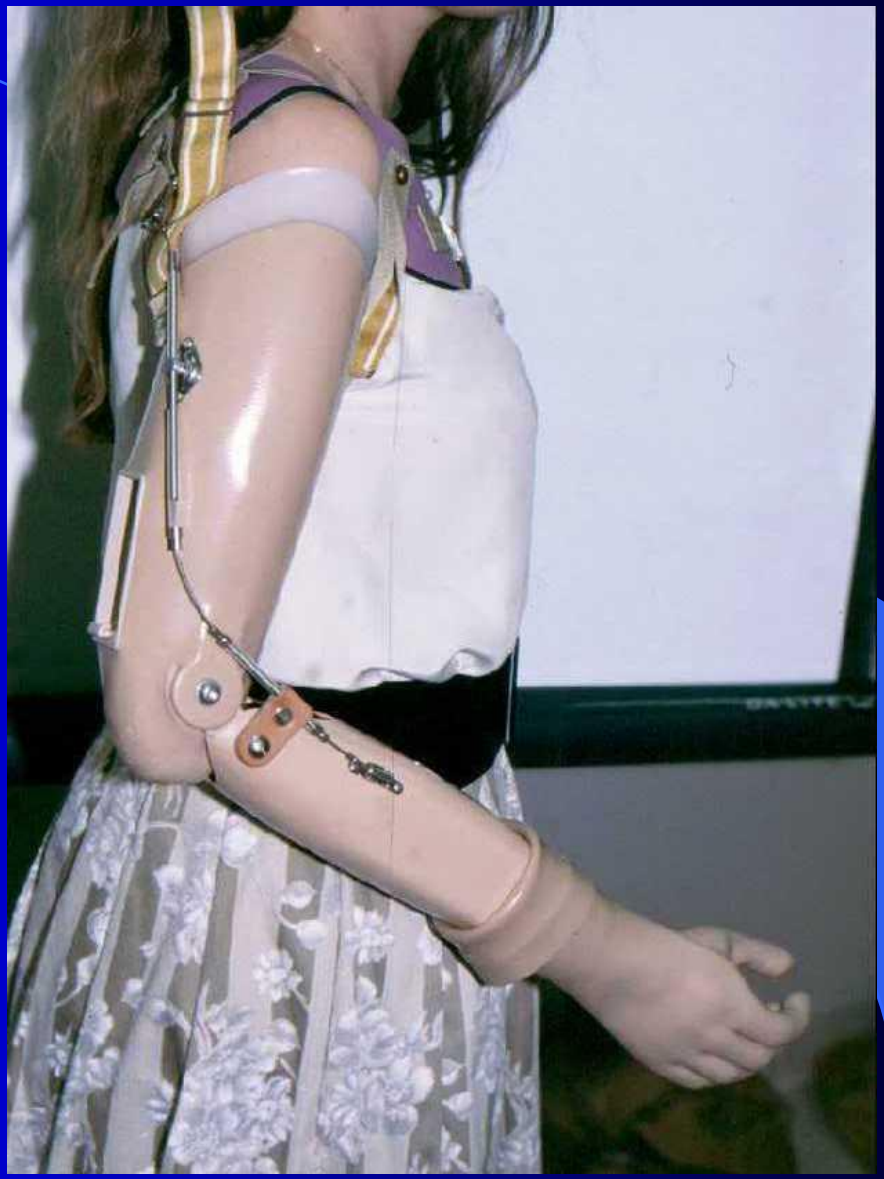
# Smart idea?

# Elbow Disarticulation Amp

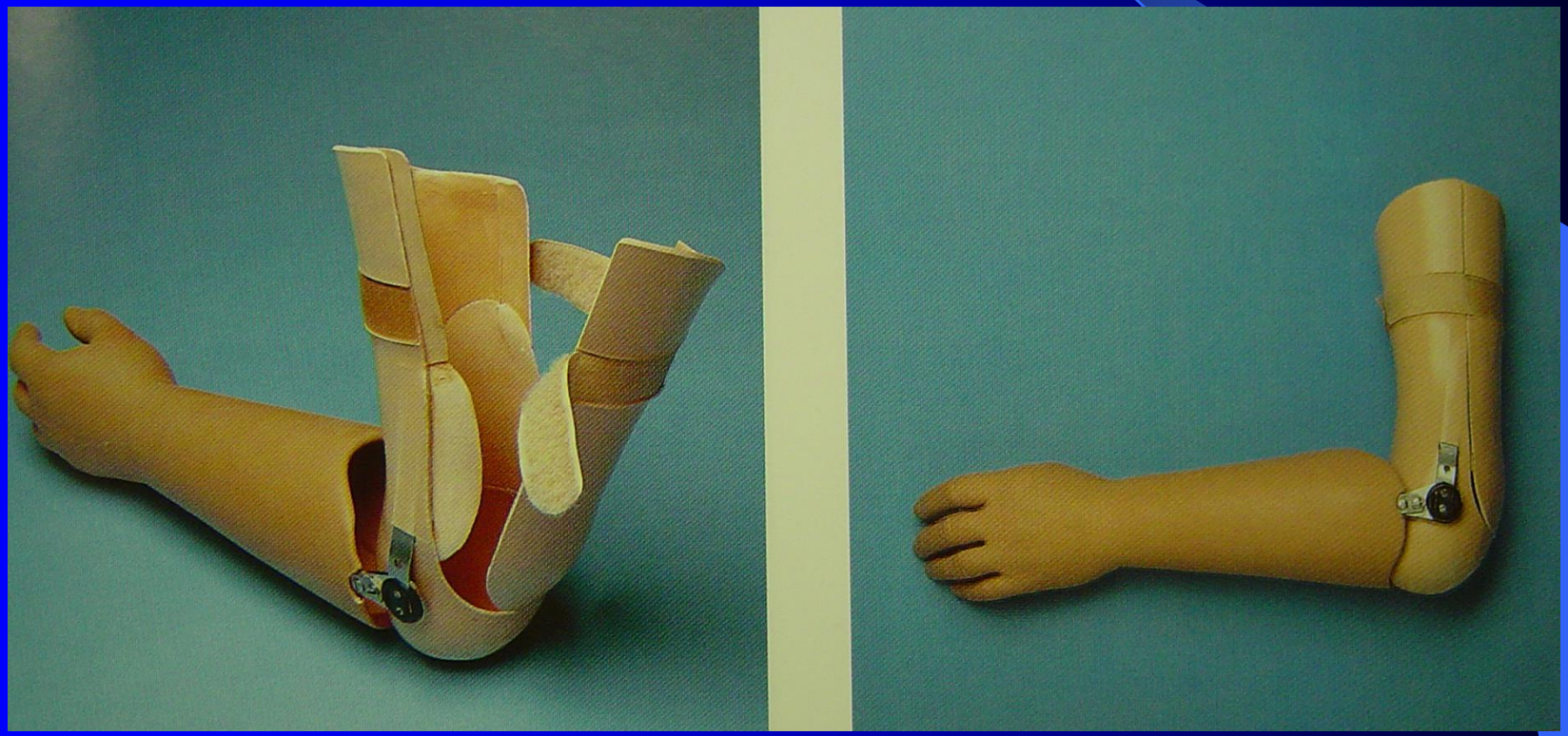
# Elbow Disarticulation Cable Prosthesis with external elbow joints

# Figure-8 Harness Plus Suspension Straps and External Locking Elbow Joint

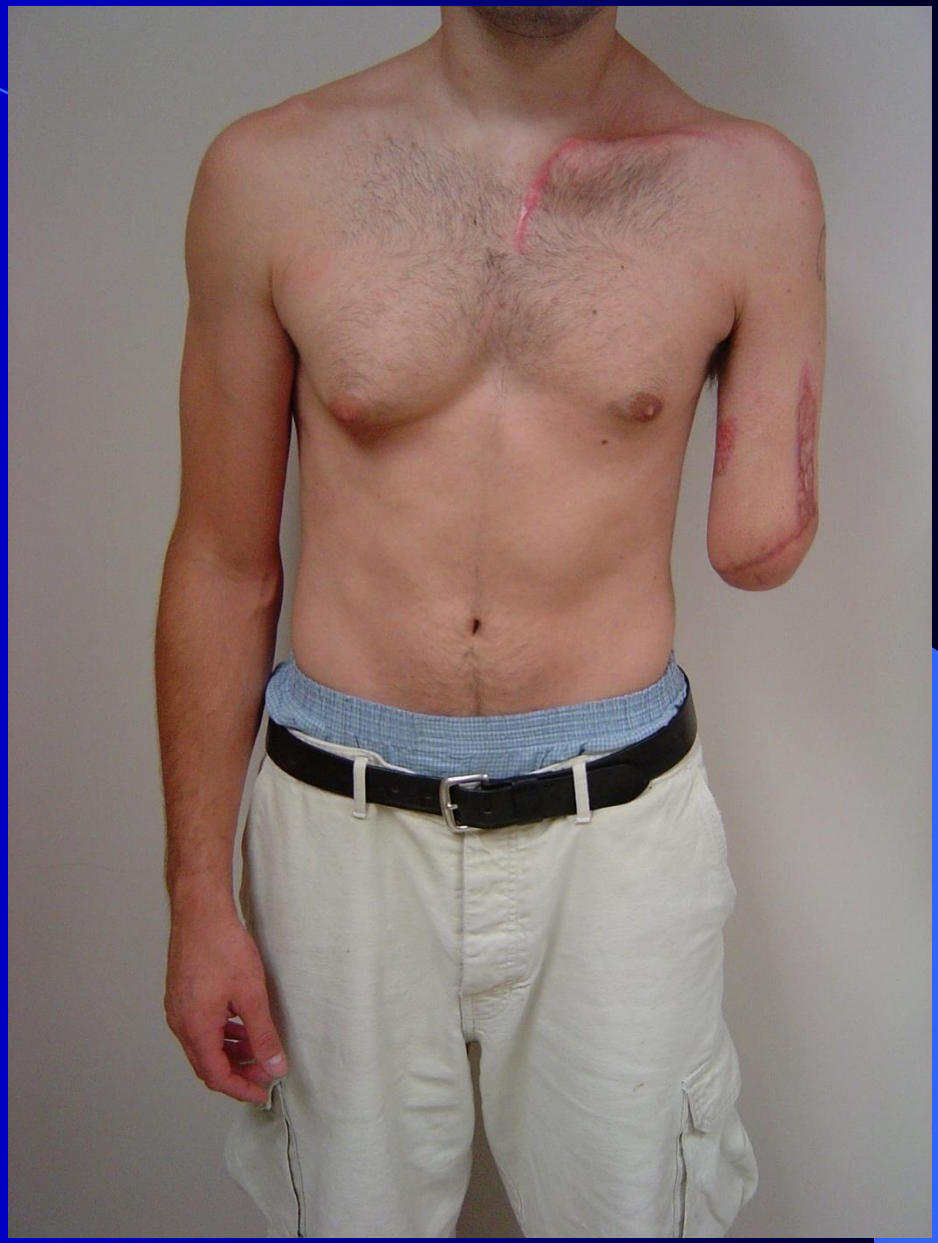
# Hybrid Elbow Disartic Prosthesis with cable to elbow and myo-hand



# Elbow Disartic Prosthesis Bi-valve Socket



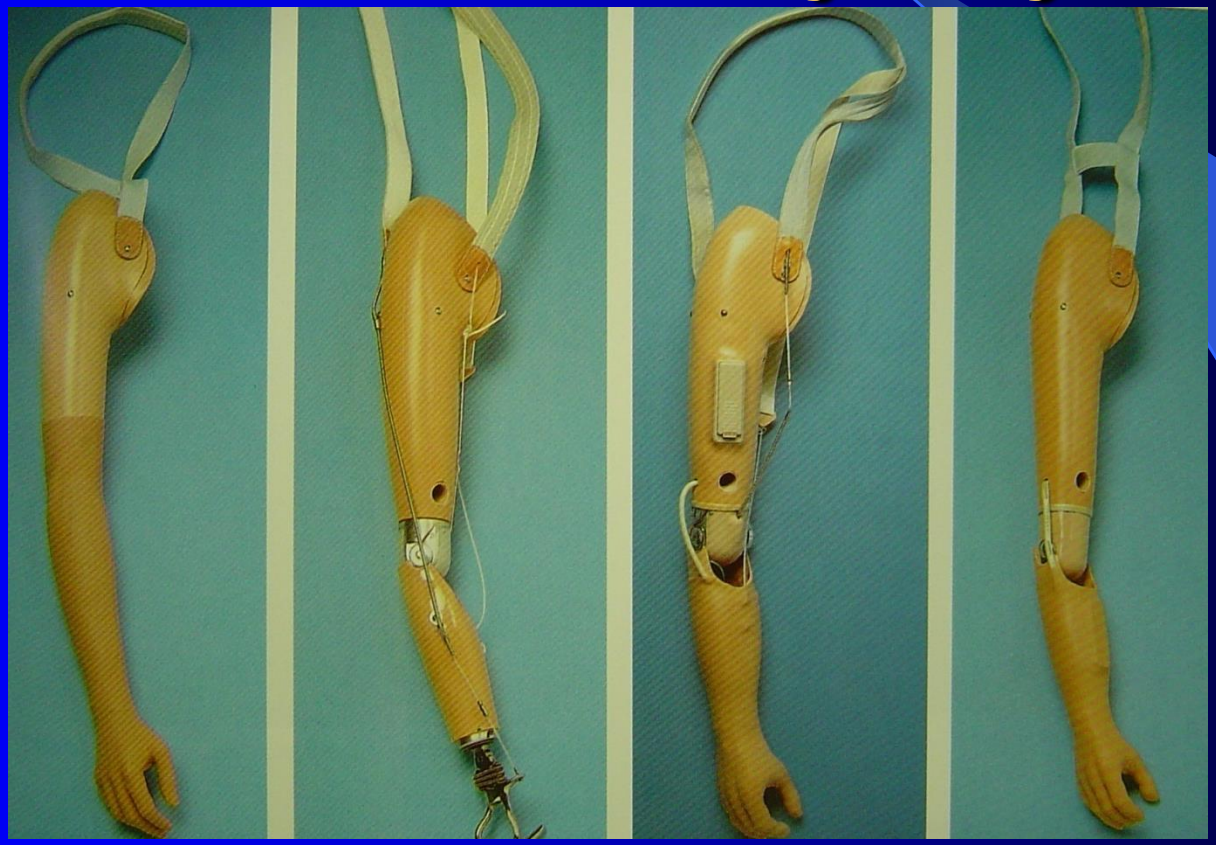
# Elbow Disartic with Brachial Plexus Injury



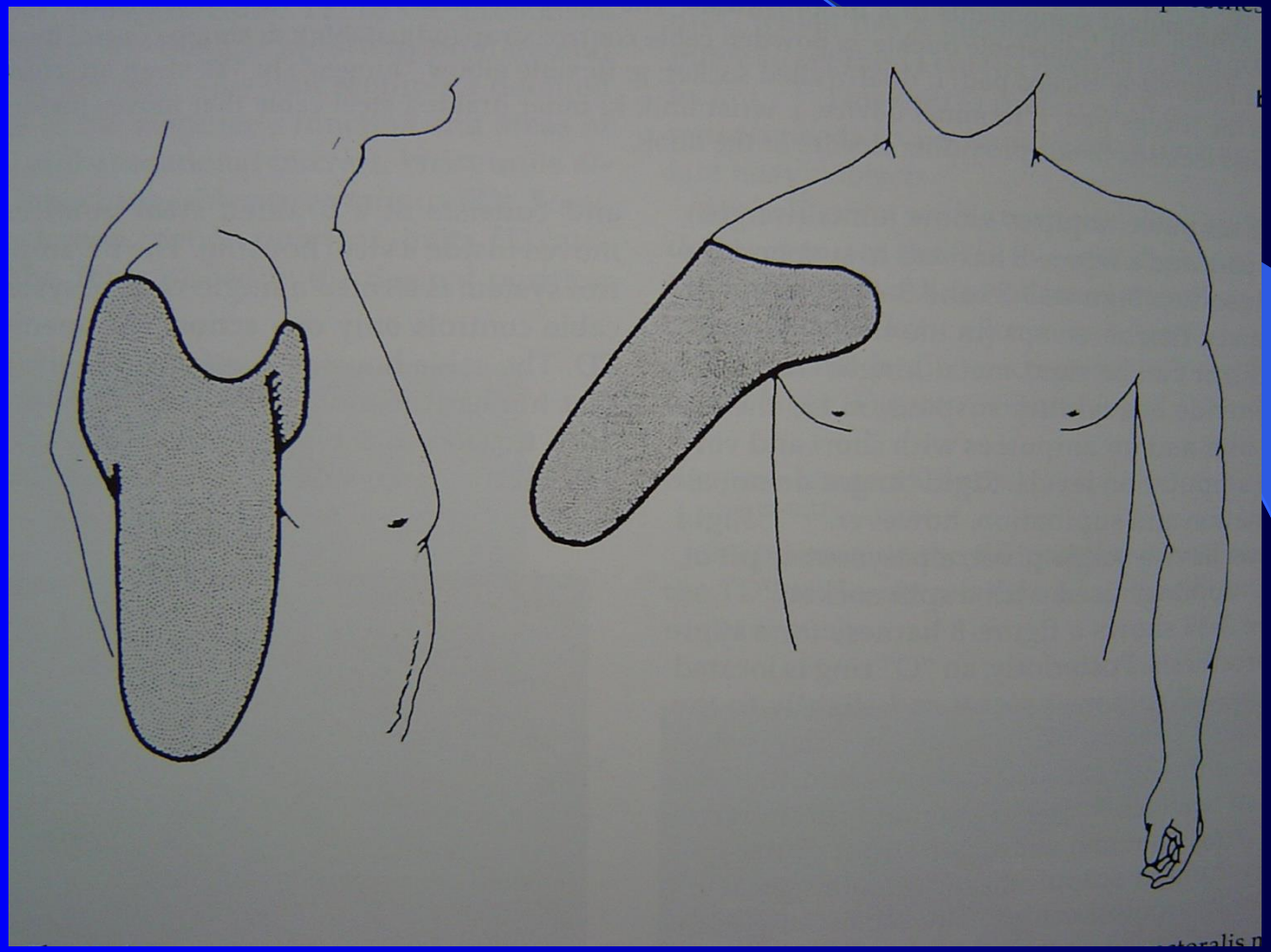
# Trans-humeral Amputation

- Long = 50-90 % of humerus intact
  - Ideal length for function and cosmesis
- Short = 30-50 % of humerus intact
  - Limited leverage for lift/push
  - Socket design now limits shoulder motion
- Very short = Humeral neck = 0-30 % intact
  - Fitted as shoulder disarticulation

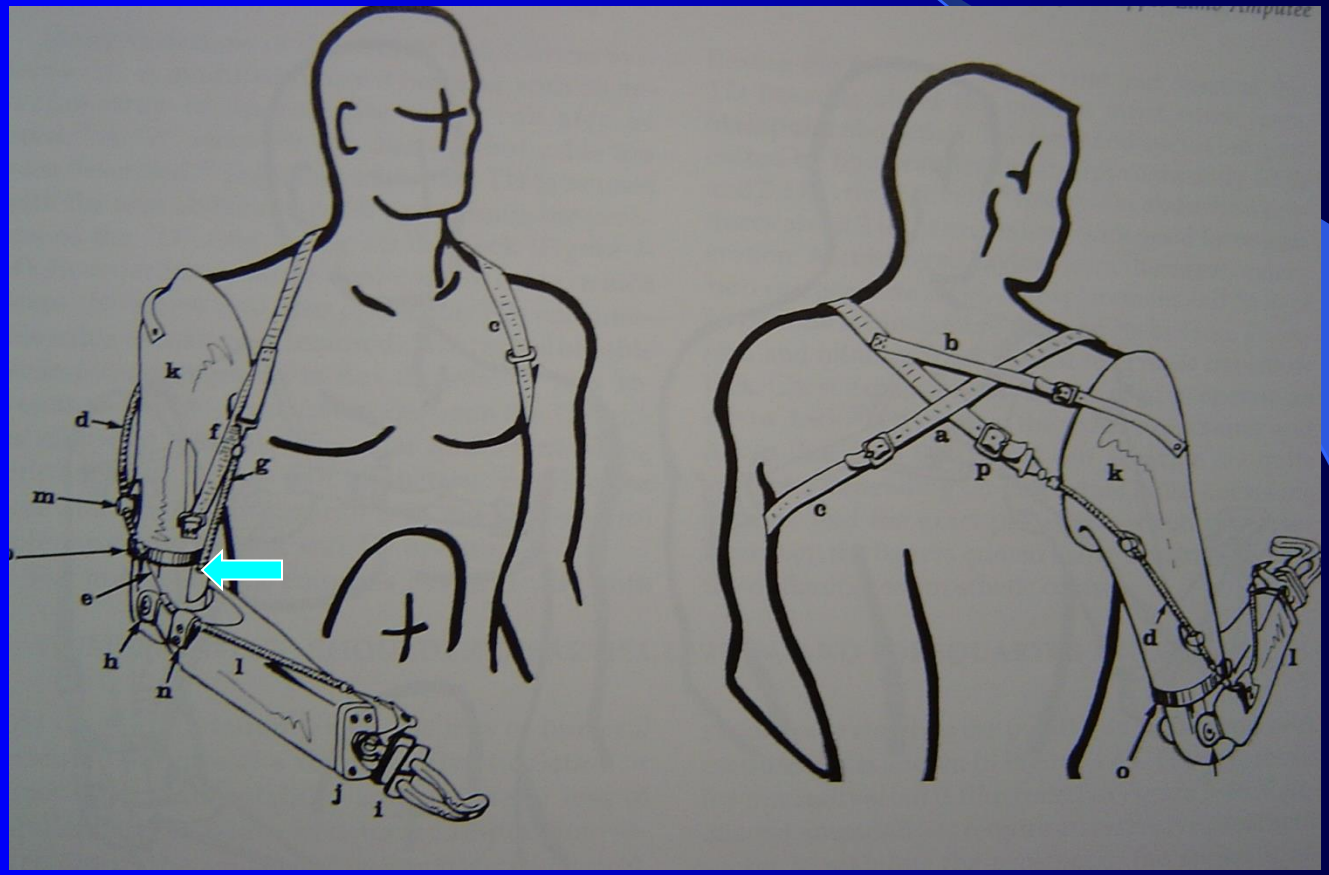
# Trans-humeral Prosthetic Options (cosmetic,cable,myo,hybrid)



# Trans-humeral Socket Design



# Figure-8 Harness on Trans-humeral Prosthesis



# Long Trans-humeral Amputee


# Long Trans-humeral Amputee


# Trans-humeral Prosthesis

# Trans-humeral Prosthesis with Hybrid Control (cable elbow)

# Short Trans-Humeral Amp

# Hybrid Trans-humeral Prosthesis

# Saddle Harness for Short Trans-humeral Prosthesis

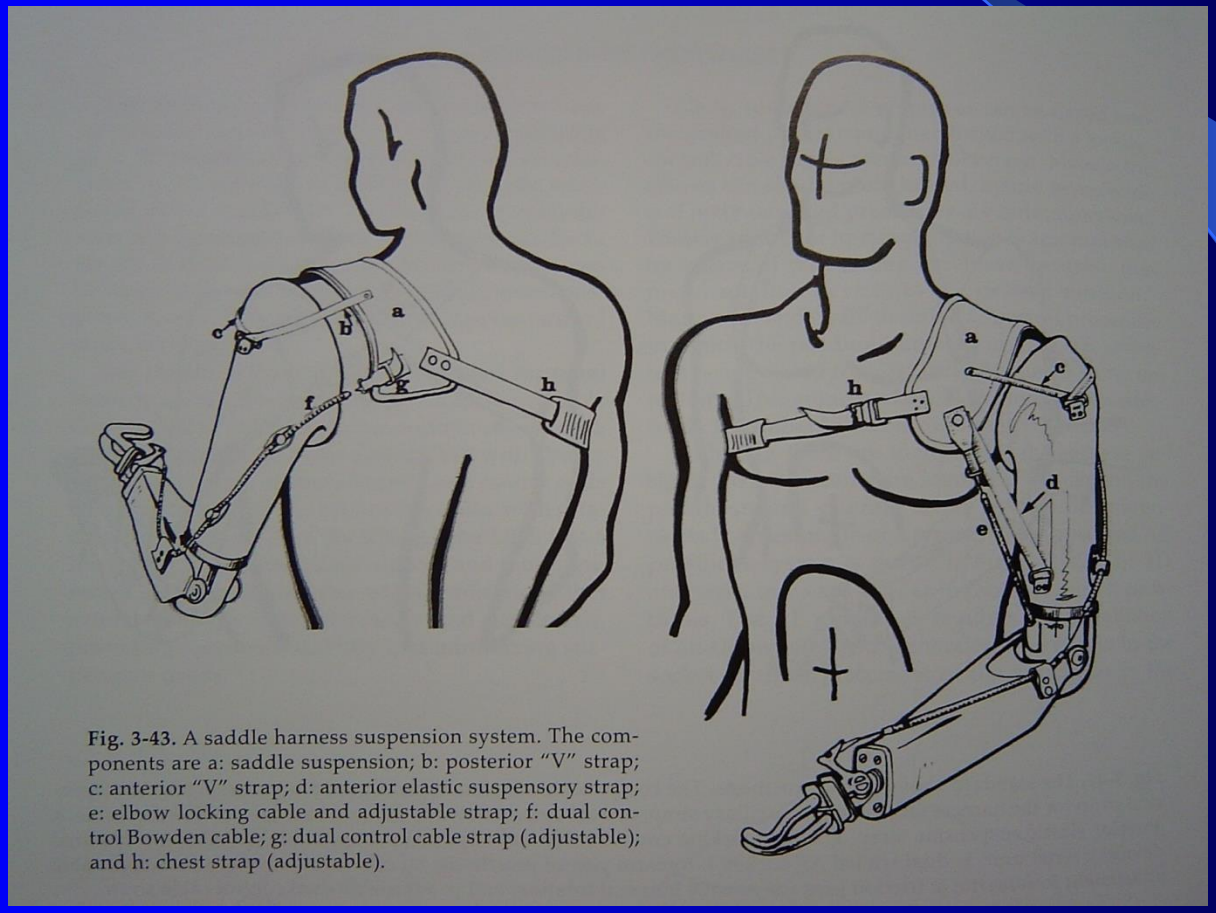



**Fig. 3-43.** A saddle harness suspension system. The components are a: saddle suspension; b: posterior "V" strap; c: anterior "V" strap; d: anterior elastic suspensory strap; e: elbow locking cable and adjustable strap; f: dual control Bowden cable; g: dual control cable strap (adjustable); and h: chest strap (adjustable).

# Humeral Neck Amputation

# Humeral Neck Cable Prosthesis

# Humeral Neck Prosthesis with Cross-chest Strap Suspension

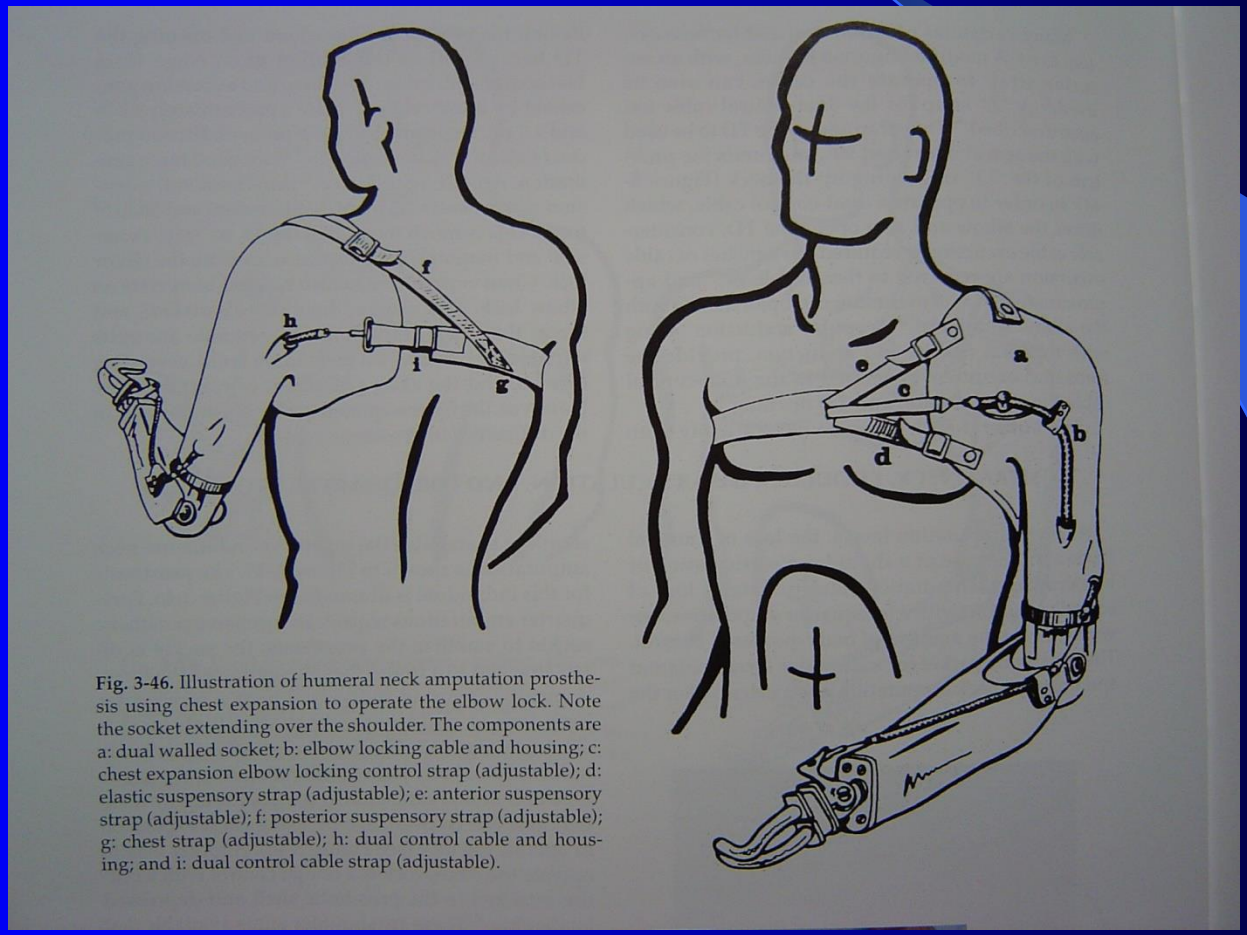
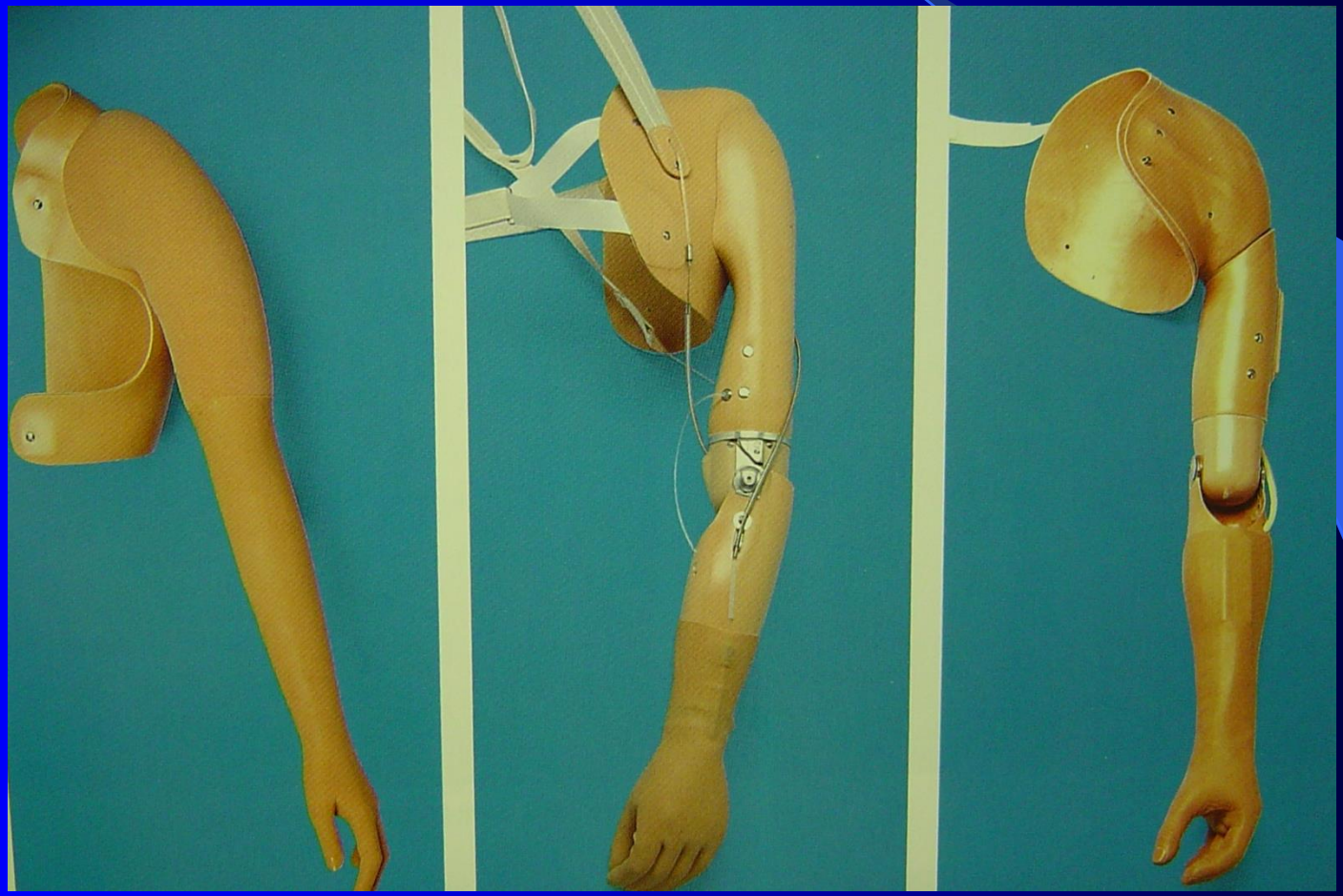



**Fig. 3-46.** Illustration of humeral neck amputation prosthesis using chest expansion to operate the elbow lock. Note the socket extending over the shoulder. The components are a: dual walled socket; b: elbow locking cable and housing; c: chest expansion elbow locking control strap (adjustable); d: elastic suspensory strap (adjustable); e: anterior suspensory strap (adjustable); f: posterior suspensory strap (adjustable); g: chest strap (adjustable); h: dual control cable and housing; and i: dual control cable strap (adjustable).

# Shoulder Disarticulation Amputation

- Difficult socket design
- Difficult to achieve functional prehension
- Heavy prosthesis may not be tolerated
- Patient may choose to be independent without prosthesis if other hand intact

# Shoulder Disartic Prosthetic Options

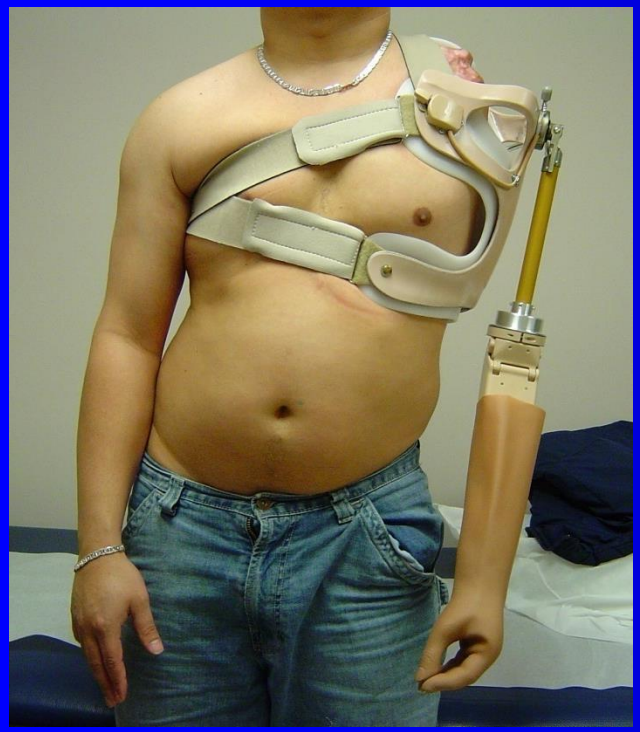


# Shoulder Disartic

# Shoulder Disartic Prosthesis Myo-electric

# Shoulder Disartic Amputation


# Shoulder Disartic Prosthesis Myo-electric



# Forequarter Amputation

- Loss of entire limb and scapula
- Most commonly caused by tumor resection
- Lightweight cosmetic prosthesis is the most practical device

# Bilateral Upper Limb Amputation

- Fit the longer residual limb with a prosthetic device for functional prehension (pinch and gross grasp)
- Fit the remaining limb as an assist for longer limb
- Use any and all available assistive devices to achieve independence in self-care and ADL's

# Bilateral Elbow Disartic Prostheses

# Complex Cases

- Multiple limb amputation
- Other confounding medical issues
- Timing of multiple limb prosthetic fitting
- If delay in fitting, preserve myo-electric sites with muscle isometric or FES


&F
GAZINE
STARS
ON THE RISE


13 11:50 AM

# Thank You