

TETRAPLEGIC HAND

Classification of tetraplegias

- C5 Shoulder abduction and elbow flexion
- C6 Wrist extension
- C7 Elbow extension and finger extension
Wrist flexion and forearm pronation
- C8 Finger flexion
- T1 Intrinsic flexion

Requisite for tendon transfer are

Availability of expendable muscle

Should have clear idea of function required

Strength to be achieved (at least Grade IV, or less for loose tendon)

Time elapsed since injury (allow at least a year)

Neurological stability

Psychological and social stability

Controllable spasticity

Trunk balance and proximal muscular control

Minimal joint contracture

Aim

To provide: active elbow extension,
active wrist extension,
active key pinch,
active finger grasp,
active digit extension

ASIA [American Spinal Injury Assessment]

ASIA	Key muscle	Tendon Transfer
C5	None	None
C6	Brachioradialis	Posterior deltoid to triceps Brachioradialis to ECRB FPL and FDP tenodesis grip
C6	Brachioradialis ECRL	In addition, ECRL to FDP Tenodesis FPL
C6	Brachioradialis ECRL ECRB	ECRL to FDP Brachioradialis to FPL
C6	Brachioradialis ECRL ECRB Pronator teres	Pronator teres to FPL Brachioradialis to adductor pollicis
C6	Above and FCR	Above and tenodesis of ED and EPL
C7	Above and Extensor digitorum	EPL transfer, opponens and intrinsic
C7	Above and EPL	Opponens transfer and intrinsic transfer
C8	Above and finger flexors	Intrinsic transfer and pinch

Popular surgeries

1. **Wrist extension** Brachioradialis to ECRB

2. **Key pinch:** FPL tenodesis

3. **Finger Grasp** ECRL to FDP

Aim is to achieve a balanced hand by surgery. Outcome depends on intensive rehabilitation.

4. **Elbow extension**

a. Posterior deltoid to triceps transfer.

b. Biceps to triceps transfer, when brachialis and supinator are intact [medial routing]

STROKE

Anesthetic problems

Tracheostomy could be necessary.

NMJ drugs should be carefully used

Contracture and positioning is important

Orthopedic problems

Deformity and joint stiffness

Heterotopic ossification

Pressure sores

Two approaches

depending on condition of patient

1. Functional surgery where patient is perceptive.
2. Surgery to improve nursing care where there is asteriognosis, and an absence of learning ability, awareness and volitional activity.

When to do surgery?

At least 6 months after stroke.

Non-operative treatments

Serial cast, botulinum, physiotherapy

Assessment of deformity

Fingers are typically clasped into the palm; nails may dig into palmar skin

Look for active and passive extension of the fingers.

Check for active control of finger flexion.

Volitional control of the finger extensors is present in 50% stroke patients

Assess degree of wrist control

Surgery depends on

Motor ability

The FDP tendon has less spasticity than FDS

The FDP usually has better volitional control than FDS

EMG

When dynamic EMG in the extrinsic flexor muscles is present, and then fractional lengthening is indicated.

When no volitional movement is detected, more significant lengthening of the flexor tendons is required. In this situation, perform a superficialis-to-profundus (STP) tendon transfer.

A. Clasped Fingers

Functional lengthening

Longitudinal incision on the volar surface of the forearm

Perform the lengthening of the individual FDS and FDP tendons by sharply incising the tendon fibres as they overlie the muscle belly at the musculo-tendinous junction, allowing the tendon to slide distally.

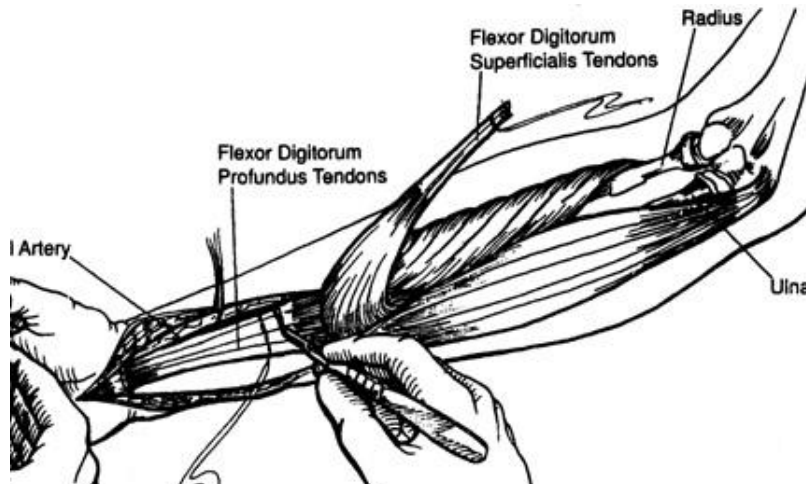
Lengthen the FPL tendon in an identical manner.

No sutures are needed when tendon is transacted over the muscle belly.

Do not immobilize postoperatively.

FDS-FDP transfer

In cases where the motor control is very limited, extrinsic finger flexor lengthening can be combined with wrist fusion.

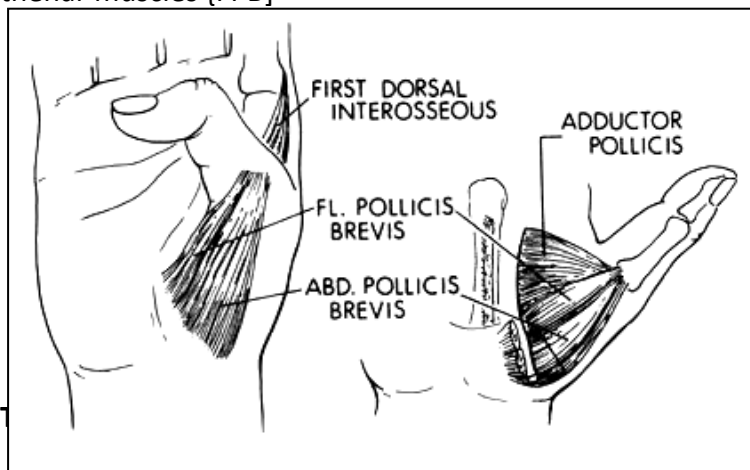


Technique

The four FDS tendons are sutured together distally and the FDP tendons are sutured together proximally and then cut. The fingers are extended, and the distal end of the FDS are then sutured en masse to the proximal end of the FDP.

b. Thumb in palm

Pathogenesis: spastic activity in FPL, adductor pollicis (AP), 1st dorsal interossei or the thenar muscles {FPB}



Make incision along the thenar crease

Detach the origins: FPB, opponens pollicis, abductor pollicis brevis from metacarpal origin, while protecting the recurrent branch of the median nerve. Release the origin of the adductor pollicis muscle from the III metacarpal.

Where web space contractures persist, despite appropriate muscle releases, perform a Z-plasty of the thumb web space.

c. Intrinsic spasticity

Intrinsic spasticity is frequently masked by the presence of extrinsic flexor spasticity. When a release of extrinsic tendon is performed, an intrinsic positive deformity of the hand may be revealed.

Swan-neck or boutonnière deformities are manifestations of intrinsic spasticity. Some patients need intrinsic release [refer under rheumatoid hand]

d. Wrist Flexion deformity

Muscles involved: FCR, FCU, PL, FDS and FDP.

Surgery

Functional lengthening, Wrist fusion, Proximal row carpectomy