# Surgical Reconstruction of Thumb-in-Palm Deformity in Spastic Cerebral Palsy Children

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# List of Contents

## List of Abbreviations

| | |
|---|---|
| **ADDP** | Adductor pollicis |
| **APB** | Abductor pollicis brevis |
| **APL** | Abductor Pollicis Longus |
| **BR** | Brachioradialis |
| **CMCJ** | Carpometacarpal joint |
| **CP** | Cerebral palsy |
| **DI** | Dorsal interossii |
| **DIP** | Distal Interphalangeal joint |
| **DPA** | Dynamic position analysis |
| **ECRB** | Extensor carpiradialis brevis |
| **ECRL** | Extensor carpiradialis longus |
| **EPB** | Extensor Pollicis Brevis |
| **EPL** | Extensor pollicis longus |
| **FCR** | Flexor Carpiradialis |
| **FCU** | Flexor Carpiulnaris |
| **FDP** | Flexor digitorum profundus |
| **FDS** | Flexor digitorum superficialis |
| **FPB** | Flexor pollicis brevis |
| **FPL** | Flexor pollicis longus |
| **IPJ** | Interphalangeal joint |
| **MACS** | Manual ability classification system |
| **MCPJ** | Metacarpophalangeal joint |
| **OP** | Opponens Pollicis |
| **PCSA** | Physiological cross-sectional area |
| **PIP** | Proximal Interphalangeal joint |
| **PT** | Pronator teres |
| **RCL** | Radial collateral ligament |

## List of Abbreviations

**SFA**..... Spontaneous functional analysis
**TCL**..... Transverse carpal ligament
**TMJ**..... Trapeziometacarpal joint
**UCL**..... Ulnar collateral ligament

# List of Tables

# List of Tables

# List of Figures

# List of Figures

# List of Figures

# List of Figures

# List of Figures

# Introduction

**Cerebral palsy** is the musculoskeletal manifestation of a non progressive central nervous system lesion that usually occurs due to a perinatal insult to the brain. Though the cerebral insult is static the musculoskeletal pathology is progressive. Spasticity leads to shortening of musculoskeletal units, which in turn causes fixed contractures and eventually leads to torsional abnormalities of long bones, joint instability, deformities, and degenerative arthritis.[1]

The clinical manifestations may vary widely, ranging from an intelligent child with mild spasticity of the hand to a completely wheelchair bound child who is unable to communicate with his environment.[2]

The anatomy of the thumb includes the skeletal articulations of the trapezial thumb metacarpal, metacarpophalangeal (MCP), and interphalangeal (IP) joints. Multilevel deformity at each of these joints can occur dynamically because of an imbalance of muscular forces across the thumb. Nine muscles are responsible for function of the thumb through skeletal stabilization and movement across the carpometacarpal (CMC), MCP, and IP joints, including the thenars (abductor pollicis brevis, opponens pollicis, and flexor pollicis brevis), the adductor pollicis, the flexor pollicis longus (FPL), the extensor pollicis longus (EPL), the abductor pollicis longus, the extensor pollicis brevis, and the

first dorsal interosseous. In cerebral palsy, deformity occurs most commonly because of spasticity and contracture of the flexion-adduction muscles, coupled with poor voluntary control and weakness of the extensor-abduction muscles.[3]

The complexity of the spastic hand is due to the fact that the spastic muscles cannot be used as tendon transfers with the same efficiency as done in reconstructive surgery of the hand with flaccid paralysis.[4]

The deformity is basically a dynamic deformity and hence the surgeon must have a definite plan before embarking on the procedure. After anesthesia, the deformities disappear and the hand may appear normal. [4]

The surgical procedures as such are not very technically demanding but the assessment, decision-making, and selecting a procedure for the given patient make this field challenging. When done well, the results are rewarding not only in terms of improvement in hand function but also in appearance and personal hygiene, which leads to better self-image and permits better acceptance in the society. [4]

The goals of surgical intervention are set depending on the preoperative functional status. When the child has a good voluntary motor control the goals are to improve function and appearance. In cases of severe involvement, surgery is a reasonable option if it facilitates the nursing care by the parents or the care giver.

Upper extremity deformities in cerebral palsy are caused by the imbalance between spastic and weak muscles acting on unstable joints. The basic goals of surgical treatment of spastic hands and upper extremities of patients with cerebral palsy can be summarized as reducing the strength of spastic muscles, strengthening the antagonist muscles, and permanent stabilization of unstable joints. Surgical techniques to achieve these goals include lengthening of spastic muscles, tendon transfers, release or plication of the joint capsule, joint arthrodesis, and skin procedures.[5]

The quality of voluntary muscle control and sensibility is the most important factors in predicting the success of operation. In the past, thumb deformities were classified on the basis of the static position of the thumb, but rational treatment decisions can be made only by a careful assessment of the patient's hand and thumb function.[6]

Thumb involvement is common in cerebral palsy and its management is complex. The thumb held flexed inside the palm impairs grip and grasp and lack of abduction and extension limits the size of the object the patient can grasp. The presence of thumb in the palm also obstructs the function of other fingers. It may even contribute to rejection of the hand and cause problems in hygiene.[7]

There are four key points to examine when considering a child with thumb deformity in cerebral palsy for surgical intervention.[8]

- Spasticity of adductor and flexor muscles – adductor pollicis (AP), flexor pollicis brevis (FPB), first dorsal interosseous (FDI), flexor pollicis longus (FPL)
- Weakness of the extensors and abductors.
- Hypermobility of the metacarpophalangeal (MCP) joint.
- Web space skin contracture.