

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

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## List of Contents

| <i>Title</i>                                | <i>Page No.</i> |
|---|-----------------|
| List of Abbreviations.....                  | ii              |
| List of Tables .....                        | iv              |
| List of Figures .....                       | vi              |
| Introduction .....                          | 1               |
| Aim of the work .....                       | 5               |
| Anatomy and biomechanics of the thumb. .... | 6               |
| Cerebral Palsy. ....                        | 24              |
| Patients and Methods .....                  | 70              |
| Results .....                               | 103             |
| Case presentation .....                     | 117             |
| Discussion .....                            | 149             |
| Summary .....                               | 163             |
| Conclusion.....                             | 167             |
| References .....                            | 168             |
| Arabic Summary .....                        | --              |

### *List of Abbreviations*

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

*List of Abbreviations*

|                  |                                 |
|------------------|---------------------------------|
| <b>SFA</b> ..... | Spontaneous functional analysis |
| <b>TCL</b> ..... | Transverse carpal ligament      |
| <b>TMJ</b> ..... | Trapeziometacarpal joint        |
| <b>UCL</b> ..... | Ulnar collateral ligament       |

## *List of Tables*

| <i>Table No.</i> | <i>Title</i>  | <i>Page No.</i> |
|------------------|---|-----------------|
| <b>Table 1:</b>  | Zancolli's classification of wrist and finger deformity and treatment directions .....                                  | 43              |
| <b>Table 2:</b>  | Static house classification of thumb in palm deformity .....  | 45              |
| <b>Table 3:</b>  | House's classification of upper extremity functional use. ....  | 45              |
| <b>Table 4:</b>  | Static house classification .....   | 81              |
| <b>Table 5:</b>  | Selection of surgical procedure .....   | 82              |
| <b>Table 6:</b>  | Operation distribution of the study group. ....   | 83              |
| <b>Table 7:</b>  | Associated operation distribution of the study group.....   | 93              |
| <b>Table 8:</b>  | Follow up distribution of the study group. ....   | 103             |
| <b>Table 9:</b>  | Comparison between pre and postoperative as regard MACS.....  | 105             |
| <b>Table 10:</b> | Comparison between pre and postoperative as regard SFA.....   | 106             |
| <b>Table 11:</b> | Comparison between pre and postoperative as regard DPA. ....  | 107             |
| <b>Table 12:</b> | Correlation study between preoperative DPA and SFA in patients group using pearson Correlation Coefficient Test. ....   | 108             |
| <b>Table 13:</b> | Correlation study between postoperative DPA and SFA in patients group using pearson correlation coefficient test. ....  | 108             |
| <b>Table 14:</b> | Correlation study between preoperative DPA and MACS in patients group using pearson correlation coefficient test. ....  | 109             |
| <b>Table 15:</b> | Correlation study between postoperative DPA and MACS in patients group using pearson correlation coefficient test. .... | 110             |
| <b>Table 16:</b> | Effect of age on MACS.....  | 111             |
| <b>Table 17:</b> | Effect of age on SFA.....   | 111             |
| <b>Table 18:</b> | Effect of age on DPA .....  | 112             |
| <b>Table 19:</b> | Effect of age on static house classification .....  | 112             |
| <b>Table 20:</b> | Effect of gender on MACS .....  | 113             |
| <b>Table 21:</b> | Effect of gender on SFA .....   | 113             |
| <b>Table 22:</b> | Effect of gender on DPA.....  | 114             |

## *List of Tables*

| <i>Table No.</i> | <i>Title</i>   | <i>Page No.</i> |
|------------------|--|-----------------|
| <b>Table 23:</b> | Effect of gender on static house classification .....                    | 114             |
| <b>Table 24:</b> | Effect of type distribution of CP on MACS .....                          | 115             |
| <b>Table 25:</b> | Effect of type distribution of CP on SFA .....                           | 115             |
| <b>Table 26:</b> | Effect of type distribution of CP on DPA .....                           | 116             |
| <b>Table 27:</b> | Effect of type distribution of CP on Static house<br>classification..... | 116             |

## List of Figures

| <i><b>Fig No.</b></i> | <i><b>Title</b></i>   | <i><b>Page No.</b></i> |
|-----------------------|---|------------------------|
| Fig 1.                | The adductor aponeurosis has been removed in this anatomic dissection .....   | 9                      |
| Fig 2.                | Anatomic dissection of the ulnar aspect of the thumb MCP joint demonstrating the insertion of the ADD into the dorsal apparatus (stabilizing retinaculum of the EPL) .....  | 14                     |
| Fig 3.                | Anatomic dissection of the APB and its relationships .....  | 15                     |
| Fig 4.                | Anatomic dissection of the thenar musculature .....   | 15                     |
| Fig 5.                | Palmar view of the deep thenar musculature relationships after distal reflection of the FPB and APB muscles.....  | 16                     |
| Fig 6.                | Average thumb-tip output vectors (N) for each functional posture in anatomical projections. All data were rotated to a right hand.....  | 23                     |
| Fig 7.                | Manual Ability Classification System (MACS).....  | 48                     |
| Fig 8.                | Incision for release of adductor pollicis.....  | 54                     |
| Fig 9.                | Intramuscular slide of flexor pollicis longus.....  | 54                     |
| Fig 10.               | Volar incision is as described by Matev along the thenar eminence.....  | 55                     |
| Fig 11.               | Using the volar thenar incision, the radial digital neurovascular bundle of the long finger directly over the lumbrical was reflected in an ulnar direction .....   | 56                     |
| Fig 12.               | Intraoperative traction to assess which recipient tendon places the thumb in the optimal position .....   | 57                     |
| Fig 13.               | The EPL tendon was transected over the MCP joint, and the distal end of the EPL was tenodesed, whereas the proximal end was delivered by a tendon passer into the proximal wound .....                                      | 59                     |
| Fig 14.               | The tendon passer was used to pass the tendon through the first dorsal compartment and deliver it into the dorsal thumb MCP joint incision, rerouting the tendon from an Adductor moment arm to allow thumb abduction ..... | 59                     |
| Fig 15.               | Sesamoid-metacarpal synostosis.....   | 62                     |
| Fig 16.               | Green transfer .....  | 64                     |
| Fig 17.               | Pronator teres re-routing-Surgical technique .....  | 68                     |

## List of Figures

| <i><b>Fig No.</b></i> | <i><b>Title</b></i>  | <i><b>Page No.</b></i> |
|-----------------------|--|------------------------|
| Fig 18.               | Age (years) distribution of the study group.....   | 70                     |
| Fig 19.               | Sex distribution of the study group. ....  | 71                     |
| Fig 20.               | CP types of the study group. ....  | 71                     |
| Fig 21.               | Distribution of deformity among study group.....   | 72                     |
| Fig 22.               | Causes of brain lesion.....  | 73                     |
| Fig 23.               | Types of thumb in palm deformity among study group .....   | 74                     |
| Fig 24.               | Operation distribution of the study group. ....  | 84                     |
| Fig 25.               | Z-plasty approach of the first web.....  | 85                     |
| Fig 26.               | The first web space after Z-plasty . ....  | 85                     |
| Fig 27.               | First dorsal interosseous release. ....  | 86                     |
| Fig 28.               | Adductor pollicis release. ....  | 86                     |
| Fig 29.               | After first dorsal interosseous& Adductor pollicis release. ....                                   | 87                     |
| Fig 30.               | Flexor pollicis longus release. ....   | 87                     |
| Fig 31.               | Traction of Extensor pollicis brevis. ....   | 88                     |
| Fig 32.               | Traction of Extensor pollicis longus. ....   | 89                     |
| Fig 33.               | Extensor pollicis longus rerouted to Extensor pollicis<br>brevis . ....                            | 89                     |
| Fig 34.               | After Extensor pollicis longus rerouting to the first<br>extensor compartment.....                 | 90                     |
| Fig 35.               | A metacarpophalangeal joint approach. ....   | 90                     |
| Fig 36.               | Retrograde K-wire through metacarpophalangeal joint of<br>the thumb. ....                          | 91                     |
| Fig 37.               | A metacarpophalangeal joint fixed by K-wire. ....  | 91                     |
| Fig 38.               | A metacarpophalangeal joint capsulodesis of the thumb. ....  | 92                     |
| Fig 39.               | Position of the thumb after metacarpophalangeal joint<br>fixation by K-wire and capsulodesis. .... | 92                     |
| Fig 40.               | Associated operations done simultaneously.....   | 93                     |
| Fig 41.               | Follow up distribution of the study group. ....  | 104                    |



## List of Figures

| <i><b>Fig No.</b></i> | <i><b>Title</b></i>  | <i><b>Page No.</b></i> |
|-----------------------|--|------------------------|
| Fig 42.               | Comparison between pre and postoperative as regard MACS.....                               | 105                    |
| Fig 43.               | Comparison between pre and postoperative as regard SFA.....                                | 106                    |
| Fig 44.               | Clinical photo (preoperatively). ....  | 117                    |
| Fig 45.               | Hyperextendable MPJ. ....  | 118                    |
| Fig 46.               | PXR Lt hand preoperative. ....   | 118                    |
| Fig 47.               | Z plasty of 1st Web space.....   | 119                    |
| Fig 48.               | Add P release.....   | 119                    |
| Fig 49.               | First dorsal interosseous release. ....  | 120                    |
| Fig 50.               | A metacarpophalangeal joint capsulodesis.....  | 120                    |
| Fig 51.               | A metacarpophalangeal joint capsulodesis with retrograde temporary fixation by K-wire..... | 121                    |
| Fig 52.               | After metacarpophalangeal joint capsulodesis with temporary fixation by K-wire. ....       | 121                    |
| Fig 53.               | PXR of Lt hand showing MPJ capsulodesis fixed by K-wire. ....                              | 122                    |
| Fig 54.               | Extensor pollicis longus rerouted to the EPB in the first dorsal compartment. ....         | 123                    |
| Fig 55.               | Site of Extensor pollicis longus after rerouting to the first dorsal compartment. ....     | 123                    |
| Fig 56.               | Position of hand and thumb.....  | 124                    |
| Fig 57.               | Thumb Pinch. ....  | 125                    |
| Fig 58.               | PXR of Lt hand showing postoperative follow up. ....                                       | 125                    |
| Fig 59.               | Rt thumb-in-Palm static house classification type III. ....                                | 126                    |
| Fig 60.               | Thumb Pinch. ....  | 127                    |
| Fig 61.               | Hyperextendable MPJ. ....  | 127                    |
| Fig 62.               | PXR Rt hand preoperative(A-P view).....  | 128                    |
| Fig 63.               | PXR Rt hand preoperative( lateral view). ....  | 128                    |

## *List of Figures*

| <i>Fig No.</i> | <i>Title</i>   | <i>Page No.</i> |
|----------------|--|-----------------|
| Fig 64.        | Z plasty of 1st Web space.....   | 129             |
| Fig 65.        | FCU. ....  | 129             |
| Fig 66.        | ECRB.....  | 130             |
| Fig 67.        | FCU to ECRB.....   | 130             |
| Fig 68.        | Position of hand after FCU to ECRB. ....   | 131             |
| Fig 69.        | Position of hand and thumb.....  | 132             |
| Fig 70.        | Hand grasp.....  | 132             |
| Fig 71.        | Thumb pinch.....   | 133             |
| Fig 72.        | PXR of Rt hand showing postoperative follow up.....  | 133             |
| Fig 73.        | Lt Thumb-in-Palm static house classification type II<br>associated with wrist flexion deformity..... | 134             |
| Fig 74.        | Lt Thumb-in-Palm static house classification type II. ....   | 134             |
| Fig 75.        | Position of hand and thumb.....  | 136             |
| Fig 76.        | Thumb pinch.....   | 136             |
| Fig 77.        | Hand grasp.....  | 137             |
| Fig 78.        | PXR of Lt hand showing postoperative follow up. ....   | 137             |
| Fig 79.        | Lt Thumb-in-Palm static house classification type I.....   | 138             |
| Fig 80.        | Lt Thumb-in-Palm static house classification type I<br>associated with wrist flexion deformity.....  | 139             |
| Fig 81.        | PXR Lt hand preoperative.....  | 139             |
| Fig 82.        | Position of hand and thumb (A-P view).....   | 140             |
| Fig 83.        | Position of hand and thumb ( Lateral view).....  | 141             |
| Fig 84.        | Thumb pinch.....   | 141             |
| Fig 85.        | Hand grasp.....  | 142             |
| Fig 86.        | PXR of Lt hand showing postoperative follow up. ....   | 142             |
| Fig 87.        | Rt Thumb-in-Palm static house classification type IV.....  | 143             |

## *List of Figures*

| <i><b>Fig No.</b></i> | <i><b>Title</b></i>   | <i><b>Page No.</b></i> |
|-----------------------|---|------------------------|
| Fig 88.               | Rt Thumb-in-Palm static house classification type IV associated with wrist flexion and ulnar deviation deformity..... | 144                    |
| Fig 89.               | PXR Rt hand preoperative (A-P view).....  | 144                    |
| Fig 90.               | PXR Rt hand preoperative (Lateral view).....  | 144                    |
| Fig 91.               | FDS and FDP release. ....   | 145                    |
| Fig 92.               | FPL release. ....   | 146                    |
| Fig 93.               | Z plasty 1st Web space. ....  | 146                    |
| Fig 94.               | Position of hand and thumb (A-P view).....  | 147                    |
| Fig 95.               | Position of hand and thumb ( Lateral view). ....  | 148                    |
| Fig 96.               | Hand grasp.....   | 148                    |
| Fig 97.               | PXR of Rt hand showing postoperative follow up.....   | 148                    |

## **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.