

# BENEFITS OF TENDON TRANSFERS IN CEREBRAL PALSY PATIENTS OF FLEXION DEFORMITY OF WRIST

## Original Article Orthopaedics

Ashish Kaushal<sup>1</sup>, Vishnu R<sup>2</sup>, Gaurav Rai<sup>2</sup>

<sup>1</sup> - Associate Professor, Department of Orthopaedics, G.R.M.C, Gwalior

<sup>2</sup> - Post Graduate Student, Department of Orthopaedics, G.R.M.C, Gwalior

### Corresponding Author:

Dr Ashish Kaushal  
Associate Professor, Department of Orthopaedics,  
G.R.M.C, Gwalior  
email: aashishkaushal2014@gmail.com

Article submitted on: 13 March 2018

Article Accepted on: 13 March 2018

### Abstract:

Cerebral palsy a primary C.N.S dysfunction leading to significant functional impairment like increased muscle spasticity resulting in muscle imbalance across joints, impaired function and over time can lead to joint contractures. The wrist is mostly affected joint. Five patients of cerebral palsy with wrist flexion deformity were selected. Aged 10 to 30 years; Transfer of flexor carpi ulnaris was done to the extensor carpi radialis longus and extensor carpi radialis brevis. While in one case Palmaris longus was also transferred to extensor pollicis longus. Good post operative wrist extension ranging from 20 degree to 40 degree of extension and full thumb extension. In present study we found that such small surgical intervention we can improve quality of life of patients suffering from cerebral palsy.

**Keywords:** *Extensor carpi radialis brevis (ECRB), extensor carpi radialis longus (ECRL), extensor carpi ulnaris muscles (ECU), flexor carpi radialis (FCR) and flexor carpi ulnaris (FCU).*

## Introduction

Cerebral palsy a central nervous system dysfunction that leads to significant functional impairment owing to its secondary peripheral manifestations in the upper extremity.<sup>1,2</sup> The upper motor neuron lesion in the brain leads to loss of normal inhibition of tone (i.e. spasticity), loss of motor control in the limb (i.e. weakness), or impaired coordination of muscle activity (i.e. athetosis).

Increased muscle spasticity causes muscle imbalance across joints, which leads to impaired function and over time can lead to joint contractures with skeletal deformity. The wrist mostly affected joint.<sup>2</sup>

Anatomy:<sup>1-4</sup> The three wrist extensor muscles are the extensor carpi radialis brevis (ECRB), the extensor carpi radialis longus (ECRL), and the extensor carpi ulnaris muscles (ECU). The two wrist flexor muscles are the flexor carpi radialis (FCR) and the flexor carpi ulnaris (FCU).

In cerebral palsy, the most common deformity is wrist flexion associated with ulnar deviation. The muscle with the greatest flexion and ulnar deviation vector is the FCU. The FCU is most commonly the deforming force, particularly because it may be coupled with a weak wrist extensor–radial deviator (ECRL and ECRB). In the early stages of spastic hemiplegia, the joints and muscles will be supple, with full passive range of motion. Staging:<sup>2,4,5</sup> With skeletal growth, the muscle imbalance across joints over time leads to muscle–tendon unit shortening and joint contractures, eventually leading to skeletal deformity. Increased FCU tone overpowers the decreased strength of the ECRL and ECRB, leading to a wrist flexion posture. Aim: This is case series done in cerebral palsy patients

with flexion deformity of wrists and our objective was to improve the grip and prehension of the affected hand. Our study includes patients in the age group between 10 to 30 years.

## Material And Methods

Five patients of cerebral palsy with wrist flexion deformity were selected. Age between 10 to 30 years; Transfer of flexor carpi ulnaris was done to the extensor carpi radiialis longus and extensor carpiradialis brevis (Green transfer).<sup>6,7</sup> This transfer was done to correct the flexion deformity of the

wrist and to improve the extension of the wrist. Intra-operatively wrist was corrected to dorsiflexed position of 20 to 40 degrees and patient had good finger movements and wrist movements post operatively. One patient had 0/5 thumb extension for which Palmaris longus was transferred to extensor pollicis longus. Ability of grasp, release & reach, Wrist Extension power was assessed based on subsets of Sollerman grip function test and its guidelines. Voluntary action of FCU was determined by palpation and observation of muscle tendon due to wrist flexion.

**Table 1: Patients of cerebral palsy with wrist flexion deformity**

Group	No. of Patients	Age/sex	Pattern deformity of hand	Wrist and thumb surgical procedure
A	2	a.10/M b.30/F	Very mild	FCU to ECRL and ECRB
B	2	a.13/M b.12/F	Modearte	FCU TO ECRL ECRB
C	1	a.17/M	Moderate with Thumb in palm deformity	FCU TO ECRL ECRB Palmaris longus to EPL

**Table 2: Pre-operative and post-operative assessment of patients**

Group	No.	Pre operative		Post operative		
		Extension power at wrist	Deformity	Wrist Extension power	Grip release and reach* score	Deformity correction
A	1	3/5	Wrist flexion def 20deg	4/5	4	>40 deg extension
	2	3/5	Wrist flexion def 25deg	4/5	3	>35 deg extension
B	3	2/5	Wrist flexion def 40deg	3/5	3	>20 deg extension
	4	2/5	Wrist flexion def 45deg	4/5	3	>25deg extension
C	5	2/5	Wrist flexion def 45deg	3/5	3	>20 deg extension
		Thumb ext 1/5	Thumb flexion def 80	4/5		

\*Based on subsets of Sollerman grip function test and its guidelines

## Operative Technique

Patient was operated in brachial plexus block or supraclavicular block, patient positioned in supine position, arm was kept on arm rest. Tourniquet was used for surgery. A longitudinal incision was applied on the ulnar aspect of the wrist approximately 5 cm long,

flexor carpi ulnaris was exposed after protecting ulnar vessels and nerve. Tendon was exposed from pisiform bone to muscle tendon junction. Tendon was cut just proximal to the pisiform bone, tendon was made wet in normal saline. Tendon was secured with a sterile needle. Second incision

was made on the dorsum of the wrist, transversely to expose the the ECRL and ECRB both were made as single unit with 5 '0' No. proline sutures, a nick was made in the unit with knife, FCU tendon was passed through the hole of the ECRL and ECRB unit and sutured by proline 5 '0' sutures by FISH MOUTH technique and while suturing it was made sure that the assistant was holding the ECRL-ECRB unit in stretched position to bring the wrist in 20 degrees dorsiflexed position. For the patient who had 0 degree thumb extension a midline incision was made on the wrist to expose the Palmaris longus and transverse incision on the dorsum of the thumb at the level of distal phalanx and EPL was exposed. Palmaris longus tendon was passed through subcutaneous tunnel to the EPL tendon and was sutured by 5 '0' proline by same fish mouth technique and thumb was corrected in extended position. Tourniquet was released and closure was done in layers closure after Achieving haemostasis and below elbow plaster of paris slab was applied in the corrected position. Limb was elevated for 48 hours post operatively, dressing changed on fourth postoperative day. Finger mobilization was started 3 weeks post operatively finger extension and wrist extension was started, limb was kept in static cock up splint.

### Post operative assessment:

finger flexors power was 5\5, finger extension was 5\5, wrist extension was 3\5, one patient had 1 power in thumb extension rest other patients had good thumb extension. All patients had good sensory function of hand and IQ was normal. finger extension was possible in wrist flexed more than 50 degrees, preoperatively. All patients had good results of surgery. One

patient had problem in healing due to wound gaping and one of the patient had post operative swelling of the operated limb.

### Discussion

Treatment of wrist lesions in Cerebral palsy needs to be directed toward improving specific functions, but care must be taken not to diminish established skills for instance, a patient with the typical wrist flexion deformity may be able to sweep the floor (using the hand as a hook), but may be unable to sweep the floor when the hand is braced in the functional position (with wrist extended and MP joints flexed).<sup>8,9</sup> It is also possible to worsen the finger flexion deformity by taking the wrist out of its flexed position and placing it in extension. Preoperative voluntary control and stereogenesis help predict postoperative functional gains. Flexor carpi ulnaris to extensor carpi radialis brevis transfer seems to be a good surgical option for the management of children with spastic CP with impaired hand function, with a 75% success rate after 2 years of follow-up, with satisfactory cosmetic results.<sup>10</sup>

**Figure 1:** Post - operative (deformity correction achieved from dorsal aspect)



**Figure 2:** Post - operative (deformity correction achieved from volar aspect)



**Figure 3:** After 6 months of deformity correction wrist in 20 degree extension



Correction of this deformity may worsen the finger flexion deformity, and releasing the flexor pronator origin improves appearance & function of the hand with severe flexion deformities of wrist and fingers. Also, If the finger flexors are so shortened that a clenched fist deformity ensues when the wrist is brought into extension, the finger flexors will need to be fractionally lengthened as part of the surgical procedure. In the report by El-Said NS.<sup>11,12</sup> Procedure reduces the power of wrist and finger flexion by release of the flexor pronator origin, and reinforces the strength of extension and supination of the wrist by transfer of FCU.<sup>13</sup> In figure 1 shows the deformity correction achieved from dorsal aspect and in figure 2 deformity correction achieved from volar aspect. In some cases, the wrist flexion deformity is more severe, and the principal wrist extensor muscles are not functional. This may be evident on physical examination, or it may require use of a diagnostic motor nerve block to temporarily weaken the spastic wrist flexor, most commonly the flexor carpi ulnaris, to assess the patient's cortical control for wrist extension. Muscles Other than FCU, which can also be transferred to augment wrist extension, include the brachioradialis, and extensor carpi ulnaris. These transfers have the advantage of leaving both flexors intact (although they may need to be concomitantly lengthened to diminish their spastic deforming force), thus minimizing the risk of

overcorrection. Use of the extensor carpi ulnaris has the advantage of diminishing the ulnar deviation forces as well for patients with concomitant ulnar deviation deformity. Use of the flexor carpi ulnaris to remove its effect as a spastic wrist flexor and to transfer its force as a wrist extensor is reserved for the most severe cases. 14 The proximal row carpectomy is used in combination with releases and tendon transfer surgeries if the wrist lacks sufficient mobility passively shortening the skeleton through proximal row carpectomy can improve the wrist flexion deformity by 30 or 40 degrees of extension. The figure 3 shows deformity correction wrist in 20 degree extension after 6 months. This may be useful in selected cases if the wrist is fixed in 10 to 20 degrees of flexion and the surgeon wishes to preserve wrist motion to maintain the tenodesis effect.<sup>14</sup> Wrist arthrodesis is always good option for spastic wrist deformities to improve appearance, hygiene, and function but should be considered in severe deformities if the patient has a severe wrist joint contracture limiting functional use of the hand and refractory to at least 6 months of nonsurgical intervention or in doubtful prognosis after soft tissue procedures. Procedures involving inlay iliac-crest graft are most successful, and wrist should be held in neutral position by a large Kirshner wire placed in third metacarpal across the wrist and into radius or arthrodesis using a dorsal plating technique.<sup>12</sup> Wrist fusion has the advantage of being a predictable procedure.

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