

# FLEXOR CARPI ULNARIS TRANSFER TO IMPROVE FUNCTION AND COSMESIS OF HAND IN PATIENTS WITH CEREBRAL PALSY

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## ABSTRACT

**Objective:** Function and appearance of the involved hand in patients with cerebral palsy can be improved by orthopedic surgery especially in spastic hemiplegia. Flexor carpi ulnaris transfer to extensor carpi radialis longus or bravis is a procedure commonly used for correction of flexion pronation deformity of hand in patients with cerebral palsy.

**Patients and Methods:** Twenty patients with the mean age 7.5 years were selected for the procedure. Eight patients were in Zancolli class I, and 12 were in Zancolli class II. Green & Banks technique was used.

**Results:** Seventeen out of twenty patients had good functional improvement and cosmetic appearance. There parents were satisfied with the results. In three patients functional improvement and cosmetic appearance was fair but parents were not satisfied with the results.

**Conclusion:** Green and Banks procedure is good for cerebral palsy patients with moderate flexion pronation deformity at wrist. Functional and cosmetic appearance of hand improves considerably with this procedure.

**KEY WORDS:** Flexor Carpi Ulnaris, Transfer, Cerebral Palsy.

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## INTRODUCTION

Cerebral Palsy is non progressive, non hereditary encephalopathy that occurs in the prenatal or perinatal period, and is characterized by altered motor sensory and often intellectual function. It can be classified as pyramidal which includes spastic hemiplegia diplegia, paraplegia and quadriplegia or as extra pyramidal which includes athetoid and ataxic patterns. A third is a mixed variety in which patient has both spasticity and athetosis.

Hand is involved in almost all type of cerebral palsy. The function of hand is usually impaired. The other common deformities of upper limb are adduction and internal rotation deformity of shoulder, elbow flexion, forearm pronation, wrist and finger flexion, thumb in

palm and swan neck deformity. Although only a small number of children's with cerebral palsy have indication for surgical treatment of upper extremity deformities, orthopedic surgery does improve function and appearance of the involved hand especially in spastic hemiplegia. Flexor carpi ulnaris transfer to either extensor carpi radialis longus or extensor carpi radialis bravis has become a standard procedure to improve function of hand in patients with cerebral palsy.<sup>1</sup>

When flexor carpi ulnaris is transferred to radial wrist extensor, it removes a deforming force that pulls the hand into ulnar deviation and flexion and provides a force that promotes supination of the forearm and extension of the wrist. This is a retrospective study in which pre and postoperative position of wrist has been compared and function is assessed by objective and subjective measures.

## PATIENTS AND METHODS

Twenty patients were selected for this study with the age range between six to nine years, (mean 7.5 years.) Twelve patients were male. Right hand was involved in 12 patients and left in eight. The surgeries were performed be-

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tween June 1998, and June 2002. The minimum follow-up was three years.

Careful repeated evaluation was made before offering surgery. Children who have completely ignored the hand were not offered surgical treatment. All the patients had good control of shoulder and elbow. Children with athetoid pattern were also excluded. The patients selected for surgery had dynamic deformities which were spastic and slowly correctable. Active extension of fingers was present in all patients. In all patients selected for surgery, flexion pronation deformity was passively correctable. Patients with static contractures were not included in the study.

Muscle examination was done to determine the degree of spasticity, strength and coordination's. Child's ability to pinch and grasp and release the object was also determined. It was also assessed that patient should have sufficient proximal control of the extremity to voluntarily place the hand on top of the head and then on the opposite knee within five seconds. Sensitivity pattern of the hand was determined. The child was blindfolded and was asked to differentiate between sphere and a cube, recognition of familiar objects egg coins, or to indicate the position of the hand when the palm has been placed by the examiner facing upward or downward. For flexion deformity of the wrist and finger, the classification system of Zancolli and Zancolli was used.<sup>2</sup>

*Class-I Mild:* Involvement, in which the patient demonstrates full finger extension with the Wrist flexed to less than 20 degrees. Therefore, reasonable dorsal motor strength is present.

*Class-II Moderate:* Involvement, in which full finger extension is possible, only when the wrist is flexed to more than 20 degrees. Patients in Subgroup A demonstrate weak extension of the wrist with the fingers flexed, while those in Subgroup B lack any wrist extension.

*Class-III:* Severe involvement where in the patient has great wrist and flexion deformity without active extension of the wrist or fingers.

Eight patients were in Class one and twelve patients were in Class II. The surgery was carried out under general anesthesia with the patient supine, the upper limb on a hand table

and a tourniquet applied to the upper arm.

*TECHNIQUE:* (Green & Banks).<sup>3</sup> Anterior longitudinal incision was made over flexor carpi ulnaris (FCU). The FCU tendon was detached from pisiform insertion and muscle was dissected proximally off ulna. Small longitudinal incision was made on the dorsum of wrist on extensor carpi radialis bravis (ECRB), proximal to first extensor compartment. FCU tendon was passed subcutaneously around ulnar border of forearm. Button hole was made in ECRB tendon and FCU was passed through button-hole and sutured to itself under appropriate tension with the forearm in full supination and the wrist in 45 degree of extension. Wound was dressed and cast extending from axilla to the tips of fingers was applied with wrist held in extension and forearm in supination and thumb in abduction. One week after surgery cast was bivalved and exercises were started with arm out of cast. This was continued for four to six weeks with cast remaining in place between exercises periods. After that the cast was worn at night only for six weeks.

## RESULTS

The procedure was successful in majority of the patients, adequate dorsiflexion was achieved in most of the cases, grasp and release was enhanced and cosmetic appearance also improved. There was superficial wound infection in two patients which was treated with antibiotics according to culture and sensitivity. Preoperatively in all patients the hand was in about 30 to 50 degrees of flexion, pronation and ulnar deviation. All the patients were able to move fingers and thumb but pinch and grasp was severely impaired due to flexed position of wrist. After surgery range of movement at wrist, and grasp and release was improved in all patients. In seventeen patients range of movement at wrist was between fifteen degrees flexion and forty degree extension, and ten degrees of pronation and fifty degrees of supination. In three patients range of movement at wrist was between twenty degrees of flexion and thirty degrees of extension and thirty degree of pronation and thirty degree of supination.

Parents of seventeen patients were satisfied with the cosmetic appearance and improvement in grasp and release mechanism of hand. Parents of three patients were not satisfied with the function but were satisfied with the cosmetic appearance.

## DISCUSSION

Flexion pronation deformity at wrist in patients with spastic cerebral palsy makes the hand almost nonfunctional and cosmetically unacceptable. Patients with good IQ and well controlled proximal part of limb have as reasonable chance of improving function as well as cosmetic appearance. Flexor carpi ulnaris transfer to either extensor carpi radialis longus or extensor carpi radialis brevis has become a standard procedure to improve function of hand in patients with cerebral palsy. The best time for intervention is between the ages of four and eight years.<sup>4</sup>

Van Heest AE et al,<sup>5</sup> studied the the supination effect of tendon transfer of the flexor carpi ulnaris to the extensor carpi radialis brevis or longus on cadaver model. The ability of this wrist extension transfer which also provide forearm supination was investigated. Releasing the distal two thirds of the FCU ulnar origin resulted in a mean supination that was significantly greater than the mean supination achieved with releasing the distal one third of the FCU ulnar origin. In the cadaver model, transfer of the FCU into either the ECRB or ECRL provided similar resultant supination and that freeing the distal two thirds of the FCU ulnar origin provided significantly more supination than freeing only the distal one Third. Transfer of the FCU into the ECRB and/or the ECRL can be used to concomitantly provide wrist extension and forearm supination. In the present study distal two third of FCU origin was freed to achieve the maximum length and functional benefit.

Other procedures proposed for pronation flexion deformity at wrist in cerebral palsy are arthrodesis of wrist joint, release of flexor origin and lengthening of flexor tendons. Each procedure has its indications and complications i.e. arthrodesis at wrist impairs flexion and

extension at fingers. Lengthening of multiple flexor tendons may result in scarring and adhesions resulting in loss of function.

Flexor pronator release at elbow is effective in correction of wrist and elbow correction but is not indicated in those patients in which wrist flexion deformity is passively correctable.<sup>6</sup> In our study all the patients were benefited by single tendon transfer. Beach WR et al,<sup>7</sup> published their 17 years experience with Green's procedure and showed tremendous success. Eighty-eight percent of their patients had cosmetic improvement, & 79% improved functionally. None had a decreased functional rating.

Winner SM, Johnson KA,<sup>8</sup> also published their successful results with the transfer of FCU and concluded that in majority of patients; wrist arc of motion was improved and grasp and release was enhanced after operation.

Our study results are comparable with the above mentioned studies. Seventeen out of twenty patients (85%) in our study showed improved function and cosmetic improvement was seen in all patients.

**CONCLUSION:** Green and Banks procedure is good for cerebral palsy patients with mild to moderate flexion pronation deformity at wrist. Functional and cosmetic appearance of hand improves considerably with this procedure.

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