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## Effect of MWM with Convectional Exercise Regime in Fracture of Distal Radial and Scaphoid: Case Study

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### KEYWORDS

Movement with mobilisation, radial and scaphoid fractures, strengthening exercises, pincer gripping.

### ABSTRACT:

**Background:** A 27-year-old male patient had evolved a Trans-scaphoid Peri-lunate Dorsal Scaphoid Dislocation in right forearm and avulsion fracture on dorsal margin of distal radius and fracture shaft of radius.

**Purpose:** To investigate the clinical utility of MWM with convectional exercise in patients with distal radius and scaphoid fractures.

**Study design:** case study

**Method:** This study comprised of a case operated with Open Reduction and Internal Fixation with K wires and Dynamic Compression Plate to accomplish earlier fixation and union of scaphoid and shaft of radius. A rehabilitation protocol of 4 weeks was decided which include MWM with convectional exercise regime so as to enhance the dexterity, grip and pinch strength, functional abilities, wrist joint and the extent of supination and pronation at distal radio ulnar joint.

**Results:** Addition of MWM with convectional exercise show positive improvement in patients of distal radial and scaphoid fracture

**Discussion:** Patients who have undergone the surgery for the distal radius fractures. it is important that Movement with Mobilization added to intervention which enhancing the overall functional activity at the wrist joint. The Movement with Mobilization is focused on performing within pain free range of motion which increases the rate of performance in the activities.

### INTRODUCTION

The fracture of distal radius and scaphoid are one of the frequently confronted fractures in orthopaedics accounting for 25% in paediatric population and 18% in adult population.<sup>5</sup> Distal radius fractures have a higher incidence along with the scaphoid fractures which are most common with prevalence of 80 to 90% among all the carpal bone injuries in young adult population with higher widespread presence in males.<sup>1,4</sup>

Scaphoid fractures can be classified into various types based on its pattern and location. In the Herbert classification, the type A fractures are stable and named as Acute scaphoid fractures which are further bifurcated into type A1 and A2 with the occurrence on digital pole and on waist of scaphoid or the non-displaced fractures of scaphoid, respectively.<sup>7,10,13</sup> Type B1 signifies distal oblique fractures in which oblique pattern results in the instability, type B2 comprises of complete waist fractures of scaphoid,<sup>13</sup> while the type B4 or Classical



Trans Scaphoid Peri-lunate Dislocation Fracture, also an unstable fracture, involving the soft tissue destruction around the lunate along with the injury pattern initializing from scapholunate joint causing numerous bony misalignments and complex ligamentous injury requiring surgical interventions to deal with.<sup>7,10</sup> The Type C fractures reports delayed union.<sup>13</sup>

The Mayo Classification defines the proximal fracture, middle fracture and distal tubercle fracture of scaphoid with prevalence of 10%, 70%, 20% in normal population hence middle third fractures of scaphoid are routinely come across according to multiple studies.<sup>10,11</sup> Proximal fractures of scaphoid are titled under unstable ones because of the paucity of ligamentous support over proximal segments.<sup>1</sup>

The third classification is Russe classification which is built upon the plane orientation of fracture, i.e., transverse, horizontal oblique and vertical oblique fractures which are highly unstable as a result of higher shear forces experienced across the fracture site, holding for 25% all the scaphoid fractures.<sup>12</sup>

Various studies have revealed the indications of numerous surgical techniques for fixing the fractures like Open Reduction and Internal Fixation using K wires, screws subjected for maximal dislocation accompanied with unstable distal radius fracture. Studies suggests that Distal Radius Fracture in adults treated with closed reduction and cast immobilization normally results in malunion and if treated using fixation with plates and K wire amounts for significant satisfactory results.<sup>14</sup> Maylene et. al. suggested that Open Reduction and Internal Fixation can achieve good to excellent results in 88% of patients and functional outcome.<sup>2</sup> Operating the proximal pole fractures of scaphoid with headless screw fixation technique can be by far used as an early management of these type of fractures<sup>1</sup> and on the other hand Open Reduction and Internal Fixation with Dynamic Compression Plate is technique used to achieve rigid fixation and anatomic reduction.<sup>15</sup> The other methods of surgical interventions are volar plate fixation used for the more complicated fractures involving numerous segments of distal radius or ulna as it results in early mobilization and faster functional recovery,<sup>9,16</sup> Percutaneous fixation technique for closed reduction is used with Herbert screw to stabilize acute scaphoid fractures and in cases of absence of surgical procedures,<sup>3</sup> internal fixation technique is recommended in vertical oblique scaphoid fracture permitting better functional after effects.<sup>12</sup>

Post operative complications for the scaphoid & distal radius fractures includes non-unions or malunion which results in disturbed mechanics of wrist causing pain and weakness in performing activities of daily living, the pain is often evolved in the first metacarpal joint on compression.<sup>8,9</sup> These fractures are also associated with decrease range of motion of wrist flexion and extension, supination and pronation at distal radio ulnar joint is also evidently reduced, decreased strength of movement, grip strength and functional traits also had a significant reduction if left uncured.<sup>6,8,9,15</sup> Studies suggests the decrease in grip strength accounting for about 2.7 % - 5.2 % throughout immobilization period because of reduced muscle activity.<sup>18</sup> Pinch strength was established to be varied in coordination with grip strength and was found to be reduced as a result of decreased muscular effort because of immobilization in the post operative phase.<sup>18</sup> Avascular Necrosis and midcarpal arthritis are also thought to be the complications of post-operative stage left neglected.<sup>13</sup> Post the application of Open Reduction and Internal Fixation techniques have the major impairments which includes the above mentioned complications with distal radioulnar joint instability, ulnar wrist pain and dysfunctional rotation as suggested by a study.<sup>15</sup> Malunions, atrophy or porosis in the healed bony segment can be counted among the impairments of fracture treated with Open Reduction and Internal Fixation using Dynamic Compression Plate in distal radius and ulnar fractures.<sup>17</sup>

Hence, early and appropriate rehabilitation is the only key to lend the benefit of Open Reduction and Internal Fixation technique in these fractures, it also assists in the proper union of the fractures and functional recovery.

## **CASE REPORT**

In this case report, a 27-year-old male patient with a history of fall from bike had evolved a Tran scaphoid Peri-lunate Dorsal Scaphoid Dislocation in right forearm and avulsion fracture on dorsal margin of distal radius and fracture shaft of radius. A detailed medical and surgical history was bought forth from the patient so as to rule out the findings, mechanism of injury, chief complaints and the investigation performed. Chief complaints of patient were pain, swelling, deformity in the right forearm and wrist and loss of consciousness. He was operated with Open Reduction and Internal Fixation with K wires and Dynamic Compression Plate to accomplish earlier fixation and union of scaphoid and



shaft of radius, further a rehabilitation protocol was decided so as to enhance the dexterity, grip and pinch strength, functional abilities, active and passive range of motion of wrist joint and the extent of supination and pronation at distal radio ulnar joint.

### **Pre-test measurements**

Informed consent along with pretest measurements were done before starting the rehabilitation program so as to design a protocol focusing on procurement of the expected results. The extension range of motion, grip strength, pinch strength was computed using the instruments with satisfactory reliability and validity. The wrist extension range of motion was measured because it is mainly affected due to the position of hand during cast immobilization, grip and pinch strength are also essentially reduced due to the muscular adaptation to the immobilized state leading to decrease in force generated by the muscles. The grip strength was measured using hand held dynamometer,<sup>19,20</sup> pinch meter<sup>21</sup> was utilized to record pinch strength and extension through manual goniometer<sup>22</sup> was recorded. In our investigation, the values taken down in pre-rehabilitation phase were 35 pounds, 15 pounds, 25° for grip strength, pinch strength, wrist extension respectively. Furthermore, minimal changes in the measurements were expected taking into account the random variations and the manual measurement errors.

### **Procedure:**

The subject was given a discrete protocol consisting of home exercises, advise, necessary precautions and exercises to be performed under the guidance and by the physiotherapist.

The rehabilitation protocol included the active range of motion for wrist flexion, extension, radial and ulnar deviation and for supination/pronation with 2 sets of 10 repetitions thrice daily, radiocarpal distraction was performed, so as to increase the joint mobility by loosening the adhesions due to the immobilization, in a dosage of 3 repetitions with 30 seconds hold time. Movement with Mobilization was of prime focus in which patient performed active movement at wrist and Distal Radio-ulnar joint in lateral glide for wrist and volar glide for Distal Radio-ulnar joint with 2 sets of 10 repetitions for each glide. The next intervention used was Muscle Energy Technique along with Post isometric relaxation technique for wrist extensors/flexors for the progression of muscle strength, these exercises were performed in 2 sets of 10 repetitions and 6 seconds hold for each repetition. Eccentric Strengthening Exercises for extensors of wrist was advised to the patient with 10 repetitions in 2 sets to be performed 3 times a day. The last exercise focused on grip strengthening in which patient had to hold a gel ball and perform 2 sets with 30 repetitions in each set thrice a day. This protocol overall was engrossed to restore the functions of wrist.

FREQUENCY	INTENSITY	TIME	TYPE
3×2 sets	<b>10 reps.</b>		<b>Active ROM exercises</b>
1 set	<b>3 reps.</b>	<b>30 sec holds</b>	<b>Radio carpal joint distraction</b>
2 sets	<b>10 reps.</b>		<b>Lateral glide MWM for wrist</b>
2 sets	<b>10 reps.</b>		<b>Volar glide MWM for distal radioulnar joint</b>
2 sets	<b>10 reps.</b>	<b>6 sec holds</b>	<b>MET+PIR for wrist flexors/ extensors.</b>
3*2 sets	<b>10 reps.</b>		<b>Eccentric exercises for extensors of wrist.</b>
3*2 sets	<b>30 reps.</b>		<b>Grip Strengthening Exercises</b>

### **Post-test**

Physical therapy measurements performed priorly were re-assessed and remarkable differences pre and post-test was observed. The post-test assessment found the values of grip strength, pinch strength, wrist extension to be 45 pounds, 14 pounds and 45°. This shows significant improvement in all the parameters improving the

functional ability, extent of pain and the muscular effort generated by the forearm muscles.

### **Discussion**

The present findings of this study show a significant improvement in the grip strength, pinch strength and wrist extension range of motion at the end of 4 weeks protocol by the application of manual therapy



techniques namely Mobilization with Movement along with other standard physiotherapy interventions. A finite amount of study was done to suggest the increase in grip strength, pinch strength wrist range of motion and decrease in pain after the implementation of mobilization with movement technique.

Vicenzino et. al. suggested the Movement with Mobilization as one of the methods to inhibit the pain due to the indulgent of endogenous pain inhibition systems which eventually will positively affect the muscular activity.<sup>23</sup> Tomruk et. al.(2020) found significant decrease in disability, pain, better wrist flexion, extension, ulnar/radial deviation, supination and grip strength after 12 weeks of continuous session following Early Manual Therapy in comparison to Passive Joint Mobilization in patients with Dorsal Radius Fracture who had undergone a surgery through volar plate fixation,<sup>24</sup> another study done by Susan and his colleagues suggested improvements in supination and pronation activities at the end of 12 weeks, wrist flexion/extension at the 4th and 12th week, faster improvement in pain and disability in the experimental group which received Movement with Mobilization however no significant in between- group difference was recorded in grip strength in this study but was found to be increased after 12 weeks because of strengthening exercises.<sup>25</sup>

So, it is important to consider that Movement with Mobilization added to intervention result in enhancing the overall functional activity at the wrist joint. The Movement with Mobilization is focused on performing within pain free range of motion which increases the rate of performance in the activities.<sup>25</sup> Our study concluded the positive effects of the Movement with Mobilization after 4 weeks of session with lateral and volar glide Movement with Mobilization. Another essential reason contributing to the effectiveness was the involvement of radiocarpal distraction and MET exercises in the intervention. The bonus point of this study is that one year follow-up was taken in which patient was performing regular home exercises and was found to have greater improvement in activity patterns almost similar to the left hand.

Based upon this study, it is advocated to take into consideration the Movement with Mobilization exercises along with the standard protocol to improve the functional ability in case of patients who have undergone the surgery for the distal radius fractures. This study also has certain limitations which can be

further elicited to have better outcomes in future. The limitations of this study is low sample size and since it is a case study no comparison has been made with other interventions and placebo.

### **Declaration of patient consent**

The authors suggest sufficient generalization of patient's information with informed and explained consent. The patient is wholly acquainted with the details presented in this journal; he gave his consent to use images, medical history and all the information vital for generating this journal. No disclosure of identity is denoted and confidentiality is promised however conspiracy is not undertaken.

### **Conflicts of interest**

There are no conflicts of interest in this journal.

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