IMPACT OF PHYSIOTHERAPY REHABILITATION ON HAND FUNCTION IN POST COLLE’S FRACTURE

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ABSTRACT

Introduction: Distal radius fractures are the most common types of fractures commonly occurring in pediatric and elderly populations but still have a significant impact on the health and well-being of young adults. Colle’s fracture of the wrist is among the most common bony injuries encountered in emergency practice commonly caused by a fall, landing on an outstretched hand with the wrist in dorsiflexion. The majority of Colle’s fractures are manageable with casting and conservative management. After healing and cast removal, the joint undergoes stiffness that needs prompt physiotherapy management to improve range of motion with muscle and ligament strengthening specifically for the injured hand and wrist affected. The patient’s main concerns were Pain, swelling, and stiffness over the forearm, wrist, and hand. The main clinical findings were pain, reduced ROM, reduced strength, stiffness and inability to perform wrist, and hand movements. Wrist and hand stiffness post Colle’s fracture. Physical therapy rehabilitation has already been proven effective in post-fracture rehabilitation, it includes protocol-based and evidence-based approach involving ROM exercises, stretching and strengthening exercises, mobilization, application of different modalities for symptomatic control, massage therapy, etc. outcomes are gross improvement in ROM, strength on MRC, improvement in the overall function of hand and activities of daily living as per Michigan hand outcome questionnaire, improvement in dexterity as per Jebsen hand dexterity test.

KEYWORDS: Post colle’s fracture, physiotherapist, Fluid therapy, mobilization techniques, strengthening.

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LIST of Abbreviation

1. DASH: Disability assessment of shoulder and hand
2. DIP: Distal Interphalangeal Joint
3. MCP: Metacarpophalangeal Joint
4. MMT: Manual muscle testing
5. NPRS: Numerical Pain Rating Scale
6. MCP: Metacarpophalangeal joint
7. PIP: Proximal Interphalangeal Joint
8. ROM: Range of motion
9. TENS: Transcutaneous Electrical Nerve Stimulation

INTRODUCTION

Distal radius fractures are one of the commonest types of fractures, accounting for around 25% of fractures in the pediatric population and up to 18% of all fractures in the elderly population but they still have a significant impact on the health and well-being of young adults though less common in this age group.\textsuperscript{10} In the pediatric population, it occurs mostly around the time of puberty, a period in which bone mineralization is relatively low. Young adults are less likely to ensure fracture of the distal radius and common mechanisms of injury include sporting activities and motor vehicle accidents. In the elderly population, fractures are more common in women than men, likely attributable to the impact of osteoporosis.\textsuperscript{2} Colle’s fracture of the wrist is among the most common bony injuries encountered in emergency practice, which accounts for 10% to 20% of all fractures and is a source of some major disability to large numbers of patients. Complications include residual deformity, loss of mobility, median and ulnar nerve injury, shoulder-hand syndrome, and rupture of the extensor pollicis longus tendon.\textsuperscript{3} It is most commonly caused by a fall, landing on an outstretched hand with the wrist in dorsiflexion. Wrist pain and tenderness to palpation will present during the examination. A classic dorsiflexion deformity is often seen and is also known as a “dinner fork” deformity. The majority of Colle’s fractures are manageable with casting and conservative management. After healing and cast removal, the joint undergoes stiffness that needs prompt physiotherapy management to improve range of motion with muscle and ligament strengthening specifically for the injured hand and wrist affected.\textsuperscript{4} When monitoring patients in the non-operative setting, many complications can arise thus, Close attention to detail, frequent follow-up, and conversion to operative treatment when necessary are important when treating distal radius fractures with conservative measures.\textsuperscript{5} The surgical procedures available for fixation of the distal radius include external fixation, dorsal...
plating, and volar fixed-angle plating. After fracture healing has been confirmed, therapists should concentrate on decreasing any residual physical impairment and regain normal functioning which can be achieved by mobilization splinting, joint mobilization, strengthening, and a supervised exercise program. Generally, physiotherapists aim at restoring or achieving optimal movement and physical functioning. Advice, patient education, and supervision for active and passive mobilization exercises, therapist-applied mobilization techniques, continuous passive motion, strengthening exercises, supportive splints, physical methods of pain management such as transcutaneous electrical nerve stimulation (TENS), heat treatment, massage, wound care, manual aids and occupational/home assessment are some of the more common therapeutic interventions used to improve the patient’s functionality. More than 90% of therapists included range-of-motion exercises and heat/cold modalities in the post-immobilization rehabilitation. There are several methods of superficial heat application used for the upper extremity, including moist hot packs, whirlpool baths, paraffin wax baths, and Fluid therapy of which hot pack application is likely the most common as it is inexpensive and can be repeated in the home environment.

PATIENT INFORMATION
A 52 years old patient, came to a private physiotherapy clinic on 28th January 2021 with a chief complaint of swelling, stiffness, and pain over the right hand, wrist, and elbow. The patient gives a history of pain and difficulty in moving the right upper limb. The patient also gives history of pain to be aggravating at night during sleep. On the Numerical Pain Rating Scale patient gives a rating of 10/10. The pain subsides for a while after taking the pain medications.

There was history of being hit by a bull on 27th November 2021 at 10 am while he was standing outside his shop following which he had a fall on his right outstretched hand. The patient was conscious and oriented following the trauma and was immediately taken to the hospital by his son where he was given the medications and was advised for X-ray, findings reveal of wrist fracture and a slab was applied to extend from lower 1/3rd of the humerus to proximal interphalangeal joint. After few days patient went to another a hospital for second opinion where he was asked to be quarantined but the patient refused and thus went back home. The patient then gives the history of visiting a nearby village for traditional treatment where the slab was removed and traditional casting was applied for 12-15 days but the pain and swelling didn’t subside. Thus, the patient went to a nearby private clinic where he was advised for the x-ray. Doctor informed him of incomplete healing of fracture on seeing the x-ray and was applied a slab following it in the same manner as earlier. After 15 days slab was removed and was advised for physiotherapy. Instead, he rested at home for 3-4 days. As the pain aggravated, he again went to the AVBRH hospital where he was given pain medications and a wrist splint was applied and was then advised for physiotherapy.

CLINICAL EVALUATION

Observation: Attitude of the affected limb, shoulder depressed and adducted with arm by the side of the trunk, elbow flexed (5-10 degree), forearm mid-prone, and supported by the opposite hand. Wrist in neutral with fingers fanned and extended. Swelling present extending from proximal forearm to the distal end of fingers. Skin appears stretched and shiny. There isn’t any discoloration or scar marks.

Palpation: Pitting edema confirmed which was grade 2. Tenderness was present over the dorsal aspect of the distal forearm, wrist, and hand and it was of grade 2. Swelling of 2 cm on the right hand and wrist.

Girth measurement

Table 1: Range of Motion (ROM) and Manual muscle testing (MMT)

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm (3 inch)</td>
<td>33 cm</td>
<td>35 cm</td>
<td>2 cm [not significant]</td>
</tr>
<tr>
<td>(6 inch)</td>
<td>30 cm</td>
<td>32 cm</td>
<td>2 cm</td>
</tr>
<tr>
<td>(9 inch)</td>
<td>28 cm</td>
<td>29 cm</td>
<td>1 cm</td>
</tr>
<tr>
<td>Forearm (1 inch)</td>
<td>29 cm</td>
<td>28 cm</td>
<td>1 cm [not significant]</td>
</tr>
<tr>
<td>(3 inch)</td>
<td>28 cm</td>
<td>27.4 cm</td>
<td>0.6 cm</td>
</tr>
<tr>
<td>(5 inch)</td>
<td>23 cm</td>
<td>24 cm</td>
<td>1 cm</td>
</tr>
</tbody>
</table>

Diagnostic assessment
Following are the Radiographic images of wrist and hand in AP and lateral views.

Figure 1. X-ray, dated 27th Nov 2020

Figure 2. X-ray, dated 16th Dec 2020

Figure 3. X-ray dated 8th Jan 2021
performed to strengthen the muscles of the shoulder, arm, and forearm.

**Week 3:** Cryotherapy was continued and mobilization techniques were employed to increase the ROM at the wrist and digits. Kneading before mobilization was continued. Patient was asked to perform assisted exercise for forearm supination using the force applied by the opposite hand and then passively performed by the therapist. Active resisted ROM exercises were performed to strengthen the muscles of the hand and to improve the grip using a squeeze ball and spring hand exerciser. Active exercises to strengthen the shoulder, arm, and forearm muscles. The patient was advised to perform ADLs using the affected hand like combing hairs, opening, and closing doors, opening and closing the lids of the jar, etc.

**Week 4:** Cryotherapy was continued to control pain and edema. Kneading before mobilization techniques were continued for digits and wrist. Active resisted ROM exercises for the shoulder and elbow were continued. Wrist strengthening and mobilization techniques were employed to further improve the range of motion. Weight-bearing ROM exercises for the wrist were also employed in addition. Mobilization of digits were performed. Active grip strengthening using squeeze ball and spring hand exerciser.

**FOLLOW-UP AND OUTCOMES**

Post 4 weeks of rehabilitation patient showed remarkable improvements.

**JEBSEN HAND DEXTERITY TEST**

Table 2: depicts time taken for given tasks in Jebsen hand dexterity test pre and post rehabilitation.

<table>
<thead>
<tr>
<th>Task</th>
<th>Pre-rehabilitation</th>
<th>Post-rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dominant hand (right-affected)</td>
<td>Non-dominant hand (left)</td>
</tr>
<tr>
<td>Writing</td>
<td>Unable to perform</td>
<td>42.10 sec</td>
</tr>
<tr>
<td>Card turning</td>
<td>Unable to perform</td>
<td>7.90 sec</td>
</tr>
<tr>
<td>Lift Small common object</td>
<td>Unable to perform</td>
<td>9.13 sec</td>
</tr>
<tr>
<td>Simulated feeding</td>
<td>Unable to perform</td>
<td>36.45 sec</td>
</tr>
<tr>
<td>Checkers</td>
<td>Unable to perform</td>
<td>20.26 sec</td>
</tr>
<tr>
<td>Lift large light objects</td>
<td>Unable to perform</td>
<td>6.46 sec</td>
</tr>
<tr>
<td>Lift large heavy objects</td>
<td>Unable to perform</td>
<td>6.50 sec</td>
</tr>
</tbody>
</table>

DASH: Disability assessment of shoulder and hand

**Pre score:** 90.83

**Post score:** 10.83

\[ \frac{\text{Sum of ‘n’ responses/n} - 1) \times 25 \]

Where, ‘n’ is number of responses i.e. 30

**DISCUSSION**

Nellans K W et al noted that children with distal radius fractures have particularly low rates of complications often results from the fact that the developing bone in children has a
remarkable ability to remodel itself back to its normal anatomy. They also found that in young adults, most extra-articular distal radius fractures have good long-term functional results with conservative treatment whereas it is difficult to obtain satisfactory results with intra-articular distal radius fractures. Wherein, distal radius fractures can be a significant source of mortality and loss of independence in the elderly. Porrino JA et al concluded in their study that a detailed understanding of the intricacies of the distal radius fracture is necessary for the radiologist to provide a clinically relevant description. Radiologists provide the information, necessary to make a clinical management decision.

Sternbach G et al mentioned that among the most common of injuries seen in emergency practice, fractures of the distal radius account for 10% to 20% of all fractures with Colle’s fracture has been extensively studied. Precise anatomical reduction is generally considered vital to the best functional outcome. Summers K et al discussed that the prognosis of a Colle’s fracture depends on the severity of the injury and the extent of complications. These complications are avoidable through prompt and adequate reduction followed by splinting and casting and follow-up with an orthopedist. Valdes K et al in a retrospective pilot study performed group comparisons and found a statistically significant difference between groups when comparing the number of therapy visits. The results also showed the statistically significant difference between groups when comparing the number of days each group took to attain functional ROM of the wrist and forearm.

Michlovitz SL et al in their study on therapy practice patterns in distal radius fracture concluded and identified that therapists apply compressive wrap with retrograde massage, heat/cold modalities, joint mobilization, electrical stimulation, continuous passive motion, soft-tissue mobilization, ultrasound, and ROM exercises to achieve the primary goals of edema control, increased ROM, and decreased stiffness. Szekeres M et al in a randomized controlled study concluded that the superficial heat modality is simply used to precondition the joint for therapeutic stretching, and only small gains in ROM would be expected.

CONCLUSION
The patient showed significant recovery following 4 weeks of rehabilitation with the use of applied interventions and further improvements are expected by the end of the 5th and 6th weeks of rehabilitation. Early, programmed, evidence and protocol-based rehabilitation has been found effective in reducing symptoms, improving functional independence, and ability to perform activities of daily living. The study also signifies how avoidance and ignorance can lead to complications that are otherwise preventable.

AUTHORS CONTRIBUTION
All authors made best contribution to the concept, assessment and evaluation, data acquisition, and analysis and interpretation of the data.

REFERENCES