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RESEARCH ARTICLE

COMBINED OCCUPATIONAL THERAPY TREATMENT TECHNIQUES IN THE MANAGEMENT OF LEFT DISTAL RADIO-ULNAR JOINT (DRUJ) INSTABILITY WITH MAL-UNITED DISTAL RADIUS FRACTURE: A CASE STUDY

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ABSTRACT

Distal Radio-Ulnar Joint (DRUJ) instabilities with or without associated conditions (such as mal-united distal radius fracture) is a common diagnosis in the field of orthopedics. However, few of these cases were referred to occupational therapy unit for post-surgical hand rehabilitation. The main reason for this is unknown but probably because of the scanty evidence to show the impact of various occupational therapy treatment modalities in treating DRUJ instability. As a result, this study intend to report the efficacy of combined occupational therapy (OT) intervention modalities in DRUJ instability by presenting Mr J, a known case of left DRUJ instability (with left mal-united distal radius fractured). He was admitted for k-wire removal after six weeks of K- wire fixation and referred to occupational therapy unit for hand rehabilitation. Having established the problems to be addressed through standardized and non-standardized OT assessments, different OT modalities which address each problems were used in the treatment process. Post treatment assessment during discharge shows a significant improvement despite the short hospital admission period. Therefore the outcome of this case study shows that, using combined OT modalities in DRUJ instability management do have greater impact on patient with DRUJ instabilities with mal-united distal radius fracture.

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INTRODUCTION

Acute Distal Radioulnar Joint (DRUJ) instability is a common clinical condition but a frequently missed diagnosis due to its co-occurrence with other orthopedics diagnosis such as mal-united distal radius fracture.^{1, 2} Having confirm the diagnosis, there are many treatments involved in the DRUJ instability which include surgical (such as: volar plating of radius) and conservative treatment (such as closed reduction by manipulation under general anesthesia and immobilization).^{3, 4} Most DRUJ patients usually undergo surgery followed by rehabilitation.⁵ The rehabilitation procedure include physiotherapy, Occupational therapy and many more.⁶ Physical therapy has been the major focus of most clinicians.^{3, 7} and less DRUJ cases were seen by occupational therapy probably because there is scanty evidence to that effect. Therefore, this case report intends to show the efficacy of combined occupational therapy treatment techniques in patient with left DRUJ instability (and left malunited distal radius fracture).

METHODS

Case Presentation: Mr J, 23 years, male, engineering student complained of inability to wash clothes and dishes, lifting heavy bucket of water, bathing, tying shoe lace, turning door knob, buttoning, ride his motorcycle, playing cricket, keeping load on laboratory machines and unable to hold or turn rod-like equipment in the laboratory. Mr J is a known case of left distal radio-ulnar joint (DRUJ) instability with Left mal-united distal radius fracture. He fell from the tree few years back and sustained a closed fracture injury at the wrist. Below elbow Plaster Of Paris (POP) was applied for 40days and he started performing his for 40 days and he started performing his daily chores without any discomfort afterwards. Two years back, he started experiencing pain in his left wrist- initially dull aching pain during performance of daily activities, and later the pain aggravated. It relieves at rest. Radiological examination (X-ray) revealed ulnar shortening and distal radio-ulnar instability. The before surgery X-ray is shown in figure i. For clarification

purpose, An X-ray is a penetrating form of high-energy electromagnetic radiation and uses invisible electromagnetic energy beams to produce images of internal tissues, bones, and organs on film or digital media.⁸



Figure 1. pre-operative radiological examination (x-ray) of the left hand revealing ulnar shortening with pain and distal radio-ulnar joint instability before the k-wire fixation

Management: He underwent surgery for DRUJ instability fixation through k-wire (The post- surgery X-ray is shown in figure ii). The surgery was followed by below elbow 6weeks POP. He was referred to occupational therapist unit for further treatment after the cast removal.



Figure 2. post-operative radiological examination (X-ray) of both anterior (front) and lateral (side) view of the left hand showing the K-wire fixation for the DRUJ instability which was followed by below elbow POP cast

Occupational Therapy Treatment Procedures

Assessment: Muscle wasting was observed on the left hand with a linear surgical scar at the anterior aspect of forearm. Another surgical scar was present on the lateral aspect of forearm with dressing over it. Tenderness was present at distal forearm and wrist around the scar and was graded 4/4 base on grading scale of tenderness developed by Le Febvre R.⁹



Figure 3. Shows the hand appearance.

There was a severe contracture at the left forearm, wrist and distal radio-ulnar joint. Using visual Analogue scale, pain experienced in left hand during task performance was scored 8. Forearm and wrist Range of Motions (ROM) using goniometer were shown in the Table I.

Table I. Active and Passive ROM of Forearm Wrist and Thumb

	Active	Passive
Forearm		
Supination	0 – 20°	0 – 30°
Pronation	0 – 10°	0 – 20°
Wrist		
Flexion	0 – 10°	0 – 20°
Extension	0 – 10°	0 – 30°
Radial deviation	0 – 10°	0 – 20°
Ulnar deviation	0 – 10°	0 – 30°
Thumb Interphalanga(IP) joint		
Flexion	0°	0 – 90°

All remaining ROM were full. Individual muscle testing to assess the muscle strength was done base on Manual Muscle Test grading.¹⁰ This is shown in table II. The left hand grip strength was 8kgf and total pinch (tip-to-tip 1kgf, pad-to-pad 2kgf, lateral 3kgf) strength was 6kg as compared to right hand with 36kgf grip and 25kgf of total pinch (tip-to-tip 8kgf, pad-to-pad 9kgf and lateral 8kgf) strength on Jamar Dynamometer. Using hand function skill grading showed in table III,¹¹ reach component of hand function which include forward, backward, lateral and overhead reach) was graded 4. Prehensile grasp components were normal. Non-prehensile grasp components were: spherical-4, disc-4, hook -3 cylindrical-5.

The In-hand manipulation evaluation component of the hand function skills and the grades were shown in table IV above. Basic activities of daily living evaluation showed modified independent for bathing, dressing and toileting on Functional Independent Measure (FIM). Instrumental Activities of Daily Living (IADL) evaluations identified difficulties in laundry, transportation and use of environmental hardware. As an engineering student, work evaluation showed difficulties in Laboratory work requires using his left hand such as keeping load on laboratory machine. Other aspect of his academic has

no problem as he is right hand dominant. Instrumental Activities of Daily Living (IADL) and work evaluation were done through patient-therapist interview. Using Patient Rated Wrist Evaluation, 70/100 was recorded from both pain and functional subscales. Michigan Hand Outcome Questionnaire (MHQ) was used to compare between the right and left hand pain and task performance (BADL, IADL and work). Most scores on MHQ for left hand were 5 why right hand was scored 1 on every component. Bilateral components were scored 3 on every component.

Assessment outcome: The overall evaluation identified pain and tenderness over the left hand forearm and the wrist, as well as contracture and decrease ROM of the left forearm and wrist, reduced muscle strength (supinator & pronators, elbow flexors and extensors, wrist flexors and extensors and IP/thumb) joint flexor and extensor), decrease grip and pinch(pad-to-pad, tip-to-tip, lateral) strength, reduced hand function skills (reach, spherical, translation with and without stability, hook, carrying, lifting, disc, cupping, cascading, complex rotation of left hand and bilateral hand use), difficulty in BADL(bathing, toileting, dressing) and I-ADL performance (laundry, transportation, and using environmental hardware) and work performance (laboratory work).

Treatment Plan: The intervention goal focused on reducing the pain, tenderness and contractures of the affected hand, increase ROM, strength (including grip and pinch strength) and improve hand function skills as well as improving independent performance in BADL, I-ADL, and work. For the pain and tenderness, intermittent cold pack (one of physical agent modalities techniques) was used for 5 to 7 minutes preceding each therapy session. We used passive mobilization (such as stretching through stretch board, supination-pronation board) as well as active mobilization (which include; using sander to hit ball to target in flexion/extension of wrist, ball activities to facilitate wrist movement, facilitating forearm movements through transferring cones, turning playing cards, pouring water from one glass to another) and splinting (wrist cock-up,) to address contracture and increase ROM. We introduced intermittent joint distraction for 7 to 10 seconds as well as few seconds of rest in-between for painful joints and 3-5minutes stretch force followed by partial release then slow intermittent stretching for restricted joints. We addressed strength and hand function problems by engaging the patient in a resistive activities such as using FEPS (Flexion, Extension, Pronation and Supination) device with minimum amount of bearable weight. The weight was gradually increased in subsequent therapy sessions. We also engaged the patient in a therapeutic activities(such as, clay activities, hand gripper, squeezing of gel ball/ sponge ball, manipulating small objects, screwing/ unscrewing nuts-bolt assembly, opening and closing jars and bottle caps, lifting weighted pegs, tying and opening knots) for strength and hand function improvement purpose.

RESULTS

The patient was seen for 7 sessions (with 45minutes to an hour in each session) before discharge by the orthopaedic physician. However, occupational therapy discharge re-assessment shows reduced pain with a score of 2 on visual analogue scale, absence of tenderness, increased ROM (including : forearm supination- 0 to 50°, pronation- 0 to 30°, wrist flexion- 0 to 50°, wrist extension-0 to 50°, wrist radial deviation-0 to 20°, Ulnar deviation-0 to 30° and Thumb IP flexion0 to 20°. There

was increased strength with a score of 4 for brachialis and brachioradialis, Triceps and anconeus were 5, supinator, pronator teres, pronator quadratus, flexor carpi radialis, flexor carpiulnaris, extensor carpi radialis longus and brevis, extensor carpi ulnaris, flexor pollicis longus were all 3+ and extensor pollicis longus was 4 (as well as 11kgf increment in left hand grip strength). Reach component of hand function which include forward, backward, lateral and overhead reach) showed a grade of 5, hook 4, lifting 4 and carrying 4 for the non- prehensile grasp component. Translation with and without stability (In-hand manipulation component) was 5. Total Patient Rated Wrist re-evaluation showed 45/100 for both pain and functional subscales. Michigan Hand Outcome Questionnaire (MHQ) comparison of the right and left hand pain and task performance (including BADL, IADL, and work) showed scores between 2 and 3 for left hand as well as 2 to 3 scores for the bilateral components.

Table II. Individual Manual Muscle Testing Grades

Hand Muscles	Grade
Biceps brachi	4
Brachialis	3+
Brachioradialis	3+
Triceps and anconeus	4
Supinator	2-
Pronator teres	2-
Pronator quadratus	2-
Flexor carpi radialis	2-
Flexor carpi ulnaris	2-
Extensor carpi radialis longus and brevis	2-
Extensor carpi ulnaris	2-
Flexor pollicis longus	2-
Extensor pollicis longus	3+

Table III: Hand Function Skills Grade

5-	Normal
4-	Functionally adequate
3-	Functionally inadequate
2-	Partially assumes
1-	Absent

Table IV. In-hand manipulation components and grades

	With Stability	Without Stability
Translation	4	3
Shift	5	5
Simple rotation	5	5
Complex rotation	4	4

Discharge plan include: To encourage the use of affected hand in BADL, IADL performance and work related activities, Keep a check for any changes or recurrence of pain (to avoid any complications), home exercise and regular follow up.

DISCUSSION

The primary purpose of this case study was to explore the efficacy of combined occupational therapy treatment modalities for the treatment of DRUJ instability with distal mal-united radial fracture. The patient was referred to occupational therapy unit for hand therapy purpose. Standardize and non-standardized assessment was done to identify patient's functional problems and to create a baseline for occupational therapy management.

Treatment goals were set and patient was treated consistently before discharge. In this case study, we hypothesized that, using different will be better due to the short hospital admission duration. Therefore, we focused the treatment using combined occupational therapy treatment modalities. This assumption is being supported by a study which concluded that, for better improvement in a patient attending OT in any acute settings, using different treatment modalities is advisable.¹² We used Physical Agents Modalities (PAM) as a preparatory activities at the beginning of every session. This is to address pain, tenderness and softening tissue to create room for patient active participation in treatment. This was supported by a position paper by American Occupational Therapy Association¹³ and a study by Moretti *et al.*¹⁴ Our use of passive mobilization as well as active mobilization and splinting to address contracture and increase ROM was supported by a moderate-quality systemic review study.¹⁵ Although, Harvey *et al.*,¹⁶ review did not support this concept. Clocksin¹⁷ supported using resistive activities to address strength and hand function problems. We engaged the patient in therapeutic activities to address strength and hand function base on the Yoo and Park¹⁸ as well as Roll and Hardison¹⁹ view. To the best of our knowledge, we do not find any contradictory opinion in the past literatures in related to this. Our use of patient- therapist interview for BADL, IADL and work evaluation was supported by 2014 Bredart *et al.* study.²⁰ The limitation for this case study is that, the patient was admitted for short duration of time (acute setting), future work can be done in a rehab setting which will allow a longer admission duration. Also, our assessment include both standardized and non-standardized assessment, feature work can focus on using only standardized tool.

CONCLUSION

As improvement was recorded, we concluded that, combined occupational therapy treatment techniques do have high impact in the treatment of DRUJ instability with distal radio-ulnar fracture.

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