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Case Report

Effect of Physiotherapy on Pain, Range Of Motion, Grip Strength and Function of Hand in Distal Radius Fracture with Volkmann's Ischemic Contracture, Grade II - A Case Report

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ABSTRACT

Objective: To find the effect of physiotherapy on Pain, Range of Motion, Grip strength and Function of hand in case of distal radius fracture with Volkmann's Ischemic Contracture, Grade II Seddon Classification.
Design: A case report.
Setting: Physiotherapy department at Almedica Clinic, Kolkata, India
Subject: A female aged 43yrs had right distal radius fracture following road traffic accident and later developed Volkmann's Ischemic Contracture, Grade II, presented with pain, weakness and contracture of the right hand.
Intervention: A 6 weeks schedule of physiotherapy containing wax bath, passive movement, stretching and strengthening exercises of the hand (1) to decrease pain (2) to increase ROM and (3) to increase grip strength thus improving function of the hand.
Outcome measures: Pain, Range Of Motion, Grip strength and Function of the affected hand.
Result: There was significant decrease of pain following two weeks of treatment with moderate improvement in range of motion and grip strength at the end of six weeks of treatment, thus improving functional status of the hand.
Conclusion: Significant improvement of the function of the hand was seen in this case following physiotherapy. Further study is required to establish generalisation.

Key word: Distal radius fracture, Volkmann's ischaemic contracture, Physiotherapy, Hand function.

INTRODUCTION

Distal radius fractures are a common injury, particularly in the elderly population. Severity of these fractures is directly related to the bone mineral density of the patient, and the clinical results are dependent on this parameter as well. [1] Distal radius fractures represent approximately 3% of all upper extremity injuries. There is a bimodal distribution of these injuries, with a peak in the 5 to 24 year-old, predominantly male population who sustain athletic and high-energy injuries and a second peak in the elderly, predominantly female population characterized by lower-energy or "fragility" fractures. Osteoporosis may be contributing to fractures in the elderly, and therefore improved attention to care of this condition may reduce the incidence of such fractures. [2]

These fractures are generally closed and usually involve displacement of fracture fragments. They may be either extra-articular (leaving the articular or joint

surface of the distal radius intact) or intra-articular (the articular or joint surface is disrupted). Numerous classifications have been devised to define and group different fracture patterns. Simple classifications based on clinical appearance, and often named after those who described them, remain in common use. In many developing countries, the traditional care of diseases and afflictions remain popular despite civilization and the existence of modern health care services. [3,4] The traditional bone setters, perhaps more than any other group of traditional care-givers, enjoy high patronage and confidence by the society. [4,5] Many reasons account for this including (1) Cheaper fees [4] (2) Easy accessibility [4] (3) Quick service [4] (4) Cultural belief [4] (5) Pressure from friends and families. [6]

The stereotyped traditional method of distal radial fracture fixation uses splints made from split bamboo or strips of wood / foot scales tightly bound around the acutely injured limb to immobilize the fracture. [7] The tight bound splints act as a tourniquet causing interruption of blood supply resulting in compartment syndrome leading to Volkmann's ischemic contracture. [8]

Ischemic injuries are classified in different ways. The most renowned classification is the one introduced by Seddon in 1964. Seddon [9] classified ischemia into three types depending on severity of involvement as follows: Grade I: Ischaemia, Grade II: Ischaemic contracture, Grade III: Ischaemic contracture with nerve involvement. In 1975, Holden classified Volkmann's ischaemic contracture of the limb into two types. Type 1 involving a major artery, occurred proximal to the site at which ischemia subsequently developed. Type 2 where direct trauma to a limb and subsequent ischemia occurred at the same site. [10] Tsuge classified ischemic contractures into mild where 2-3 fingers are involved with no nerve involvement, moderate where finger and wrist flexors as well as nerve involvement are present and severe where both flexors and extensors of hand as well as nerve involvement is seen. [11]

Following distal radius fracture, many patients are referred for physical therapy to expedite recovery. Physical therapy is directed toward improving quality of life and well-being following an injury, with a specific focus on mobility and function. Therapy protocols vary widely and can include soft-tissue compression, manual therapy techniques, heat/cold modalities, electrical simulation, ultrasound, whirlpool, and training (eg, self-care/ home management training and community/work reintegration training). [12]

The purpose of this study was to determine the effect of physiotherapy in a case of distal radius fracture with secondary Volkmann's Ischemic Contracture. It was hypothesized that stretching of the affected muscle and soft tissues along with strengthening of the muscles would be effective in improving hand function

The results will help physiotherapists to appreciate the extent and vigour of simple stretching manoeuvre to improve the extensibility of soft tissue thus allowing the resistive exercise programme to improve the strength of the muscles.

METHODOLOGY

A 43 year old female had an accident which resulted in distal radius fracture of the right upper limb. Her family took her to a traditional bone setter who applied a stick around her forearm, wrist and bandaged it firmly. Within the next few weeks the patient experienced excruciating pain over the forearm and hand with finger stiffness. The bandage was removed after four weeks and re-applied for another six weeks by the bone setter. After the removal of the bandage she visited the orthopaedic clinic and was referred for physiotherapy. She presented with wrist and finger stiffness (Grade II Seddon Classification) and pain. Examination revealed the index finger to be in flexion contracture at the PIP joint with painful movement at MCP and DIP joints, the middle and ring fingers had flexion

tightness at PIP joint with painful MCP and DIP joint and the little finger was in flexion contracture at the PIP and DIP joints with painful MCP joint movement. The thumb movement was pain free with no restriction of movement (Figure 1). Wrist was in neutral position with both flexion and extension being restricted and painful. The forearm was in pronated position with supination painful. Elbow and shoulder movements were pain free and within normal limits. Data was collected for pain using Numeric Pain Rating Scale, passive range of motion using a universal goniometer in positions recommended by the American Society of Hand Therapists (Adams et al 1992). ,grip strength using a dynamometer was measured in kilograms using a calibrated Jamar dynamometer on Setting 2 to ensure maximal grip strength (Firrell 1996) with the elbow flexed to 90 degree and functional evaluation was done by The Patient-Rated Wrist Evaluation questionnaire. Data was collected at baseline, two, four and six weeks of therapy, at the physiotherapy department.

Treatment protocol comprised of wax bath therapy for wrist and fingers followed by supervised exercises, six days a week, for six weeks. Home exercises were taught to the patient, to be done twice, every day.

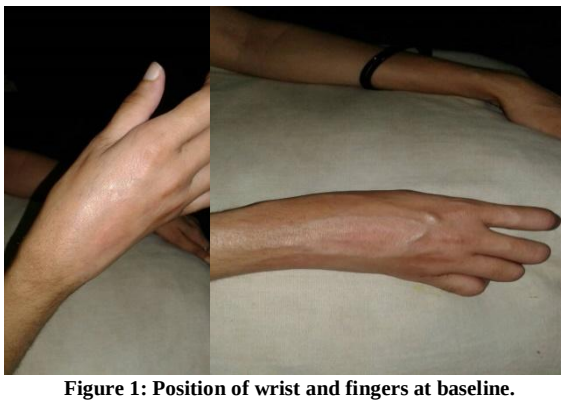

Figure 1: Position of wrist and fingers at baseline.

INTERVENTION

Wax Bath : 6-8 coats of wax was applied by brushing technique on dorsal and volar aspect of the hand and wrist and was covered in towel for 20 minutes following which it was removed and exercises were done.

Exercise: week 1

Intervention	Dosage
Passive ROM	Passive movement of wrist and fingers done by therapist within the pain free range , 10 reps, 2sets
Stretching	Low intensity static stretching , 30 sec hold, 5 reps.

Exercise: Week 2

Intervention	Dosage
Active assisted ROM	10 reps, 2sets
Stretching	Low intensity static stretching , 30 sec hold, 5 reps.
PNF ,Hold-Relax Technique	Prestretch , end-range ,isometric contraction , 5 sec hold, 5 reps

Exercise: Week 3

Intervention	Dosage
Active assisted ROM	10 reps, 2sets
Stretching	Low intensity static stretching, 30 sec hold, 5 reps, 2sets
PNF Hold-Relax Technique	Submaximal, end-range, isometric contraction, 10 sec hold, 5 reps

Exercise: Week 4

Intervention	Dosage
ROM	10 reps , 2sets
Stretching	Low intensity static stretching, 30 sec hold, 5 reps, 2sets
PNF Contract-Relax Technique	Submaximal, end-range, isometric contraction, 10 sec hold, 5 reps
Resistive Exercises	Submaximal manual resistive exercises within available range,5-8 reps

Exercise: Week 5 and 6

Intervention	Dosage
ROM	10 reps , 2sets
Stretching	Low intensity static stretching, 30 sec hold, 5 reps, 2sets
PNF Contract-Relax Technique	Submaximal , end-range, isometric contraction, 10 sec hold, 8-10 reps
Resistive Exercises	Maximal manual resistive exercises within available range, 8-10 reps

Home exercise programme was taught which was similar to the weekly protocol and on every visit the patient was asked to demonstrate the home exercises so that any correction, if required, was done.

RESULT

During the 6 weeks of active treatment, pain which was 8/10 at baseline gradually reduced to 6/10 at two week to 5/10 at four week and 4/10 at the end of six weeks of treatment as evaluated by the Numeric Pain Rating Scale. Range of

motion at the PIP joint of the index finger which was fixed at 30 degree flexion at baseline improved to 0-85 degree of flexion and 85-0 degree extension, the tightness of the middle and ring finger was reduced with complete range of motion at the joints. However there was not much improvement, in terms of range, at the little finger with the PIP joint being at 20-35 degrees of flexion and the DIP joint being at 0-10 degrees of flexion, at the end of six weeks of treatment (Figure 2). The wrist range improved to 0-75 degree flexion and 0-60 degree extension by the end of the sixth week (Figure 3). For grip strength there was moderate but significant improvement thus resulting in improvement of hand function at the end of six weeks of physiotherapy.

Figure 2: Position of fingers at six weeks of treatment.

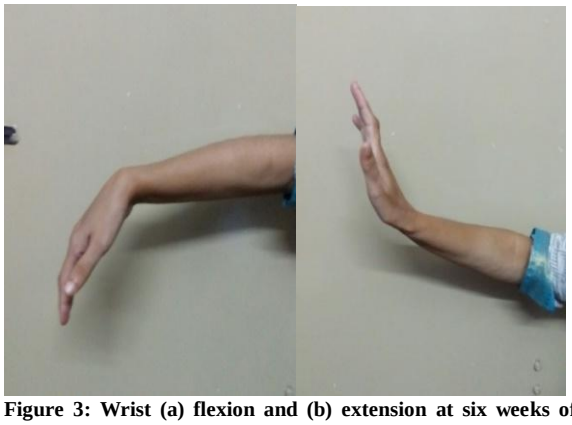

Figure 3: Wrist (a) flexion and (b) extension at six weeks of treatment.

DISCUSSION

ROM at a joint is maintained by moving the segment through the available range. ROM is reduced due to various reasons such as trauma and immobilization. Extensive research by Salter has provided evidence of the benefits of movement on the healing of tissues in various pathological conditions. [13,14] Functional ROM is associated with joint integrity and the extensibility of the soft tissues that surround the joint. Stretching plays a vital role to increase the extensibility of soft tissues that have adaptively shortened and become hypomobile due to immobilization. Adequate muscle strength is a key factor to reform various functional activities of the hand and thus ROM and tissue extensibility has to be supported with adequate grip strength of the hand. With increase in ROM the joint pain is reduced by the neurophysiological and mechanical effects acting on the joint. [13]

CONCLUSION

Stretching of muscle and soft tissue along with strengthening of the muscles of the hand following distal radial fracture with secondary Volkmann's ischaemic contracture, Grade II Seddon Classification showed an improvement of hand function as evaluated by The Patient-Rated Wrist Evaluation questionnaire.

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