2007

Examination and Treatment for a Patient with a Distal Radius Fracture

Chuck McCullough
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Examination and Treatment for a Patient with a Distal Radius Fracture

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A Scholarly Project Submitted to the Graduate Faculty of the
Department of Physical Therapy
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in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota
December 2007
This Scholarly Project, submitted by Charles McCullough in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title Examination and Treatment for a Patient with a Distal Radius Fracture

Department Physical Therapy

Degree Doctor of Physical Therapy

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Date 11-14-07
# TABLE OF CONTENTS

LIST OF FIGURES. ................................................................. 5

LIST OF TABLES. ................................................................. 6

ACKNOWLEDGEMENTS. ......................................................... 7

ABSTRACT .......................................................................... 8

CHAPTER
  I.  Introduction. ................................................................ 9
  II. Examination, Evaluation, and Diagnosis. ......................... 11
  III. Prognosis and Plan of Care .............................................. 18
  IV. Intervention. ............................................................. 20
  V.  Outcomes at Discharge. .................................................. 25
  VI. Discussion. ............................................................... 28

ADDENDUM .................................................................. 33

ALGORITHM .................................................................. 34

REFERENCES .................................................................. 35
LIST OF FIGURES

1. Patient Rated Wrist Evaluation ........................................... 16
2. Addendum - home exercise program ...................................... 33
3. Algorithm ............................................................................. 34
LIST OF TABLES

1. Goals. ............................................................... 13
2. Shoulder active range of motion. ......................................... 14
3. Wrist range of motion measurements. .................................... 15
4. Problem list. ........................................................... 17
5. Wrist range of motion measurements at discharge. .................... 25
6. Goals summary. ........................................................ 26
7. Costs of care for this patient. ............................................. 32
ACKNOWLEDGEMENTS

I would like to acknowledge the support and assistance from the entire staff of the University of North Dakota Physical Therapy Department. I would also like to give a special thank you to my advisor, Bev Johnson, for all of the hard work with the preparation of this project and for the tireless dedication to my education.
ABSTRACT

Examination and Treatment for a Patient with a Distal Radius Fracture

BACKGROUND AND PURPOSE: This article describes the eight month outpatient physical therapy management of 67 year old female who had an open fracture of the left distal radius that was stabilized internally with K-wire and externally with the application of external fixator. Initially, this patient presented with a need for patient education on wound care, edema control techniques, splinting, and a maintenance program for finger and shoulder range of motion. The physical therapy intervention progressed to range of motion, strengthening, joint mobilization, and functional exercises for the wrist and hand. The purpose of this article is to describe the interventions used for this patient, the results of these interventions, and the rationale for these interventions. DESCRIPTION: This case was unique due to the addition of a splint that was worn with the external fixator. Treatment of this patient included wound care, therapeutic exercise, joint mobilization, edema control techniques, patient education, and splinting.

RESULTS: Following PT intervention, this patient achieved objective improvement of range of motion and grip strength as well as improvements in functional activities of the hand.

DISCUSSION: Treatment guidelines outlined by the American Society of Hand Therapists provided the framework and foundation for evaluation and treatment for this individual and were deemed appropriate for this individual. While these guidelines were useful for the evaluation and treatment of this patient, adaptations, such as the splint, were implemented.

KEY WORDS: Distal radius fracture, wrist pain, Patient-Rated Wrist Evaluation.
CHAPTER I

Introduction

This article describes the eight month outpatient physical therapy management of a 67 year old female, who had an open fracture of the left distal radius that was stabilized externally. In this case study, the physician chose to use an external fixator rather than internal fixation because it was quickly and easily applied, she had an open fracture, and he felt that he would achieve sufficient bony alignment with the external fixator. This article will examine the techniques used to rehabilitate this patient.

Distal radius fractures are one of the most common fractures in the United States. Studies have shown that in the USA, a Caucasian female at 50 years old has a 15% lifetime risk of this type of fracture.\(^1\) Where as a Caucasian man of the same age has a lifetime risk of 2%. Many of these types of fractures occur from falls. One study noted that falls are the most prevalent mechanism of injury.\(^2\) Often, a closed reduction and internal fixation is performed to restore the wrist anatomy but there are times that an external fixator is used by the physician instead. External fixation is a surgical treatment used to set bone fractures in which a cast with a closed reduction would not allow proper alignment of the fracture.\(^3\) In this kind of reduction, holes are drilled into uninjured areas of bones around the fracture and special bolts or wires are screwed into the holes. Outside the body, a rod or a curved piece of metal with special ball-and-socket joints joins the bolts to make a rigid support. This technique is indicated when the individual is mentally and physically healthy. The external fixator's goal is to restore proper wrist anatomy and optimizing results for the best functional outcome by providing sufficient anatomical alignment, maintain carpal alignment, and maintain proper length.
The rehabilitation of an individual who has undergone external fixation can be rigorous. The main concern for the use of an external fixator is the potential for additional wrist and hand stiffness. Subsequently, the various rehabilitative techniques and treatment guidelines that are applied for individuals receiving rehabilitative services following a distal radius fracture need to be examined. Also, the usage of a custom orthoplastic splint in conjunction with the external fixator is not a common practice but was used with this particular patient. There is very little evidence supporting this procedure and only one case study in the literature that has examined this course of action. This case study will not debate the pros and cons of this physician's choice to support the wrist with an orthoplastic brace but only examine the physical therapy techniques used and the possible benefits to the patient.

Studies have shown that functional and anatomical results indicate excellent to good ratings in more than 80% of the cases when an external fixator is used. While this is a promising study, additional studies have noted a gap in our current knowledge. A recent meta analysis of rehabilitative techniques used in the treatment of distal radius fractures in adults noted that there was not enough evidence available to determine the best form of rehab for these patients. Subsequently, the need for research, case studies, and assessments of these techniques is warranted.

A theoretical framework for treatment of individuals post application of an external fixator is based on guidelines outlined by the American Society of Hand Therapists (ASHT). This provided the framework and foundation of evaluation and treatment of the patient I will discuss in this article. While the suggestions and recommendations from the ASHT were beneficial, the unique addition of a splint in conjunction with the external fixator necessitated a distinctive approach and facilitated the development of this case study.
CHAPTER II

Examination, Evaluation, and Diagnosis

The patient was a 67 year old left handed female who injured herself when she fell performing gardening activities on May 4th, 2005. She thought she may have stepped in a hole and fell towards her left side onto her outstretched arm. She immediately noticed pain and deformity of her wrist and an open wound over the ulnar side of her wrist. She sought treatment immediately at the local emergency room and was seen by the orthopedic surgeon that day for evaluation. The physician’s evaluation noted that she had an open laceration above the distal ulna with an intra-articular comminuted fracture of the distal radius. She was seen in surgery the same day and underwent irrigation and debridement of her open wound on the distal ulna, as well as internal stabilization with percutaneous pins through the distal radius and an external fixator to provide additional stabilization. The fixator was applied with two percutaneous pins at the mid shaft of the radius proximally and distally using two pins positioned at the mid shaft at the second metacarpal. K-wire was used to stabilize the radius to address the intraarticular fracture.

She then followed up with the orthopedic surgeon in his clinic five days later on May 9th, 2005. At that point in time, physical therapy treatment was initiated to begin education and to fabricate a custom splint. This patient's orthopedic physician requested the splint in order to provide additional support at the hand. With the splint extending into the palm, he felt that this patient would feel more support and would be more apt to use her hand thus trying to minimize loss of motion or stiffness at the fingers and thumb. The patient’s chief complaints included the following: pain, swelling, and decreased function of the left hand and wrist.
Prior to the injury this individual was fully independent and did not require any assistive devices for activities of daily living (ADL) or ambulation. She presented a past medical history of previous left and right total hip replacements due to osteoarthritis, history of low back pain, non smoker, and post menopausal. She denied a history of falls. While she currently denied any cardiac problems or current cardiac treatment, her family history was significant for heart disease and arthritis. She described herself as an active retired teacher with no history of smoking, drug, or alcohol usage. Specific questioning about possible osteoporosis was denied and she denied previous fractures of the spine, upper extremity, and lower extremity. She reported no specific exercise routine that she was currently engaged in on a regular basis. She felt that her leisure activities and assisting with the care of her grandchildren kept her busy. Leisure activities and hobbies included: gardening, crocheting, baking for her grandchildren, and playing with and assisting with her grandchildren’s care. She lived in a home with only her husband. She did state that her grandchildren did come to visit often and she did assist with the care of these children. She reported that she was left hand dominant and denied having any problems when using the right upper extremity.

Since fracture and external fixator placement, she reported significant loss of function. The pain, swelling, and stiffness significantly affected her function. She reported all her leisure activities were considerably limited as well as her personal care. She was now requiring her husband to assist with daily cares, such as getting dressed and driving. She was unable to assist with the care of her grandchildren and reported to me that this was a major complaint. She saw her role as a grandmother significantly changed, which she felt was adversely affecting the quality of her life.
Goals were mutually discussed and agreed upon by the patient and the physical therapist. These initial goals (Table 1) were established during the physical therapy evaluation at 12 weeks post fracture and modified two additional times.

**Table 1: Initial goals**

<table>
<thead>
<tr>
<th>No.</th>
<th>Goal Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The patient will present grip strength of 60 pounds or better during hand dynamometer testing within 2 months.</td>
</tr>
<tr>
<td>2.</td>
<td>The patient will score a 10 or lower when completing the PRWE within 2 months.</td>
</tr>
<tr>
<td>3.</td>
<td>The patient will report being able to perform baking activities in the kitchen without assist within 2 months.</td>
</tr>
</tbody>
</table>

Her physician started her on oral antibiotics after the initial injury and on the same day of surgery. She had completed the series at the time of second physical therapy visit. She denied any allergic reaction to the antibiotics. She was prescribed Tylenol with codeine on the day of injury and used it for the first two weeks status post surgery. She reported no side effects. This medication's common side effects include the following: nausea, vomiting, constipation, lightheadedness, dizziness, drowsiness, flushing, vision changes, or mental/mood changes. These side effects could limit or inhibit her ability to participate in rehabilitation or home exercise activity. She later used over the counter Tylenol. Its side effects are rare. The most serious side effect is liver damage due to large doses, chronic use or concomitant use with alcohol or other drugs that also damage the liver. She presented no adverse signs or symptoms or undesirable effects of this medication.

Initial physical therapy visit occurred on May 9th, 2005. Assessment was based on clinical assessment recommendations from the American Society of Hand Therapists (ASHT). Assessment began with visual inspection of the extremity. At the wound sites there were no sign of infection, redness or drainage. There were no asymmetries in temperature of the skin on the left wrist radial side compared to the right side with no signs of infection around the pin areas. It was noted that the physician instructed the patient to perform Hydrogen Peroxide wound
cleansing around the pin sites. Shoulder active range of motion (AROM) was assessed and noted to be equal on the left and right by goniometric evaluation as noted in Table 2. Elbow motion was significantly limited due to the placement of the external fixator and was not objectively measured. At this initial visit, wrist range of motion was unable to be assessed due to the external fixator.

Table 2: Shoulder active range of motion

<table>
<thead>
<tr>
<th>Motion indicated in degrees</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>Extension</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Abduction</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

The patient was instructed to continue with extremity elevation to address edema. A home exercise program to maintain shoulder AROM included five to ten repetitions of shoulder flexion five times per day. Finger passive range of motion exercises were given to this patient to be done five to ten repetitions, five times per day.

This initial visit also included fabrication of an orthoplast splint for the patient’s hand and wrist. Specific instructions were received from the physician to fabricate a custom splint with palmar support throughout her hand extending proximally up the ulnar side of the forearm to provide additional control and stability. Specifically, control at the hand level was to be achieved with the splint extending into the palm and stability at the radiocarpal and distal radioulnar joint with the splint extending through two thirds of the forearm.

At this point continued management of the patient was carried out by the orthopedic surgeon as her fracture site was still healing. No additional physical therapy intervention was required as the patient independently continued with her home exercises, edema management, and splint management. Her external fixator was removed at 10 weeks post fracture. At 11 weeks, she was assessed again by her physician and x-rays were performed. The surgeon was
satisfied with stability and ordered rehabilitation to begin on July 20th, 2005, 12 weeks post fracture.

A second examination of this individual was performed. Wounds were closed with minimal scar and no signs of infection. Prior to exam, the patient was given the Patient-Rated Wrist Evaluation (PRWE). See figure 1 for a sample of the PRWE. Her initial score for the PRWE was 133. This tool was developed at the Hand and Upper Limb Center, St. Joseph Health Center, London, Ontario, Canada. The PRWE has been shown to provide a brief, reliable, and valid measurement of patient rated pain and disability. The tool was chosen because it was a one page, easy to fill out, and could be used intermittently to gather data for evaluation of outcomes. Table 3 describes the initial wrist range of motion. Grip strength was measured using the second grip position with the right at 50 pounds and left at five pounds. A Jamar hand dynamometer was used to assess grip strength; standard protocol. This form of grip strength assessment has been found to be a valid and reliable method of testing. It was also noted that the patient could not make a full fist. The amount of flexion lag was not measured.

Table 3. Initial wrist range of motion measurements.

<table>
<thead>
<tr>
<th>Motion indicated in degrees</th>
<th>Right AROM</th>
<th>Left AROM/PROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion:</td>
<td>60</td>
<td>40/44</td>
</tr>
<tr>
<td>Extension:</td>
<td>60</td>
<td>10/12</td>
</tr>
<tr>
<td>Radial deviation:</td>
<td>10</td>
<td>0/4</td>
</tr>
<tr>
<td>Ulnar deviation:</td>
<td>40</td>
<td>20/30</td>
</tr>
<tr>
<td>Pronation:</td>
<td>80</td>
<td>10/20</td>
</tr>
<tr>
<td>Supination:</td>
<td>80</td>
<td>5/10</td>
</tr>
</tbody>
</table>
A systems review was performed at this second visit. Cardiovascular and pulmonary assessment notes that she has had general edema at the right wrist and hand, but not the left and no lower extremity edema was noted. Blood pressure was at 132/84 with a heart rate of 72 beats per minute. At the initial evaluation, integumentary system looked good and she had pins in
place with no signs of infection. At the second visit, her hand and wrist generally looked good. Her skin was pink with no signs of infection. Her muscle skeletal exam noted she presented a height of five feet and four inches with a weight of 190 lbs. Her gross motor coordination was good as she ambulated and transferred independently without any type of assistive device. No fall assessment was performed at the time even though her mechanism of injury was a fall. She was orientated to person, place and time.

This completed the evaluation at her second physical therapy visit. Her main physical complaint was loss of function. She was restricted with functional activities such as baking and playing with her grandchildren. She felt that she had a role as the "grandmother" and doing grandmotherly things, like baking and caring for grandchildren was limited. She stated that this loss "really bothered" her. Subsequently, it became a strong motivating factor for her to participate in physical therapy and perform her home exercises. A problem list was developed and is noted in Table 4. A physical therapy diagnosis was also established using the Guide to Physical Therapist Practice and noted the following: 4G - Impaired joint mobility, muscle performance, and range of motion associated with fracture. The International Statistical Classification of Diseases and Related Health Problems (ICD) provides codes to classify diseases and a wide variety of signs, symptoms, abnormal findings, complaints, social circumstances and external causes of injury or disease. Three codes were designated for this patient's diagnosis; 813.41 for Colles' fracture, 719.53 for wrist joint stiffness, 719.43 for wrist joint pain.

<table>
<thead>
<tr>
<th>Table 4: Problem list</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wrist joint stiffness</td>
</tr>
<tr>
<td>2. Wrist pain</td>
</tr>
<tr>
<td>3. Weak grip</td>
</tr>
<tr>
<td>4. Decreased functional usage of the right hand</td>
</tr>
</tbody>
</table>
CHAPTER III

Prognosis and Plan of Care

This patient's prognosis was good. This individual had a strong desire to achieve her goals and return to her previous level of activity. Prognosis for this type of fracture is generally good. One study noted functional and anatomic results indicated excellent to good ratings in more than 80% of the cases after a five year follow up.iii Another study used the PRWE to assess outcomes in patients over 65 years of age with external fixation of a distal radius fracture six months post surgery.xiv According to the PRWE results in this study two patients had no pain and no functional disability; five had minimal; five had mild pain and functional disability; and one had moderate degree and frequency of pain with moderate functional disability. Subsequently, I felt that there was good evidence that this patient would have a good outcome. In addition, this individual was very motivated and I felt comfortable treating this type of problem.

Occasionally, the treating orthopedic physician will just give the patient a pamphlet of exercises to do on their own for self-directed rehabilitation. Watt et al xv investigated the use of physical therapy intervention versus independent patient exercise. The results found that patients who attended physical therapy achieved average wrist extension of 55 degrees versus 38 degrees with the group who received no active therapy.xv Mean grip strength was also better with the therapy group by seven kilograms over the group receiving no active therapy. This specific patient was more complicated with an external fixator and a notable slow healing time prior to PT starting than in comparison to the people in this particular study. In spite of this fact, I still felt that her prognosis was good because our plan of care did include comprehensive management by a Physical Therapist.
The plan of care and goals were discussed and mutually agreed upon. In clinic physical therapy treatment was used as well as exercises to be done on a home basis. These initial goals were set up at the 12 weeks post fracture physical therapy evaluation and listed in Table 1.
CHAPTER IV

Intervention

This patient was seen for 16 visits over the course of eight months. The first visit was for the splinting then she was not seen until 12 weeks post fracture. This patient was seen twice a week for four weeks. Treatment was diminished to once a week for the next four weeks. The frequency diminished to one visit per month over the course of the next three months. At eight months status post fracture this patient was discharged from physical therapy as she has reached maximum achievement towards her goals.

I coordinated efforts with her orthopedic surgeon. His office is within the same building as my office and subsequent communication was easily accomplished. An example of this level of communication would be the directives for the splint fabrication. Specific instructions were received from the physician to fabricate a palmar support throughout her hand to provide additional control and stability. While I followed the basic principles and techniques of splinting, a pure custom fabrication of a splint was made for this individual based on this physician's instructions.

Assessment was based on clinical assessment and recommendations from American Society of Hand Therapists.¹ This text is the standard for evaluation of upper extremity and specifically, hand therapy assessment. It provides explanation and justification on various evaluation techniques and procedures used for the assessment of this patient throughout her care.

Intervention techniques

My initial encounter with this patient was for fabrication of a protective orthoplast splint. The splint was recommended by the surgeon to provide additional stabilization, beyond his surgical technique. The use of splints is not very common in this situation so a custom splint was needed. Even though this was a custom splint, the basic fundamentals of splinting were
followed: the greater the surface area the greater the support, folds in the material increases strength, longer level arms provide more support.xvi

North Coast medical Spectrum II material was used for the splint as it provided stability and draped easier on the arm when fabricating and customizing the splint. On the palmar side of her hand, from the MCP joints to the hypothenar eminence, the material provided palmer side support. The Spectrum II material was continued on this palmar side to the distal two-thirds of the forearm. A soft strap was secured on the dorsal side of the splint just distal from the second metacarpal pins to secure the hand in the splint. Another strap was placed at the area of the wrist and another proximally from the two stabilizer pins at the radius using soft cushioned strapping. The patient was given instruction, demonstration, and practice about the application and removal of the brace and she was independent with both. The cost of this splint was minimal and fabrication was easy with very little time needed.

Wound care assessment was performed at the initial visit with a visual inspection of the extremity. At the wound sites there was no sign of infection, redness or drainage. There were no asymmetries in temperature of the skin on the left radial side compared to the right radius side of the forearm with no signs of infection around the pin areas. It was noted that the physician started a series of oral antibiotic medication and instructed the patient to perform Hydrogen Peroxide wound cleansing around the pin sites, as he was concerned about infection. At her second visit, after the pins were removed, the wounds continued to note no signs of infection and were closed within two weeks. There was no significant scar formation.

At the time of the second physical therapy visit and continuing for the next six physical therapy visits, heat was used prior to in clinic range of motion activities. Also, the patient was instructed to use a heating pad (she chose to use her electric heating pad) at home for 10 minutes
prior to the home exercise program. This is a common technique used in the treatment of patients with distal radius fractures. More than 90% of therapists included in study by Michlovitz used heat/cold modalities in the post-immobilization treatment plans. This was a very effective treatment for this patient as she stated a better sense of motion and an analgesic effect of the heat.

A home range of motion program to improve wrist motion is another common practice pattern. At the first visit, along with the splinting, this patient was given instructions on home activities. The patient was instructed to continue with extremity elevation to address edema to include holding her hand up above her shoulder or to rest it on a pillow. A home exercise program was established to maintain shoulder AROM that included five to ten repetitions of shoulder flexion AROM daily. Finger passive ranges of motion exercises were given to this patient to be done five to ten repetitions daily. This patient was given instruction by her physician to perform daily dressing changes around the dressing pin sites. These instructions were reinforced and reiterated to the patient at the first visit. A sample of this program is included in addendum A.

At the second physical therapy visit a home program was established to be performed five sessions a day that included finger, elbow, and wrist range of motion. Wrist range of motion for flexion, extension, radial and ulnar deviation, supination, and pronation was emphasized with 10 repetitions of each exercise at each session. The exercises eventually progressed to strengthening with the use of therapeutic putty, three to five minutes per session, and five sessions per day. The effectiveness of wrist range of motion exercises on a home basis for treatment of stiffness post-immobilization is positive. With this patient, it was effective and beneficial. She appeared to be compliant with her exercises as she did improve with care.
As this patient continued with her home exercises, in clinic treatment continued from visit two through visit number ten in which gentle stretching, range of motion, and grade II and grade III joint mobilizations at the wrist and fingers was performed. During these visits, after the usage of a moist heat pad, I manually mobilized the wrist and fingers to assist with improving range of motion and after this passive mobilization; active motion was performed with simple active wrist flexion, extension, radial deviation, ulnar deviation, and wrist circumduction. MacDermid\textsuperscript{xix} found that these techniques are a commonly used approach.\textsuperscript{xix, xx} Hands-on stretches and joint mobilization glides are useful in selected patients having difficulty maintaining their active range of motion solely with the use of active exercise. Patients may require these hands-on techniques and scar massage/management to restore full tissue mobility. As noted in the initial evaluation, she was lacking range of motion. Subsequently, she needed assist with improving these values. It appeared that as she improved with her range of motion her function improved.

Strengthening exercises to improve grip was also needed due to her poor grip strength and function. Exercises to build functional strength are common techniques used by physical therapists for many dysfunctions and that exercise is a common useful tool when treating distal radius fractures.\textsuperscript{xxi} The home exercise program continued with functional strengthening with therapeutic putty and a stress ball to build strength. She had a strong desire and physical need to improve her functional strength in order to achieve her goals. She performed various types of grips and pinches with the therapeutic putty or the soft foam ball. I recommended that she does three to five minutes of the motions for five sessions per day. There are many journals and texts that recommend or justify the need for these techniques and reinforce that the strengthening activities are common practice patterns when treating patients with distal radius fractures.\textsuperscript{xxii}
Regardless, this patient definitely benefited from this type of intervention as noted with objective grip improvement as well as improved PRWE score.
CHAPTER V

Outcomes at Discharge

At eight months post fracture this patient was discharged from physical therapy as she has reached maximum achievement of her goals. Final PRWE performed and her score was a 19 indicating mild pain and functional disability. Final range of motion measurements are provided in Table 5. The final grip strength measurements were right at 50 pounds and left at 40 pounds.

Table 5. Wrist range of motion measurements at discharge.

<table>
<thead>
<tr>
<th>Motion indicated in degrees</th>
<th>Right AROM</th>
<th>Left AROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion:</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Extension:</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>Radial deviation:</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Ulnar deviation:</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>Pronation:</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Supination:</td>
<td>80</td>
<td>60</td>
</tr>
</tbody>
</table>

Her response to the intervention was noted to be positive as she was able to return to previous activities in the kitchen and all ADLs without assistance. She did well with physical therapy intervention with no adverse effects, no decrease in function with the interventions, and she made objective improvement with treatment.

She did have some impairments and functional limitations at discharge. While her grip did not achieve 60 pounds, weakness was still noted even though she was subjectively reporting no functional problems. This was evident from the PRWE score. As noted previously, the PRWE clinometric tool was used to track and describe changes in functional status of the patient. Initial testing noted that she really could not function, a 138 is very high number indicating a large subjective amount of pain and physical limitations. Her final PRWE noted good functional improvement, not at a zero but scored a 19. While she has some limitations she was going to continue with her rehab on her own. I would anticipate continued improvement. Rikili, iii reported improvements for up to five years post surgery. Her level of accomplishment of
anticipated goals and expected outcomes was very good. The goals that were set at the second visit are noted below. The target date to achieve these goals was two months. While she made progress to these goals she did not meet them. While I felt that they were worthy goals, I overestimated her progress. Subsequently, I needed to reset them after two months and then reset them again after another two month period of physical therapy intervention. The final outcome took longer than initially expected and Table 6 summarizes the final outcomes. I did anticipate that she would eventually meet the goals, but we needed to allow additional time for rehabilitation.

**Table 6: Goals summary**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The patient will present grip strength of 60 pounds or better with testing with the hand dynamometer within 2 months.</td>
<td>although not met, significant progress</td>
</tr>
<tr>
<td>2. The patient will score a 10 or lower when completing the PRWE within 2 months</td>
<td>although not met, significant progress</td>
</tr>
<tr>
<td>3. The patient will report being able to perform baking activities in the kitchen without assist within 2 months.</td>
<td>met</td>
</tr>
</tbody>
</table>

This patient was fully compliant with attendance to physical therapy treatment sessions and appeared to follow the exercise program instructions properly. She gave me no reason to doubt her. She could verbally and physically reproduce the exercises so I believed that she was doing them on her own. Risk reduction and prevention issues were minimal. She was provided one on one care by me, no aides or physical therapy assistants provided care. She could safely perform her exercises in clinic and at home, all exercise in clinic done under my supervision, and I made sure she had pictures of the program to insure that she did exercises correctly. I did use moist heat prior to exercises and made sure that the risk of burn was minimized by utilizing the heat only 10 minutes and providing sufficient layering.

The patient satisfaction with physical therapy intervention was not formally measured.
She appeared to be satisfied with the results. I have seen her and visited with her in public since discharge from rehabilitation and she reports no problems. My personal level of satisfaction was met as she had a good outcome in the end.
CHAPTER VI

Discussion

Generally, the outcome of this individual indicated that the physical therapy intervention was effective. The best explanation that I can give for the results is that we followed evaluation and treatment principles that were reliable, valid, and effective. Studies of long term results of external fixation of distal radius fractures have indicated excellent to good outcomes.iii iv xiv

The eight month period of rehabilitation and eventual final evaluation was shorter than a long term follow up study. Specifically, Rikliiii did follow up studies after five years. The eight month period for my patient was sufficient for this situation and she did have a pleasing outcome. Subsequently, I can conclude that my patient did very well with no complications. Reflex sympathetic dystrophy can be a problem in patients with type of fracture and stabilization, but in the end, this patient has no such complications in the eight months of rehab under my care.iv

At the time of discharge the patient was pleased with her progress. There was improvement in function as measured by the PRWE as well as increase in strength and range of motion. With the improvement in her function and with the lower PRWE score, the clinical implications of this observation lead me to believing that the PRWE was an effective tool. Recommendations for future studies of the usage of the PRWE, specifically with patients with and external fixator would be beneficial.

Because this patient was compliant and was able to understand and perform the exercises, I was able to decrease our frequency of treatment over time and look towards a more long term approach for her rehabilitation. Quite often a home exercise program is used to address this type of patient.xvii xxii xxiii Studies have shown that adherence to a hand therapy program helps
improve initial outcomes after distal radial fracture. The important clinical implication of this observation in this study supports the use of a home exercise program. I believe that a home program can improve long term outcomes as evident in this patient by her achievement and progress to her goals. Future studies to look at specific exercises for these types of patients will be helpful in order to find the most effective exercises and techniques available. Home exercise adherence was noted to be one of the most important predictors of outcomes. Clinically, it appears that with this was an important factor in order to achieve her goals. I believe this patient definitely benefited from adherence to her home exercise program. The physical therapy sessions were important to help monitor her progress and to improve adherence to her home exercise program. When treating a patient with a distal radius fracture, the treating physical therapist should not only prescribe an appropriate home program but should make a point of monitoring and improving patient compliance to that home program.

I believe the guidelines for treatment and rehabilitation established by the American Society of Hand Therapists was beneficial with assisting in the clinical evaluation and intervention of this patient. They did provide effective guidelines and should be used by therapists treating this type of injury. This will also provide improved reliability between therapists with testing. For example, to test the grip strength, a standard procedure was used with the patient in the same position each time. This was good as I was accurately testing the grip the same way each time and could be easily and reliably reproduced by another therapist if needed.

The splint usage was a unique aspect of treatment for this patient. This has been the only patient that I have used orthoplastic splinting in conjunction with an external fixator. Her orthopedic physician was pleased with the healing of this patient's radius and felt that the splint
was a useful tool in this healing. I do not anticipate consistent usage of this type of splinting in the future but this was a good example of using the fundamentals of splinting in unique or difficult situations.

More evidence is needed to help therapists treat people with distal radius fractures. In 2006, Handoll vii published a systemic review of management of patients with distal radius fracture. The author's conclusion was that with the available evidence from randomized controlled trials, there was insufficient evidence to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius. The study was able to only look at 15 trials as many were excluded. This leads to the conclusion that additional high quality, randomized control studies are needed to provide further and adequate evidence.

Reflective Practice

Based on the outcomes of this study, I would proceed similarly with the examination, evaluation, and intervention. The algorithm in figure 3 demonstrates that decision making process of the examination, evaluation, and intervention. There are things that I have learned and will improve upon based on this study. The mechanism of injury was a fall. In the future, fall assessment could benefit the patient by determining risk for additional injury as well as possible prevention of problems in the future. My goal setting will also change. I needed to extend the target dates for the goals with this patient. The two month goal was too soon and needed to look longer term. The one to two month period may be better suited for short term goals. I did not set a specific pain scale goal for this patient. The first section of the PRWE includes a pain scale that not only allows the patient to rate their pain levels at rest but with functional activities so I felt that this clinometric tool addressed this issue sufficiently. I have included this tool in my
practice for the past 5 years and plan on continuing its usage not just for distal radius fractures but other patients with wrist pain from surgery or injury.

Usage of a splint with the external fixator is extremely rare. Additional evidence and reasons to use it is definitely an area that would need further exploration. The practice is uncommon so I do not anticipate research on this in the future. The rational in this case was based on clinical need and by the physician treating the fracture. The ability to adapt to different and new situations or conditions by the therapist is crucial in these unusual circumstances.

No other disciplines were needed in the care of this individual. I did make it a point to work closely with her orthopedic surgeon to follow the care recommended and to keep him informed on the patient's progress. Medically she was stable and no need for referral was required.

Considering the movement towards pay for performance for physical therapy services and considering the constraint on health care dollars, I did note the cost of the equipment and of the physical therapy sessions for this patient. This patient was seen for 16 visits over the course of eight months. Dollar amounts are summarized in Table 7. She was seen initially for splinting then physical therapy restarted at 12 weeks from fracture. The splint cost was minimal at $31.21 for the material and the cost to the patient was $40.00. An advanced beneficiary notice (ABN) was used for splint costs as Medicare would not cover the splint. This assured my billing department that the patient was fully aware of the costs and was expected to pay for the amount not covered by Medicare. Our clinic "accepts assignment" from Medicare so we received full payment of the evaluation and exercise costs plus full payment of the splint was received leading to 100% reimbursement. There was no co-pay needed for each visit and she had already met her
deductible when she had the initial emergency room visit and surgery. This was a very reasonable price for the care received.

**Table 7: Costs of care for this patient**

<table>
<thead>
<tr>
<th>Charges</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial evaluation and therapeutic exercise at the first visit</td>
<td>$102.00 + $49.00</td>
<td>$151.00</td>
</tr>
<tr>
<td>Splint costs at the first visit</td>
<td>- spectrum II material 1/4 of sheet $12.00 - Strapping material (3) $21.21</td>
<td>$40.00</td>
</tr>
<tr>
<td>Therapeutic exercises provided at 15 additional visits</td>
<td>15 x $49.00</td>
<td>$735.00</td>
</tr>
<tr>
<td>Total cost of care</td>
<td></td>
<td>$926.00</td>
</tr>
<tr>
<td>Total cost of care to the patient</td>
<td></td>
<td>$40.00</td>
</tr>
</tbody>
</table>

As a certified hand therapist, I will continually see individuals with this type of injury. I have a strong interest in this specialty area and will continually work to improve my care of all my patients. In order to achieve this goal, I plan to continue my education with attendance to fracture management classes as well as reading journals. The Journal of Hand Therapy is an excellent resource that I have been reading for the past five years and will continue this practice to further my education and knowledge base.
Addendum A: home exercise program

### SHOULDER CARE TIPS

**Do:**
- Read and understand your shoulder will naturally.
- Wear a shirt or shirt in a dark.
- Keep your shoulder warm and exercise to maintain range of motion.
- Exercise daily using all moves and positions.
- Keep your shoulder warm and exercise to maintain range of motion.
- Exercise daily using all moves and positions.
- Do not stand on this side.
- Use the ball or ball of your leg.

**DONT:**
- Do not stand on this side.
- Do not stand on this side.
- Do not stand on this side.
- Do not stand on this side.

**Repeat:**
- Do __ times, per day.

### FINGER CARE TIPS

**SHOULDER - 1: Total Release (Passive)**

- From standing or sitting position, place arms at sides, palms forward.
- Push forward on arms, over head until tension is felt.
- Repeat __ times, per day.

**FINGER - 19: DIP Extension (Assisted)**

- Use other hand to hold finger tip straight.
- Let go and try to maintain position.
- Repeat __ times, per day.

**FINGER - 34: Finger Gliding (Active Full Fist)**

- Straighten all fingers, then make a fist, bending all joints.
- Repeat __ times, per day.

**FINGER - 32: MP, PIP, DIP Composite Flexion (Passive + Strengthen)**

- Use other hand to hold finger tip straight.
- Let go and try to maintain position.
- Repeat __ times, per day.

**FINGER - 31: Finger Gliding (Active Hook Fist)**

- With fingers and knuckles straight, bend middle and pinky joints. Do not bend thumb.
- Repeat __ times, per day.
Addendum A: home exercise program
Algorithm - Examination and Treatment for a Patient with a Distal Radius Fracture

Primary Stage/Immobilization Stage: Week 1 - Week 11. Immobilization by external fixation. Splint fabrication, wound care education, shoulder and finger ROM exercises, and complete PRWE clinometric.

- Assess wound: any signs of infection?
  - Yes: Refer back to
  - No

- Fabricate splint: unable to fit and/or poor vascular status?
  - Yes: Assess non-immobile joints: Any loss of
  - No: Yes: Restore/maintain range of motion of uninvolved joints and instruct client in independent home exercise program and precautions.
  - No

Secondary Stage/Mobilization Stage: Begins at Week 12. Orthopedic physician has deemed fracture stable. Complete new PRWE. Assess active, passive, and resisted wrist motion; Assess strength with grip and pinch tests.

- Yes, there is a loss of active, passive, and/or resisted motion: Instruct in exercise program/begin treatment in clinic.
- No loss of motion or strength, equal left and right, or minimal difference left vs. right: Instruct in exercise program/begin treatment in clinic.

Continued deficits

Tertiary Stage/Late Strengthening Stage: Begins at Week 16-20. Final orthopedic physician evaluation completed. Complete new PRWE. Assess active, passive, and resisted wrist motion; Assess strength with grip and pinch tests; perform additional ADL tests for home or work related tasks.

- Deficits noted with testing: Continue treatment as stated in secondary phase as needed. Exercises: More aggressive progressive strengthening, resistive functional activities. ADL/Work: Begin work conditioning, ADL, or hardening program as indicated. Job modifications as needed. Focus on specific functional exercise program in clinic and with home program.
- No deficits: Full return to functional tasks, PRWE score less than 20. Discharge from skilled physical therapy services to continue with home based exercise program.

Re assess at subsequent physical therapy visits.
References:


