Abstract. Achievement of optimal level of functioning of a patient or client must be one of the main goals of any physical therapy intervention. To achieve this, the physical therapist must look at the interaction of multiple body systems, evaluate and identify disabilities and impairments based on these interactions, and design treatment plans that treat the person as a whole. This evaluation may become complex as the clinician recognizes the significant contribution of associated medical conditions and risk factors in the individual’s prognosis and expected outcomes. This case report illustrates the importance of these concepts in the optimal rehabilitation of an individual who sustained an elbow fracture with displacement, and has numerous preexisting medical conditions and risk factors that at the outset may appear to be significant complicating factors in her progress following therapy. Central to her achievement of favorable results included early medical and physical therapy intervention. Key components of the therapeutic intervention include AROM/ PROM to the joint, appropriate scar tissue mobilization and steady progress into functional activities. From the therapist’s perspective, it was important to address the injury at hand as well as the various comorbidities affecting the main problem. From the standpoint of the subject, empowerment of the individual to her own health and well-being provided the necessary motivation to achieve optimal function.

Key words: Physical therapy examination, Evaluation and intervention, Olecranon fracture

INTRODUCTION

Early physical therapy intervention following a trauma or pathology in a complicated joint after medical intervention can make the difference between a functional limb and an extremity with permanent functional loss. When a joint such as the elbow is involved, function of the surrounding joints may also be compromised and may lead to further disability. Confounding medical conditions and significant risk factors may also contribute to a complicated recovery and less than optimal prognosis.

This case report involves a 55 year-old post menopausal female who sustained an olecranon fracture with displacement. The patient had pre-existing medical conditions beside the elbow fracture that put her at high risk for complications as well as functional problems. The potential for multiple disabilities was certainly present. However, through excellent medical, surgical and physical therapy intervention, these problems were avoided and full functional recovery of the entire upper extremity was accomplished.
The case report illustrates the importance of a solid clinical decision-making process which involves the consideration of the interaction of multiple body systems in rehabilitation and recovery.

**REVIEW OF RELATED LITERATURE**

The olecranon with its vulnerable subcutaneous position makes it susceptible for traumatic encounters. Common causes of fracture with displacement are blunt trauma and falling\(^1\text{-}^3\). Radiographs are necessary to confirm as well as distinguish factors necessary in determining the type of reduction necessary. Radiographs should include an anterior to posterior (A/P) and a lateral view. An oblique view is needed if involvement of the radius is suspected\(^1\text{-}^2\).

In a fracture with dislocation, the olecranon usually displaces posteriorly, while the distal ulnar fragment may displace anteriorly\(^4\text{-}^5\). Open reduction and internal fixation (ORIF) is generally recommended to anatomically reduce and stabilize the displaced fracture especially if a step-off gap exists\(^1\text{-}^6\). It is important to restore the congruity of the articular surfaces and allow for early ROM\(^2\text{-}^4\text{-}^7\).

There are different types of fixation. The choice is made based on the patient factor, fracture type, and the mechanical aspect of the fixation\(^2\text{-}^4\). The most common procedures include tension band wiring, intermedulary screw, plate fixation, or a combination there of. The principle behind the tension band wiring technique is to “counteract the tensile forces that act across the fracture site and convert them into compressive forces”\(^8\). It is a simple but effective way to transfer the forces produced by the pull of the triceps to cause a compression of the fracture. This stimulates healing as well as stabilizes the reduction\(^9\). Typically, after the fracture is reduced, two intramedullary Kirshner wires are inserted longitudinally, and a tension band wire is wrapped in a figure 8 style. Tension band fixation has been shown to be an advantageous surgery for a displacement with gap fracture type\(^3\text{-}^5\text{-}^10\text{-}^11\). Nork\(^12\) noted from cadaveric studies it was determined that “the screw-plus-wire combination was found to be the strongest.” This method is particularly accepted as it allows for early active elbow range of motion\(^1\text{-}^4\text{-}^7\). A screw is usually used with transverse fractures to ensure some cortical fixation distally\(^2\).

Physical Therapy examination should include observation, palpation, range of motion (ROM), strength assessment, and a neurological check. With all procedures, the primary goal post surgery is for early ROM\(^2\text{-}^3\). The usual protocol for this type of injury involves a half cast for 7 days, then, depending on healing factors, a hard cast with the elbow positioned at 90° or immobilization brace may be used for 1–4 weeks. However, an attempt to keep immobilization to less than 10 days is preferred. Active range of motion begins early on, and as healing proceeds, active assisted range of motion then to passive range of motion is safe. Stengthening is started once healing is confirmed by radiographs, generally 6–12 weeks\(^2\). Gentle isometrics are recommended at the beginning then to develop into an isotonic program. The expected duration of rehabilitation varies from 10–12 weeks to 5–6 months\(^1\text{-}^4\). Physical therapy is recommended with gentle ROM, soft tissue mobilization (STM), and modalities initially. As the healing progresses, the intensity of physical therapy intervention may also increase. Good functional outcome is the goal for the entire rehabilitation process.

**CASE PRESENTATION AND DISCUSSION**

M.S., a 55 y.o. female, height 1.67 meters, weight 72.5 kilograms, was walking her dog on a leash when the dog lunged and tripped her. She fell to the ground and tucked to break the fall. She immediately felt pain in her right upper extremity. On a visual-analog scale of 0–10, she rated this pain a 10. Each time her arm swung, she recalled an intense “electric shock type pain” from her elbow to her hand. She was taken to the emergency department of a local hospital. Radiographs taken at that facility revealed a “fracture dislocation of the right elbow” (Fig. 1). The radiology report read as follows:

“*There is a separated fracture of the olecranon with an approximate 1.5 cm gap at the fracture site. The finding has been identified by the clinician. No other significant bone or joint abnormalities are identified.*”

An orthopedic surgeon was immediately called to assess the situation and determine the best course of action. M.S. was informed that the best intervention would be to perform an open reduction internal
fixation of the elbow using pins instead of a plate fixation based on the type of fracture that she sustained, the location of the fracture and the absence of other pathologic problems in her skeletal system (e.g. osteoporosis). The orthopedic physician told her after surgery that she had “the bones of a young woman” and indicated that at least she did not appear to have osteoporosis.

M.S. had a twenty-eight year history of thrombophlebitis and a three-year history of a semi-controlled complicated genetic clotting disorder. She had been off work and was on disability for the past year when the fracture occurred. She related to the orthopedic surgeon her complicated past medical history, as she wanted to make sure he was aware of the possible ramifications of this history to the planned surgical intervention. This was a major consideration since she would have to be taken off her anticoagulants for the surgery to take place. Fortunately, her clotting indexes had been fairly good that week. Since she was not a “high risk priority”, it was decided that she would undergo surgery the following day.

M.S. underwent surgery the next day. In the surgical procedure done on M.S. the surgeon used a 3/16 stainless steel canulated screw and 18 gauge stainless steel wire for the tension band wiring (Fig. 1). After completion of the surgery, she was placed in a half cast. The surgery went without medical complications. The radiograph showed the pin fixation in place, indicating a good alignment of the fractured segments. M.S. was then placed in a rigid half cast and was told to come back in one week for a recheck. She was strictly instructed to not move the elbow to protect the healing fragments. Her pain rating dropped to a 9/10 following surgery.

She was sent home the next day after the surgery with full monitoring of her coagulation levels. On her second night home from the hospital, she started to complain of severe chest pains. She went back to the E.R. to have this evaluated, and it was discovered that she might be developing a pulmonary embolism. She was then immediately hospitalized in intensive care. Fortunately, after a few days, her coagulation levels went back to near normal values, and she was sent home.

As mentioned, M.S. was placed in a half cast. At 5 days she was already experiencing increased pain but it was tolerable. Her pain in the splint was 5/10, and out of the splint was a 9/10. Her orthopedic surgeon then placed her in a full cast at 90°. By the second day she started having hot/cold changes, color changes, sweating, and excruciating pain in her hand (9/10 pain in the cast). She also complained of intermittent numbness in the lower third of her humerus extending down her forearm. On the 5th day following full casting she saw her orthopedic surgeon and related these changes she felt were signs of the “starting stages of reflex sympathetic dystrophy (RSD)”. Her pain at this point had exceeded the scale at an 11/10. She felt she was having an “autonomic panic” and knew she would “end up in bad straights”. The doctor felt that the follow-up radiographs indicated good healing and felt the rigid cast should stay in place for at least two-three weeks. She then informed the doctor, “The cast needs to come off. Either you are going to take it off, or I am”. The cast was taken off and she was placed in a Don Joy locking brace with a range of 45° to 90° with the ability to pronate and supinate. Her pain immediately dropped to a 5/10. The doctor also allowed her to take the brace off to shower under strict instructions not to force motion in either direction. This allowed her to do activities...
within the available range. Her strength in the biceps and triceps was 3/5 in the allowable ROM. It was extremely helpful that this patient was a P.T. and able to manage her orthopedic problem with a medically based competency, as well as excellent intuition.

Physical therapy intervention at this point consisted of gentle scar mobilization in warm water. She described the scar as being “bound down rock solid”. She frequently did pronation/supination movements, wrist flex/ext/circles, and finger movements during activities of daily living (ADL’s) with use of her brace.

She remained in the hinge brace for the next 10 weeks and the range was increased from 28° to 100°. Her strength was to a point she was capable of doing her normal ADL’s in the splint. Her pain had dropped to a 2/10. Two weeks later, she was seen for a re-check with report from MD of impressive progress. Repeat films showed good healing of the fracture site.

She continued with the same P.T. intervention with the addition of passive extension of the elbow, and active flexion to 100°. The soft tissue mobilization became a little more aggressive. M.S. reports that she no longer felt any numbness in the forearm other than intermittent “zinging” along the course of the ulnar nerve, and hand color and temperature remained constant within normal limits. It is theorized that the early intervention help to prevent the development of RSD.

Once the hinge brace was removed, she progressed to deep cross friction to the biceps/triceps, elbow capsule, and to the scar. She could feel places along the scar that felt bound to the wires. She was placed in a low tension Dynasplint into extension. The tension started at a 1.5 on the tension knob. In three weeks, her ROM had increased to lacking 5° to 152°. Once during this 3-week stint, she increased the tension to 2.0, but actually felt she was losing ground and reduced it to 1.5 again. Her strength had returned to close to normal. She could do most activities, pain-free.

M.S. did not do specific manual resistive exercises (MRE’s), but was a very active person. Once healing was safe enough to increase activity, she returned to martial arts. This type of training emphasized upper extremity proprioceptive neuromuscular facilitation patterns and a fairly aggressive elbow extension snap. She incorporated many bilateral activities to encourage overflow and assist in her functional returns. The result to this time was almost full ROM return, good/normal strength return, and return to functional activities, all within approximately four months.

M.S. went in for a follow-up a few months later and wanted to do have the pin removed. She requested this, as she was unable to place her elbow on any surface, as the head of the pin being close to the surface gave her a sharp pain on contact. The hardware removal surgery was performed the next month. M.S. had to stop taking her coumadin and heparin for surgery.

Three days after removal, back on anticoagulants, she had a scheduled follow-up appointment with her primary MD to get her bandages changed. She was experiencing excessive bleeding. At 5 days post-op she saw her orthopedic surgeon having again bled through the bandages. He felt this was normal for her situation. She went to the emergency room at 7 and 9 days post-op having again bled through the bandages on both occasions.

By this time, M.S. was getting concerned, knowing that she was a bleeder on high doses of anticoagulants and had lost an excessive amount of blood in the past 12 days. She contacted her hematologist, explained the situation and the hematologist felt that a cauterization was indicated and that the emergency room should be obliged to cauterize the site. However, per the emergency room physician’s conversation with her orthopedic MD, he felt the bleeding was from the bone itself and not the vascular system and just needed more time to heal. She was re-wrapped in a fixated cast to apply increased pressure to the area and sent home.

At 14 days, and another application of bandages, she continued to bleed. She saw her orthopedic surgeon who scheduled her to have the cauterization the next week. The day before the procedure was to take place, she stopped bleeding and no surgery was necessary. There is some speculation that a flight she took during that week may have caused her to form a clot, secondary to her clotting disorder, and sealed her site of bleeding.

**ANALYSIS AND CONCLUSIONS**

The patient and the physician must come to an understanding of the reasonable goals following a particular intervention. Many factors come into play with this determination, but is important for the patient and the practitioner to set outcomes that
reflect optimal functional recovery. It is important to remember that individuals may have the same impairments and disabilities but completely different functional limitations\(^\text{13}\).

Several authors have attempted to define “functional” ranges of motion for the elbow. According to Magee\(^\text{14}\), the necessary arc of motion for functional flexion in 15 ADL activities is 30°–130°. These ADL’s are also accomplished with 50° of supination and pronation. Hoppenfeld\(^\text{1}\) documented functional ranges of 20°/30°–90° for flexion and 50° for supination and pronation. Many of the studies noted that early intervention with elbow ROM decreased functional disability\(^\text{9}\). In many of the studies reviewed, they claimed that most of the subjects regained function. However, in some of these studies function was not well defined. In one study, the ROM gained showed a mean flexion contracture of 25° and a range of 5° to 65°\(^\text{15}\). To an active physical therapist, a 65° flexion contracture was certainly not functional, and at 90° of flexion, an individual would not be able to get a spoon in his/her mouth without compromising another joint. What might be sacrificed with a lack of 30° of extension? For this patient, the functional ranges reported in the literature were unacceptable.

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There may be a question of whether that was a reasonable expectation considering the severity of the fracture, her associated medical conditions and her age. However, it can be noted that appropriate and aggressive clinical decisions lead to better and more expedient functional outcomes.

Strength loss after open reduction internal fixation is typically within a 25%–30% range\(^\text{2,15}\). M.S.’s desire was full strength with ability to return to full contact martial arts. She attained both of these goals: 5/5 strength and return to her sport.

In this case M.S. had regained almost full function within 4 1/2 to 5 months. This would be within normal limits, not within functional limits. There were many factors that we believe made this possible. First, the ability to start early restricted PROM into extension, and AROM into flexion, as well as rotational movements allowed her to establish joint and tissue mobility and nourishment. Secondly, the early scar and tissue mobilization prevented the adherence (that was quickly taking place at the wires) to adjacent structures and gain necessary length and alignment with her tissues. Lastly, the ability to steadily progress in her activities, allowed her to regain functional patterns and stimulate her nervous system to re-attain normal function.

M.S. had the advantage of having not only a solid theoretical and clinical background regarding her medical condition and rehabilitation, but also a solid proactive stance with regards to her health and healing. Obviously, the general population would not have these knowledge and skills, but what could “regular” patients do to ensure optimum access to health care? First, just as practitioners must develop good communication skills, patients must also take the responsibility of open and honest communication with their health care providers. Also, patients must empower themselves to take the responsibility for their own health and well-being.

M.S. was a success story, having attained an excellent elbow ROM lacking 5° of extension to 152° of flexion, good scar tissue mobility with no notable binding, 5/5 strength and returned to her pre-injury sport of martial arts within 17 weeks of her procedure. This was possible due to excellent medical, surgical and physical therapy intervention in a timely manner.

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