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Response Of Frozen Shoulder To Six Weeks Of Short Wave Diathermy And Supervised Active Exercises: A Case Report

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Abstract: ***Shoulder disorders such as frozen shoulder have constituted a major disability and apprehension among the sufferers. This gives rise to the need to understand the underlying causes and management of the disorder. Although, findings from literature are inconclusive, shortwave diathermy and supervised active exercises have been recorded to be effective in the management of frozen shoulder. Mrs. B. is a 54year old woman who was diagnosed of (L) frozen shoulder and presented at physiotherapy clinic (out-patient department) for physiotherapy. Prior to the diagnosis, she presented with four months' history of painful and restricted active and passive glenohumeral joint range of motion. The range of motion of the (L) shoulder was limited in all direct ions on examination. Shortwave diathermy and supervised active exercises were introduced after thorough examination. After six weeks of shortwave diathermy and supervised active exercises, patient recorded a remarkable improvement in pain and range of motion of the (L) shoulder. Findings from this study showed that shortwave diathermy and supervised active exercises are effective in the management of frozen shoulder as they showed a remarkable improvement in pain and range of motion after six weeks of both therapies. Other studies have also recorded the effectiveness of shortwave diathermy and supervised active exercises in the management of frozen shoulder. Supervised active exercises help to increase the range of motion and relieve pain while shortwave diathermy relieves pain and improves tissue extensibility. The preference for shortwave diathermy over other electrotherapy modalities in this study is because it is effective in management of deep rooted pains and it covers a large area of skin. The study showed that shortwave diathermy and supervised active exercises increase the rate of frozen shoulder resolution. However, a wider study involving many patients should be carried out to further ascertain the efficacy of shortwave diathermy and supervised active exercises in the management of frozen shoulder as used in this study as the outcome on one patient may not be adequate to generalize their effectiveness to the wider population. Lastly, emphasis should be laid on the use of active exercises as preventive measures rather than treatment in the management of frozen shoulder.***

Keywords: Frozen Shoulder, Pain, Shortwave Diathermy, and Active Exercises.

I. INTRODUCTION

The shoulder is a unique anatomical structure with a complex range of motion that allows us to function effectively in our environment. Frozen shoulder is a disabling disorder involving glenohumeral pain and loss of motion. The pain and restricted movement associated with frozen shoulder affect patient's functionality making therapeutic intervention

necessary. Frozen shoulder is a poorly understood musculoskeletal disorder. Thus, the need to understand the underlying causes and possible management approaches cannot be overemphasized. It can be diagnosed by numerous characteristics including thickening of the synovial capsule, adhesions within the subacromial or subdeltoid bursa, adhesions to the biceps tendon and/or obliteration of axillary fold secondary to adhesion (Anton, 1993; Fareed & Gallivan, 1989; Loyd & Loyd, 1983; Mcclure & Flowers, 1992; Murnaghan, 1988; Nesviaser 1980; Parker, Rroimson, & Arsham, 1989; Rizk, & Christopher, 1983; Rizk & Pinals,1982).

Patients with frozen shoulder present with gradual and progressive onset of pain and loss of active and passive shoulder motion in both elevation and rotation. Frozen shoulder is marked by the presence of multiregional synovitis, consistent with inflammation (Hannafin & Chiaia, 2000; Neviaser & Hannafin, 2010, Nesviaser, 1980, Nesviaser, 1987; Watson, Dalziel & Story, 2000). Yet others attribute frozen shoulder to focal vascularity and synovial angiogenesis (increased capillarity) (Bunker & Anthony 1995; Ide & Takagi, 2004; Wiley 1991; Wiley, 1991). Substantial capsuloligamentous complex fibrosis and contracture are usually observed upon open or arthroscopic shoulder surgery and histologic examination. The whole capsuloligamentous complex can become fibrotic but the rotator cuff interval and specifically the capsuloligamentous complex are mainly involved (Ide & Takagi, 2004; Neer, Satterlee, Dalsey & Flatow, 1992; Neviaser & Hannafin, 2010, Nicholson, 2003; Omari & Bunker, 2001; Ozaki, Nakagawa, Sakurai & Tamai, 1989; Uhthoff & Boileau, 2007; Uitvlugt, Detrisac, Johson, Austin & Johnson, 1993; Wiley, 1991). Although the etiology of frozen shoulder remains unclear, there are a number of associated factors. Recent evidence suggests that elevated serum cytokine level causes sustained intense and protracted inflammatory /fibrotic response affecting the synovial lining and capsuloligamentous complex in patients with frozen shoulder (Bunker, Reiley, Baired & Hamblen 2000; Hutchinson, Tierney, Parsons & Davis 1998; Rodeo, Hannafin, Tom, Warren & Wickiewicz, 1997). However, to date, the relationship between cytokines and the causative factor whether it is insidious or related to minor trauma remains unknown.

The role of physiotherapy in management of frozen shoulder cannot be over emphasized. This is evidenced by a research which showed that "Supervised neglect" which included instructing patients not to exercise past their pain threshold, to do pendulum exercises and active exercises within painless range of motion, and to resume all activities as tolerated led to significant improvement in pain and range of motion (Diercks & Stevens, 2004). On the other hand, shortwave diathermy provided at a comfortable heating intensity through 27.12 MHz wave through anterior and posterior electrodes as adjunct therapy to stretching exercises also led to significantly greater improvement in range of motion when compared to treatment groups treated with superficial heating and stretching versus stretching alone (Leung & Cheing, 2008). Shortwave diathermy helps to increase tissue extensibility thereby relieving pain and improving joint range of motion.

The choice of treatment modality depends on individual requirements, preference of the clinician and institutional practice. Physiotherapy management of frozen shoulder involves a wide range of treatment modalities which include electrotherapy, active exercises and passive exercises. The primary aim of physiotherapy is to relieve pain, improve range of motion, strengthen weak muscles and restore optimum function.

This report describes a case of frozen shoulder in a 54-year-old woman who presented with four months' history of (L) shoulder pain with limited range of motion. It reviews the pathophysiology, etiology, epidemiology, clinical presentation, diagnosis, differential diagnosis of frozen shoulder with its management and the physiotherapy modalities used in the management of the above patient.

II. REVIEW

The conceptual framework of variables of interest which include frozen shoulder, shortwave diathermy and supervised active exercises would be considered under this review.

Frozen shoulder is characterized by initially painful and later progressively restricted active and passive glenohumeral joint range of motion with spontaneous complete or near complete recovery over varied period of time. It is often defined as loss of more than 25% in at least two directions (Dias & Massoud, 2005; Kelly, Mcclure & Leggin, 2009, Brue, 2007; Cleland & Durall, 2002; Bal, Eskioglu, Gulec, Ayclog, Gurlay & Cakci, 2008; Bussieres, Peterson & Taylor, 2008) especially abduction and external rotation. Frozen shoulder is associated with synovitis and capsular contracture of the shoulder joint (Dias & Massoud, 2005; Kelly, Mcclure & Leggin, 2009; Brue, 2007; Cleland & Durall, 2002; Bal, Eskioglu, Gulec, Ayclog, Gurlay & Cakci, 2008; Wamsley, Rivett & Osmotherly, 2009). Clinically, it can be difficult to distinguish early stage of frozen shoulder from other shoulder disorders (Dias & Massoud, 2005). However, it is important for therapists to be able to develop an early suspicion of this condition so as to benefit the patients. Physiotherapy management of patients with frozen shoulder may vary in important ways from management of patients with other shoulder disorders.

III. PATHOPHYSIOLOGY

Researches on pathophysiology of frozen shoulder have provided inconsistent and inconclusive results. However, frozen shoulder has been considered to be a product of the interplay of inflammation and fibrosis mediated by Cytokines, growth factors, matrix metalloproteinases and immune cells. Proinflammatory cytokines and growth factors released from immune cells control the action of fibroblast matrix remodelling and is regulated by matrix proteinases and inhibitors. Prolonged immobility of a joint has been linked to several detrimental pathophysiologic findings including decreased collagen length, fibrofatty infiltrations into the capsular recesses, ligament atrophy resulting in decreased stress absorption, collagen band bridging across recesses,

random collagen production and altered sarcomere number in muscle tissue (Mangine, Heckman & Eifert-Mangine, 1994).

IV. ETIOLOGY

Although the etiology of frozen shoulder remains unclear, frozen shoulder can be classified as primary or secondary. It is considered primary if the onset is idiopathic while secondary results from a known cause or surgical event (Wamsley, Rivett & Osmotherly, 2009). Three subcategories of secondary frozen shoulder include systemic (diabetes mellitus and other other metabolic conditions, extrinsic (cardiopulmonary pathologies, biceps tendinopathy, calcific tendinopathy, acromioclavicular joint arthritis (Kelley, Mcclure, & Leggin, 2009). Other associated risk factors of frozen shoulder include: trauma, prolonged immobilization, thyroid dsease, stroke, myocardiac infarctions, presence of autoimmune disease (Bal, Eskiogulu, Gulec, Ayclog, Gurlay & Cakci, 2008; Jewell, Ridle & Thacker, 2006).

Frozen shoulder affects the anteriorsuperior joint capsule, axillary recess, and the coracohumeral ligament. Arthroscopy shows that patients tend to have a small joint with loss of the axillary fold, tight anterior capsule and mild or moderate synovitis but no actual adhesion (Dia, Cutts & Masoud, 2005; Vermueulen & Vlieland, 2006). Contracture of the rotator cuff interval has also been seen in frozen shoulder patients, and greatly contributes to the reduced range of motion seen in this population (Kelly, Mcclure & Leggin, 2009). Although there is continued disagreement about whether the underlying pathology Is an inflammatory condition, fibrosing condition or an algoneurodystrophic process, evidence suggests that there is synovial inflammation followed by capsular fibrosis in which type 1 and 111 collagens are laid down with subsequent tissue contraction (Dia, Cutts, & Massoud 2005). High levels of serum cytokines have been observed to quicken tissue repair and remodeling during inflammatory processes. In primary and some secondary cases of frozen shoulder, cytokines have been shown to play a role in the cellular mechanism that leads to sustained inflammation and fibrosis and a loss of normal collagenous remodeling which can lead to stiffening of the capsule and the ligamentous structures (Kelly, Mcclure & Leggin, 2009).

V. EPIDEMIOLOGY

Frozen shoulder is usually more prevalent in woman, individuals 40- 65 years old, and in diabetic population, with an occurrence rate of approximately 2-5% in the general population (Bal, Eskioglu, Gulec, Ayclog, Gurcay & Cakci, 2008; Kelly, Mcclure & Leggin, 2009; Gasper & Willis, 2009; Boyles, Flynn & Whitman, 2005; Cleland & Durall, 2002; Vermeulen, Rocing, Obermann, Cessie & Vlielan, 2006). The often cited percentage of the occurrence rate of frozen shoulder in the general population generates doubts among some researchers because of how often the disease is misdiagnosed; this would make the disease appear much rarer than previously thought (Bunker & Tim, 2009). Occurrence in children and people under 40 is rare but peaks between 40 and 70years of age (Ewald, 2011). If an individual has frozen shoulder, they have a 5-34% chance of having it in the contralateral shoulder at some point. Simultaneous bilateral involvement has been found to occur in approximately 14% of cases (Kelley, Mcclure & Leggin, 2009.

VI. CLINICAL PRESENTATION

Patients with frozen shoulder will often report an insidious onset with a progressive increase in pain, and gradual decrease in active and passive range of motion (Kelly, Mcclure & leggin, 2009; Gasper & Willis, 2009). Patients frequently have difficulty with grooming, performing overhead activities, dressing and particularly fastening items behind the back (Durall, 2002; Jewell, Riddle & Thacker, 2009). There is usually more than 25% loss of range of motion in at least two directions especially abduction and external rotation. Frozen shoulder is seen as a self- limiting disease with sources stating symptom resolution as early as 6months up to even 11years. Unfortunately, some times, many patients may never fully recover (Jewell, Riddle, Thacker, 2009; Kelly, Mcclure, & Leggin 2009; Yang, Chang, Chen & Wang, 2007; Kline, 2007; Bal, Eskioglu, Gulec, Aydog, Gurcay, & Cakci, 2008; Gasper & Willis, 2009; Blanchard, Bar & Cerisola, 2010; Brue, 2007; Cleland & Durall, 2002).

VII. STAGES OF FROZEN SHOULDER

According to literature reports, frozen shoulder progresses through three overlapping clinical phases (Dia, Cutt & Massoud, 2005; Cleland & Durall, 2002, Kline, 2007; Jewell, Riddle & Thacker, 2009; Wamsley, Rivett & Osmotherly, 2009). These include:

A. ACUTE/FREEZING/PAINFUL PHASE

This is characterized by gradual onset of shoulder pain at rest with sharp pain at the extremes of motion and pain at night with sleep interruption that may last about 3-9months.

B. ADHESIVE /FROZEN/STIFFENING PHASE

Pain starts to subside but with characteristic progressive loss of glenohumeral motion in capsular pattern. Pain is apparent only at extremes of movement. The phase occurs at about 4months and lasts till 12months.

C. RESOLUTION/ THAWING PHASE

There is spontaneous progressive improvement in functional range of motion which may last 1-3.5 years.

VIII. DIAGNOSIS OF FROZEN SHOULDER

A distinctive sign of frozen shoulder is that the joint becomes so painful, tight, and stiff that it is almost impossible to carry out simple movements, such as raising the arm. The

movement that is mostly affected is external rotation of the shoulder. Stiffness and pain are said to be worse at night. Patients often complain of having difficulty with grooming, performing overhead activities, dressing especially fastening items behind the back. Frozen shoulder is usually dull or aching. It can be worsened with attempted motion. A physical therapist may suspect that patient has a frozen shoulder if a physical examination reveals limited shoulder movement where active range of motion is the same or near the same with passive range of motion. An arthrogram or an MRI scan may be used to confirm the diagnosis but this is rarely required in clinical practice. Features of frozen shoulder are seen on non-contrast MRI but MR arthrography and invasive arthroscopy are more accurate in diagnosis (Neviaser, 1980). Ultrasound and MRI can help in diagnosis by assessing the coracohumeral ligament with a width of greater than 3mm being sensitive and 95 % specific for diagnosis. The condition can also be associated with edema or fluid at rotator interval, a space in the joint normally containing fat between the supraspinatus and subscapularis tendons, medial to the rotator cuff. Frozen shoulder also characteristically fibrose and thicken at axillary pouch and rotator interval, best seen as dark signal on T1 sequences with edema and inflammation on T2 sequences (Shaikh & Sundaram, 2009). Findings on ultrasound associated with frozen shoulder are hypoechoic material surrounding the long head of the biceps tendon at the rotator interval, reflecting fibrosis. In the painful stage, such hypoechoic material may demonstrate increased vascularity with Doppler ultrasound (Arena, 2013).

IX. DIFFERENTIAL DIAGNOSIS

- ✓ There are conditions that can simulate the clinical features of frozen shoulder. They should be included in the differential diagnosis. Such conditions include but not limited to Osteoarthritis, rotator cuff pathologies, Parsonage –Turner syndrome, acute calcific bursitis/ tendinitis, a locked posterior dislocation or proximal humeral fracture (Kline, 2007; Kelley, Mcclure & Leggin, 2009).
- ✓ Osteoarthritis (OA): Both may have limited abduction and external rotation AROM but with OA, PROM will not be limited. OA will also present with the most limitations with flexion whereas this is the least affected motion with frozen shoulder. Radiography can be used to rule out pathology of osseous structures.
- ✓ Rotator Cuff (RC) Pathologies: The primary way to distinguish RC pathologies from frozen shoulder is to examine the specific ROM restrictions. Frozen shoulder presents with restrictions in the capsular pattern while RC involvement typically does not. RC tendinopathy may present similarly to the first stage of frozen shoulder because there is limited loss of external rotation and strength tests may be normal. MRI and ultrasonography can be used to identify soft tissue abnormalities of the soft tissue and labrum.
- ✓ Parsonage-Turner Syndrome (PTS): PTS occurs due to inflammation of the brachial plexus. Patients will present without a history of trauma and with painful restrictions of all motions. The pain with PTS usually subsides much quicker than with frozen shoulder and patients eventually display neurological problems (atrophy of muscles or weakness) that are seen several weeks after the initial onset of pain.
- ✓ Bursitis: Bursitis presents very similarly to frozen shoulder, especially compared to the early phases. Patients with bursitis will present with a non-traumatic onset of severe pain with most motions being painful. A main difference will be the amount of PROM achieved. Frozen shoulder will be extremely limited and painful whilst patients with bursitis, although painful, will have a larger PROM.
- ✓ Posterior Dislocation: A posteriorly dislocated shoulder can present with shoulder pain and limited ROM, but, unlike adhesive capsulitis, it is related to a specific traumatic event. If the patient is unable to fully supinate the arm while flexing the shoulder, the clinician should suspect a posterior dislocation.

X. TREATMENT

The treatment of frozen shoulder depends on patient's symptoms and stage of condition. Treatment is tailored to the stage of the condition because it has a predictable progression (Dias, Cutts & Massou, 2005; Nesvier & Hannafin, 2010). Comorbid factors may play a role in the rate of recovery. It is suggested that the primary treatment should be based around physical therapy and anti-inflammatory measures (Brue, 2007), the outcomes however are not always superior to other interventions (Kelley, Mcclure & Leggin, 2009). Treatment may last for months and there is no strong evidence to favour a particular intervention (Ewald, 2011).

Management of frozen involves a combination of pharmacological, rehabilitative, and /or surgical treatment. These include the use of NSAIDS, corticosteroids, manipulation under anesthesia, physiotherapy, osteopathy, occupational therapy and arthroscopic capsular release in the management of frozen shoulder.

Physiotherapy as part of the rehabilitation considers patient's symptoms and stage of condition alongside with medical history and findings from proper examination.

Physiotherapy Modalities that can be used to relieve frozen shoulder includes:

- ✓ Hot or cold compression packs.
- ✓ Interferential current.
- ✓ Transcutaneous electrical stimulation (TENS).
- ✓ Pulse electromagnetic field therapy (PEMF).
- ✓ Low level laser therapy.
- ✓ Ultrasound.
- ✓ Shortwave diathermy.
- ✓ Active exercises.
- ✓ Passive exercises

Outcome measures that can be used to measure the level of prognosis following an intervention in the management of frozen shoulder include but not limited to the following:

- ✓ Shoulder Pain and Disability Index (SPADI).
- ✓ Disability of the Arm, Shoulder and Hand scale (DASH).

- ✓ American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES).
- ✓ Simple Shoulder Test (SST).
- ✓ Penn Shoulder Scale (PSS).
- ✓ Visual Analogue Scale (VAS).
- ✓ Numerical Pain Rating Scale (NPRS)

XI. DESCRIPTION OF THE INTERVENTIONS USED IN THIS STUDY

Shortwave diathermy as one of the electrotherapy modalities used in management of frozen shoulder produces its physiological and therapeutic effects by rapidly alternating electrical and magnetic currents at short wave frequencies (27.12hHz). According to (Lindsay, Bearne, Michael, & Hurley, 2010), it increases skin temperature by 3-7 degree centigrade, muscle temperature by 2-6 degree centigrade (Robertson, 2006) and intra articular heating has also been observed (Oosterveld, 1992). It can be continuous or pulsed. Shortwave diathermy uses oscillating electromagnetic field of high frequency to heat body surfaces. It heats to a tissue depth of 2 to 3cm. It was applied through two electrodes placed anteriorly and posteriorly on the patient's shoulder at a comfortable heating power (40watts). Its aim is to relieve pain and improve tissue extensibility.

On the other hand, supervised active exercises utilized in this study include

A. PENDULUM STRETCH

This involves relaxing the shoulder, standing and leaning over slightly, allowing the affected arm to hang down. Swing the affected arm in a small circle about a foot in diameter. Perform 10 revolutions in each direction once a day. Increasing the diameter of the swing as symptom improves without forcing it. As symptoms improve, increase the stretch by holding a light weight (three to five pounds) the arm.

B. TOWEL STRETCH

This involves holding one end of a three–foot-long towel behind your back and grabbing the opposite end with your other hand. Hold the towel in a horizontal position. Use your good arm to pull the affected arm upward to stretch it. You can also do an advanced version of this exercise with the towel draped over your good shoulder. Hold the bottom of the towel with the affected arm and Do this 10 to 20 times a day.

C. FINGER WALK

Face a wall three-quarter of an arm's length away. Reach out and touch the wall at waist level with the fingertips of the affected arm. With your elbow slightly bent, slowly walk your fingers up the wall, spider-like, until you have raised your arm as far as you comfortably can. Your fingers should be doing the work, not your shoulder muscles. Slowly lower your arm with the help of the good arm, if necessary. Repeat the exercise 10 t0 20 times a day.

D. CROSS - BODY REACH

Sit or stand. Use your good arm to lift your affected arm at the elbow, and bring it up and across your body, exerting gentle pressure to stretch the shoulder. Hold the stretch for 15 to 20 seconds. Do this 10 to 20 times per day.

E. ARMPIT STRETCH

Using your good arm, lift the affected arm onto a shelf about breast-high. Gently bend your knees, opening up the armpit. Deepen your knee bend slightly, gently stretching the armpit, and then straighten. With each knee bend, stretch a little further, but don't force it. Do this 10 to 20 times each day.

F. OUTWARD ROTATION

Hold a rubber exercise band between the hands with the elbows at a 90 –degree angle, close to the sides. Rotate the lower part of the affected arm outward two to three inches hold for five seconds. Repeat 10 to 15 times, once a day.

G. INWARD ROTATION

Stand next to a closed door, and hook one end of [a rubber exercise band around the doorknob. Hold the other end with the hand of the affected arm, holding the elbow at a 90-degree angle. Pull the band toward the body two or three inches and hold for five seconds. Repeat 10 to 15 times, once a day.

These are active stretching and strengthening exercises prescribed by Harvard Medical School for management of frozen shoulder. Though there is no strong evidence yet supporting their effectiveness in the management of frozen shoulder, these stretching and strengthening exercises were utilized in this study alongside with shortwave diathermy to ascertain their effectiveness in the treatment of frozen shoulder.

XII. CASE PRESENTATION

Mrs. B. is a 54-year-old woman who presented at National Orthopaedic Hospital, Enugu with four months' history of (L) shoulder pain with restricted range of motion. She was diagnosed of (L) frozen shoulder at General Out Patient Department (GOPD) prior to her referral for physiotherapy. Patient walked into the physiotherapy clinic with a straight posture. She complained of (L) shoulder pain and inability to use her left upper limb effectively. She said she had been on all sorts of analgesics but to no avail. She was not in any obvious painful distress. She was afebrile, not pale and not dehydrated well oriented in TPP.

On physical examination, palpation around the (L) shoulder elicited pain superior anteriorly, pain worsened on movement of the (L) shoulder. There was restricted movement in all directions particularly in abduction and external rotation. Mild muscle tightness around the (L) shoulder was noted. There was no obvious muscle atrophy and no differential

warmth. There was mild weakness of the (L) shoulder muscles especially the abductors, external rotators and internal rotators about muscle power 4. Shoulder shrug sign was positive. Digital pressure along the spine did not elicit pain. Movement of neck in all directions was pain free. There was no other pathology in the (L) upper limb outside the shoulder. There was no history of trauma. X-ray of the (L) shoulder showed no degenerative changes. After thorough examination of the patient, there was need to commence physiotherapy immediately. However, prior to commencement of physiotherapy, patient's baseline functional status was ascertained using shoulder pain and disability index (SPADI) as an outcome measure. Baseline score was 61%.

Following the findings from the assessment, Shortwave diathermy and supervised active exercises using pendulum stretch, Towel stretch, Finger walk, cross body stretch, Armpit stretch, outward rotation and inward rotation as prescribed by the Harvard Medical school were introduced. Patient was receiving both shortwave diathermy and the supervised active exercises on three times per week appointment basis in addition to home programmes. On each treatment session, patient would have shortwave diathermy with power intensity of 40watts for 20minutes. Thereafter, patient would undergo the following supervised active exercises:

- ✓ Pendulum stretch: This involves relaxing the shoulder, standing and leaning over slightly, allowing the affected arm to hang down. Swing the affected arm in a small circle about a foot in diameter. Perform 10 revolutions in each direction once a day. Increasing the diameter of the swing as symptoms improve without forcing it. As symptoms improve, increase the stretch by holding a light weight (three to five pounds) the arm.
- ✓ Towel stretch: This involves holding one end of a three – foot-long towel behind your back and grabbling the opposite end with your other hand. Hold the towel in a horizontal position. Use your good arm to pull the affected arm upward to stretch it. You can also do an advanced version of this exercise with the towel draped over your good shoulder. Hold the bottom of the towel with the affected arm and Do this 10 to 20 times a day.
- ✓ Finger Walk: Face a wall three-quarter of an arm's length away. Reach out and touch the wall at waist level with the fingertips of the affected arm. With your elbow slightly bent, slowly walk your fingers up the wall, spider-like, until you've raised your arm as far as you comfortably can. Your fingers should be doing the work, not your shoulder muscles. Slowly lower your arm with the help of the good arm, if necessary. Repeat the exercise 10 t0 20 times a day.
- ✓ Cross - Body Reach: Sit or stand. Use your good arm to lift your affected arm at the elbow, and bring it up and across your body, exerting gentle pressure to stretch the shoulder. Hold the stretch for 15 to 20 seconds. Do this 10 to 20 times per day.
- ✓ Armpit Stretch: Using your good arm, lift the affected arm onto a shelf about breast-high. Gently bend your knees, opening up the armpit. Deepen your knee bend slightly, gently stretching the armpit, and then straighten. With each knee bend, stretch a little further, but don't force it. Do this 10 to 20 times each day.
- ✓ Outward Rotation: Hold a rubber exercise band between the hands with the elbows at a 90 –degree angle, close to the sides. Rotate the lower part of the affected arm outward two to three inches hold for five seconds. Repeat 10 to 15 times, once a day.
- ✓ Inward Rotation: Stand next to a closed door, and hook one end of a rubber exercise band around the doorknob. Hold the other end with the hand of the affected arm, holding the elbow at a 90-degree angle. Pull the band toward the body two or three inches and hold for five seconds. Repeat 10 to 15 times, once a day.

On the first day of treatment, patient received shortwave diathermy and performed supervised active exercises based on available materials. Patient was asked to procure a rubber exercise band and a three- foot long towel so as to be able to undergo the whole exercise regimen. On subsequent visits, patient received shortwave diathermy for 20 minutes and performed all the supervised active exercises as recommended. After two weeks of physiotherapy intervention using the above treatment modalities, patient recorded minimal improvement in both pain and range of motion of the (L) shoulder with a score of 53 % using (SPADI) as an outcome measure. Patient was closely supervised and instructed further to do her home programmes religiously. After four weeks of physiotherapy interventions, patient's condition begins to improve appreciably as her score came down to 35% using (SPADI). Patient seemed happy and continued with her treatment. Six weeks after intervention, shortwave diathermy and supervised active exercises using pendulum stretch, towel stretch, finger walk, cross body reach, armpit stretch, outward rotation and inward rotation proved to be effective in the management of frozen shoulder as patient recorded remarkable improvement in both pain and range of motion of the (L) Shoulder with a score of 18% using shoulder pain and disability index as outcome measure.

XIII. DISCUSSION

Frozen shoulder as seen in Mrs. B. is a self- limiting disorder that is predominantly found among women especially in the diabetic population. It can be primary (idiopathic) or secondary when the cause is known or results from a surgical event (Walmsley, Rivett & Osmotherly, 2009). Secondary frozen shoulder has three subcategories which include systemic (diabetes mellitus and other metabolic conditions, extrinsic (cardiopulmonary disease, cervical disc disease, CVA, humerus fracture, parkinson's disease), and intrinsic factors (rotator cuff pathologies, biceps tendinopathy, calcific tendinopathy, acromioclavicular arthritis) (Kelley, Mcclure & Leggin, 2009). Frozen shoulder occurs in three phases; freezing (painful), frozen (adhesive) and thawing (resolution).

Resolution of frozen shoulder takes time. It can take up to two to three years for symptoms to resolve and some patients may never fully regain full motion (Blanchard, Barr, & Cerisola, 2010). However, early diagnosis and quick intervention both pharmacologically, rehabilitative and/or surgically can facilitate shoulder resolution. This study utilized physiotherapy approach involving short wave

diathermy and supervised active exercises in the management of the frozen shoulder.

Findings from this study showed that shortwave diathermy and supervised active exercises are effective in the management of frozen shoulder as patient recorded a remarkable improvement in the pain and range of motion after six weeks of both therapies. Other studies (Diercks & Stevens, 2004) showed that supervised neglect which included instructing the patient not to exercise past their pain threshold, to do pendulum exercises and active exercises within painless range of motion, and to resume all activities as tolerated led to significant improvement in pain and range of motion in the management of frozen shoulder. Supervised active exercises help to increase the flexibility of the shoulder muscle s and thereby relieving pain and improving joint range of motion.

On the other hand, shortwave diathermy provided at a comfortable heating intensity through 27.12 MHz wave through anterior and posterior electrodes as adjunct therapy to stretching exercises also led to significantly greater improvement in range of motion when compared to treatment groups treated with superficial heating and stretching versus stretching alone (Leung & Cheing, 2008). Shortwave diathermy helps to increase tissue extensibility thereby relieving pain and improving joint range of motion.

Frozen shoulder is usually rare in children and people under 40 years. It is predominantly common among people between 40 and 70 years of age (Ewald, 2011). One of the limiting factors in this study is patient's compliance with her home programmes as one could not determine how well patient was doing her home programmes but had to depend solely on the report given by the patient.

However, this study has advantage over other researches that utilized active exercises in the management of frozen shoulder because the kind of active exercises utilized in this study are clearly stated unlike in other researches. Worthy of note is that the result recorded in this study could be attributed to strict adherence to principles guiding the management of frozen shoulder.

XIV. CONCLUSION

This study showed that shortwave diathermy and supervised active exercises increase the rate of frozen shoulder resolution. However, a wider study involving many patients should be carried out to further ascertain the efficacy of the shortwave diathermy and supervised active exercises in the management of frozen shoulder as utilized in this study as the outcome on one patient may not be adequate to generalize their effectiveness to the wider population. Lastly, emphasis should be laid on the use of active exercises as preventive measures rather than treatment modality in the management of frozen shoulder.

XV. RECOMMENDATION

- ✓ A wider study involving many patients is needed.
- ✓ Physiotherapy intervention should be tailored to patient's symptoms and stage of condition
- ✓ People up to 40 years and above should keep moving their shoulders fully in all directions to prevent frozen shoulder.
- ✓ Patients should be reassured of possible resolution of symptoms
- ✓ Patient should be educated from the onset of treatment on the possible prognosis regarding their condition.
- ✓ Efforts should be made to avoid complications arising from manipulation under anesthesia or post –operations
- ✓ Home exercise regimen should be well streamlined and emphasized to patient so as to facilitate patient's recovery
- ✓ At the painful/ freezing stage, if patient fails to respond within 3-6 weeks with physiotherapy alone or patient's condition worsens, Corticosteroid injection should be offered to the patient
- ✓ If a patient is unresponsive to conservative treatment for at least 6months of conservative treatment, arthroscopic capsular release alone or in conjunction with manipulation should be offered to the patient as this has shown to be effective in improving range of motion.

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