International Journal of Physical Education, Sports and Health 2022; 9(6): 119-129


**P-ISSN:** 2394-1685
**E-ISSN:** 2394-1693
Impact Factor (RJIF): 5.38
IJPESH 2022; 9(6): 119-129

www.kheljournal.com
Received: 10-08-2022
Accepted: 14-09-2022

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# A study on assessing the effectiveness of muscle energy technique and interferential therapy with conventional therapeutic exercises and interferential therapy in patients with frozen shoulder: A comparative study

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**DOI:** https://doi.org/10.22271/kheljournal.2022.v9.i6b.2683

**Abstract**
The aim of present study was to assess the effectiveness of Muscle Energy Techniques (MET) and Interferential therapy (IFT) and assess the effectiveness of Conventional therapeutic exercises and Interferential therapy (IFT) and compare the effect of Muscle Energy Technique (MET) and Interferential therapy (IFT) with Conventional therapeutic exercises and Interferential therapy (IFT) in leading to better clinical outcomes in management of frozen shoulder in reducing pain, improving range of motion (ROM) and functional ability.
In this study 60 patients of both genders were randomly selected who were satisfying inclusion and exclusion criteria and were divided into two groups of each consisting of 30 patients, Group A patients were treated with Muscle energy technique (MET) and interferential therapy (IFT). Group B patients were treated with Conventional Therapeutic Exercises and interferential therapy (IFT). Both the groups were treated for 4 weeks. Patients were evaluated for pain using VAS, ROM using universal goniometer and functional ability by SPADI score on $1_{st}$ day, $2_{nd}$ week and 4th week, respectively.

**Keywords:** Interferential therapy (IFT), muscle energy technique (MET), range of motion (ROM), shoulder pain and disability index (SPADI), visual Analog scale (VAS)

## 1. Introduction
Frozen shoulder is also known as adhesive capsulitis or periarthritis, characterized by development of dense adhesions, capsular thickening and capsular restrictions in dependent folds of capsule.
The onset usually occurs between the ages of 40-60 years; there is period of pain and restricted motions in this condition. Associated impairments in mobility and muscle performance also occur in the muscles and other connective tissues in the area [1]. Frozen shoulder is defined as a clinical syndrome characterized by painful restriction of both active and passive shoulder movements due to shoulder causes like- tendinitis of rotator cuff, bicipital tendinitis, fractures and dislocations around the shoulder and non-shoulder causes like- diabetes, frozen hand shoulder syndrome, complication of Colles fracture etc. [2].
Dupley first described in 1872 and called it as humero-scapular periarthritis. In 1934, Codman coined as frozen shoulder. In 1945, Neviaser named it as adhesive capsulitis [2] Frozen shoulder is defined as slow onset pain near the insertion of deltoid muscle with loss of internal rotation initially followed by more than 50 percent loss of external rotation and abduction of less than 90 degrees [3, 4].
Frozen shoulder is characterized by pain, stiffness, limited function of the glenohumeral joint and muscle weakness from disuse which adversely affects the entire upper extremity. Patients typically describe onset of shoulder pain followed by a loss of motion. The most common limitations in range of motion are flexion, abduction, and external rotation. The average range of motion in frozen-stage shoulder patients is 98 of abduction, 117 of flexion, 33° external rotation and 18 of internal rotation with the shoulder abducted to 90 [5]. Frozen shoulder is characterized by spontaneous onset of pain, where the pathology results in thickening and

eventual contracture of glenohumeral capsule [6]. The capsular pattern is reduced with external shoulder rotation followed by shoulder flexion, and internal rotation [7]. There are three stages of frozen shoulder - painful stage, stiffness or frozen stage and recovery or thawing stage, with the average length of symptoms lasting 30 months.

Stage I (Freezing stage) is mainly characterized by pain usually lasting 2.5–3 months leading to a gradual decrease of active and passive ROM. Significant limitation of forward flexion, abduction, internal rotation, and external rotation. Patient reports an insidious onset of diffuse shoulder pain, difficulty lying on the affected side and progressive loss of shoulder motion. Patients often identify pain at night. Ache is unrelated to activity and may be worse at rest [6].

Stage II (Frozen stage) here stiffness is marked lasting 4–12 months. Pain gradually subsides and is described as a dull aching type of sensation and occurs at the extreme of their available movement. Loss of motion plateaus with passive motion equal to active motion or gross reduction of glenohumeral movements, with near total obliteration of external rotation (Capsular pattern). There is significant limitation of ROM with rigid end feel [6].

Stage III (thawing stage) here pain resolves and improvement in range of motion (ROM) appears. This may occur in 12-36 months. It is not uncommon to have thawing period last for years. It is characterized by the gradual improvement of shoulder motion and the reduction of pain symptoms, mean duration from onset of frozen shoulder to resolution is over 30 months [6].

Frozen shoulder affects females slightly more than males typically between 40 and 60 years of age. The non-dominant arm is more likely to be involved, although about 12% of people are affected bilaterally [5]. The incidence of shoulder pain in general medical practice is estimated to be 11.2/1000 patients The Annual incidence of shoulder symptoms is estimated to be 10 to 25/1000 enrolled patients. Adhesive capsulitis was seen in 17.9 % Diabetics compared to 7 % in non-diabetics in Indian population. The incidence of' frozen shoulder in the general population has been reported to be 2-5 %, while among individuals with Diabetes it is 10-20 % [12].

International Diabetes Federation reported 61.3 million people in India with diabetes in 2011. The figure is projected to rise to 101.2 million by 2030, i.e., approximately 58% increase in two decades. Impact of type II diabetes mellitus is considerable as it increases morbidity. An increased prevalence of musculoskeletal problems affecting hand and shoulder is recognized in type II diabetes which is likely to cause major limitations in activities of daily living. Despite high prevalence of musculoskeletal disorders among people with diabetes mellitus (type II), approximately 50% of people suffering from shoulder pain and stiffness have diabetes.

### 1.1 Muscle Energy Technique (MET)

MET are a class of soft tissue osteopathic (originally) manipulation methods that incorporate precisely directed and controlled, patient initiated, isometric and or isotonic contractions designed to improve musculoskeletal functions and reduce pain [16].

MET is used in lengthening shortened muscles, to strengthen a weakened muscle, reduces localized edema, mobilizing restricted joint. It is also used in reliving passive congestion, reducing muscle tone in hypertonic muscles, muscle spasm, stretching chronic or sub-acute restricted, fibrotic, contacted soft tissue (fascia, muscle) or tissues housing active myofascial trigger points [17].

### 1.2 Interferential Therapy (IFT)

The resulting current of IFT has a frequency that is modulated between 1- 100Hz, which produce pain reduction through the gate control theory [23]. IFT predominately excites large-diameter nerve fibers and reduces the transmission of nociceptive signals through small-diameter nerve fibers to the spinal dorsal horn by presynaptic inhibition, thus achieving pain modulation in the higher center [24, 25].

### 1.3 Conventional therapeutic exercises

Include set of shoulder exercises involving pulley, wand, self-stretching, scapular stabilization, self-mobilization exercise, active shoulder ROM with weight cuff and Codman's exercise. These exercises help in controlling pain, edema, and joint effusion; the ROM is progressed up to the point of pain, including all shoulder and scapular motions [1, 6].

## 2. Materials and methodology

Study design comprised of comparative experimental study using randomized controlled trial where the patients with diagnosed frozen shoulder were taken into the study were patients referred from KIMS orthopedic department to KIPT OPD which consisted of 60 subjects who were randomly assigned to two groups. Group A consisted of 30 frozen shoulder patients treated with Muscle energy technique (MET) and interferential therapy (IFT) and Group B consisted of 30 frozen shoulder patients treated with Conventional Therapeutic Exercises and interferential therapy (IFT).

Sampling method used was simple randomized technique where the samples were selected through simple random sampling technique by using chit method. First 60 chits were prepared (30 in each group) and placed in a box. Patients were asked to pick one chit. Whichever group selected by the patient, as found on the chit, was allocated to that patient. Chit was not replaced back into the box.

### 2.1 Materials used

Consent form, Treatment Couch, Pillow, stick, chair, pulley, Towel Roll, weight cuff, Universal goniometer conducting gel, Cotton, Velcro Tape, Power Cable, Four Rubber Pad electrodes, IFT machine.

### 2.2 Inclusion criteria

Patients who were diagnosed with frozen shoulder (stage II) with shoulder pain and restricted range of motion. Both the genders were selected in equal numbers. Patient's age group between 40-60 years were selected having Bilateral/unilateral frozen shoulder and participants who had no medical contraindications to exercise and were cognitively and physically able to complete the assessments and exercise Program were included.

### 2.3 Exclusion criteria

Patients with recent history of surgery on particular shoulder, paresthesia or loss of sensation, fractured shoulder complex, rotator cuff rupture, frozen shoulder secondary to Reflex sympathetic dystrophy, cervical spine injury and neurological disorder like C.V.A, brachial plexus injury, peripheral. Nerve injury, Parkinsonism. Malignancy, pacemaker, systemic disorders. Patients who do not give consent to take part in the study were excluded.

### 2.4 Methodology

Patients were assessed for inclusion and exclusion criteria. Informed consent was taken from the patient, parents or

guardian of patient. Patient, parent or guardian of patient were explained about the treatment procedure. Two groups each consisting of 30 patients with frozen shoulder. One group treated with IFT and conventional therapeutic exercises while another group with IFT and Muscle Energy Technique.

**2.5 Measurement tools**

On the first day of treatment procedure both the groups were evaluated for pain, disability, strength, and range of motion of the shoulder flexion, abduction, internal and external rotation by using visual analogue scale (VAS), the shoulder pain and disability index (SPADI), and ROM by universal goniometer.

**Shoulder Pain and Disability Index (SPADI)**

It is a self-administered questionnaire designed to measure the pain and disability associated with shoulder pathology in the outpatient setting. It consists of 13 items in 2 domains; pain (5 items) and disability (8 items), scored on a visual analog scales, ranging from 0 to 100 (0 = no pain/no difficulty and 10 = worst pain imaginable/so difficult) required help. Each item score is equally weighted, then added for a total percentage score from 0 to 100 (0 = best and 100 = worst).

**Visual Analog Scale (VAS)**

It is designed to present to the respondent a rating scale with minimum constraints. Respondents mark the location on the 10-centimeter line corresponding to the amount of the pain they experienced. This gives them the greatest freedom to choose their pain exact intensity. It also gives the maximum opportunity for each respondent to express a personal style.

**Goniometric Measurements for Shoulder:**

Universal goniometry is used to objectively measure passive and active range of motion. Measurements are generally used to assess limitations in ROM, determine appropriate interventions and document treatment progression.

The evaluation of these above outcome measures was done as Pre-test on Day 1, Interval test on 2nd week and Post-test on 4th week.

**2.6 Interventions carried out on patients**

A group of 60 patients who were randomly divided into Group A and Group B. Each group consisted of 30 patients each where Group A frozen shoulder patients were treated with Muscle energy technique (MET) and interferential therapy (IFT) and Group B frozen shoulder patients were treated with Conventional Therapeutic Exercises and interferential therapy (IFT).

**Interferential Therapy (IFT)**

The skin underlying the affected shoulder was cleaned with alcohol. Four electrodes were placed around the painful area of the shoulder using crisscross clover leaf pattern to deliver a quadripolar interferential current. Its medium frequency of 4000 and 4100 Hz to produce the amplitude modulated frequency at 100 Hz in vector mode which produces lower impedance to the skin and allows deeper penetration into tissue.

Calibration of the Instrument includes Frequency of 4 kHz (4000 Hz), Base of 80 Hz, Spectrum of 100 Hz, Intensity was adjusted to a level that induces a strong tingling sensation just below the pain threshold. The mode used was a 2 channel with 4 carbon-type electrodes.

The coupling media technique was coplanar method and treatment time was 20 minutes which was performance for 3 days per week, on alternative days, 4 weeks of intervention.

Muscle Energy Technique (MET) included post isometric relaxation technique which was used in improving restricted flexion, abduction, internal rotation and external rotation.

The procedure includes patient positioned in side lying, with affected shoulder on top, facing toward therapist and the therapist table hand stabilizes patient's shoulder and non-table hand grasp's patient's forearm. The therapist slowly introduces shoulder flexion, as the ROM to 1800 is assessed, keeping elbow extended, where the position of restriction in movement is noted. The shoulder is brought to mid-range position and patient is instructed to pull the elbow towards further shoulder flexion direction against therapist resistance – utilizing 20 % of available strength, building up slowly contractions are maintained for 7-10 seconds, and patient is instructed to slowly cease the effort. The rest period of 5 seconds or so to ensure complete relaxation, before stretching. After complete relaxation on exhalation, the arm in taken into new restriction barrier and stretch is maintained for 30-60 seconds.

The above MET technique was given: 5 repetitions per session, 1 session per day, 6 days per week, 4 weeks of intervention.

Conventional therapeutic Exercises included Codman exercise performance in standing with trunk flexed and arm hangs loosely downward. A pendulum or swinging motion of the arm is initiated.

Pulley exercises were performed sitting in a chair with pulley assembled. The patient was asked to raise the affected arm overhead, arm out to side and overhead pulling down on the pulley with the other hand so that you feel a stretch.

Wand exercises were performed while patient lying or standing with affected hand at the top of the stick using the stick for assistance, the patient was asked to stretch the arm higher overhead, rotate hand and forearm outweigh from your body, moved out to side overhead and grasp stick behind back in standing position, slide stick up and back so that you feel the stretch, hold for 10 seconds so that you feel a stretch.

Self-stretching techniques includes to increase flexion, patient sitting with the involved side next to the table, forearm resting along the edge of table. Patient slides the forearm forward along the table.

- To increase abduction- patient sitting with the involved side next to the table, the forearm resting with palm up. The patient slides the arm across the table laterally towards other side of table.
- To increase internal rotation- patient side lying on affected side, with the shoulder and elbow flexed and arm internally rotated. The patient is asked to push the forearm towards the table with opposite hand.
- To increase external rotation- patient standing and facing doorframe with palm against the edge of frame and elbow flexed to 900. Patient then turns away from fixed hand. Hold stretch for 10 seconds.

Self-mobilization technique includes Caudal glide- patient sits on a firm surface and grasps the fingers under the edge. Patient then leans the trunk away from the stabilized arm and anterior glide- patient lying supine with both the arms behind the body. Patient then leans the body weight between the arms. Sustained grade II and III is incorporated for 10 seconds.

Scapular stabilization exercise include the patient assumes upright posture with shoulders relaxed. Move Affected Shoulder blade down and towards opposite Active ROM with

weight cuff where the patient in comfortable position, the effected side it tied with weight cuff of weight tolerable by the patient without causing discomfort. Patient is asked to do shoulder ROM within the available range.

The above exercises were given 10 repetitions per session, 1 session per day, 6 days per week, 4 weeks of intervention.

### 3. Statistical Analysis

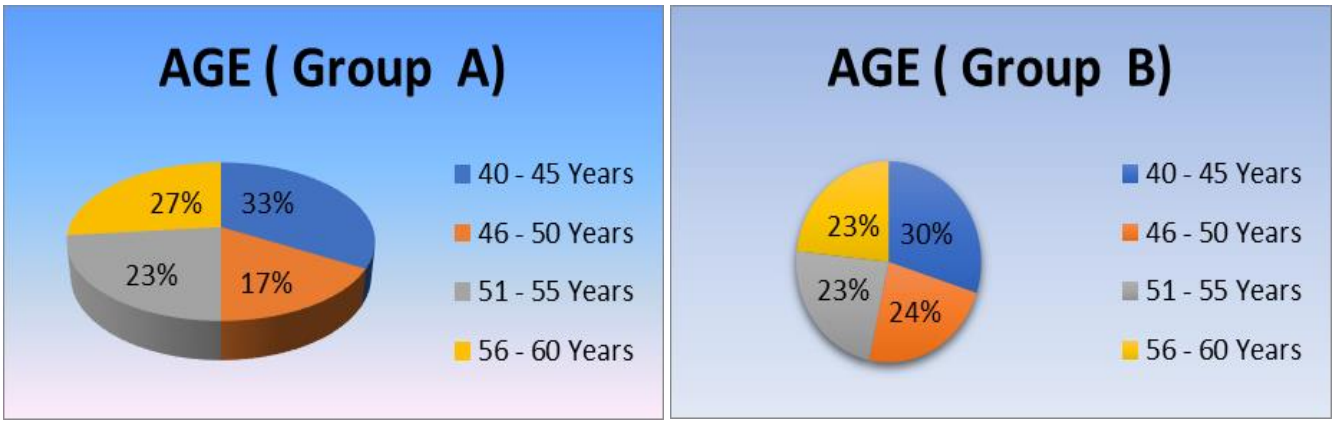
The analysis was done by using SPSS 16.0 software. The following are the statistical analysis

1. Descriptive Statistics was used to calculate mean and Standard Deviation (SD)
2. In both Groups where, Group A - patients who received Muscle Energy Techniques (MET) and Interferential therapy (IFT) in reducing pain, improving shoulder range of motion and functional ability in Frozen Shoulder, and Group B – patients who received Conventional therapeutic exercises and Interferential therapy (IFT) in reducing pain, improving shoulder range of motion and functional ability in Frozen shoulder, Effectiveness of treatment was calculated by Repeated Measures of ANOVA.
3. Paired t-test was used to compare the effectiveness of Muscle Energy Technique (MET) and Interferential therapy (IFT) with Conventional therapeutic exercises and Interferential therapy (IFT) in reducing pain, improving shoulder range of motion and functional ability in frozen shoulder.

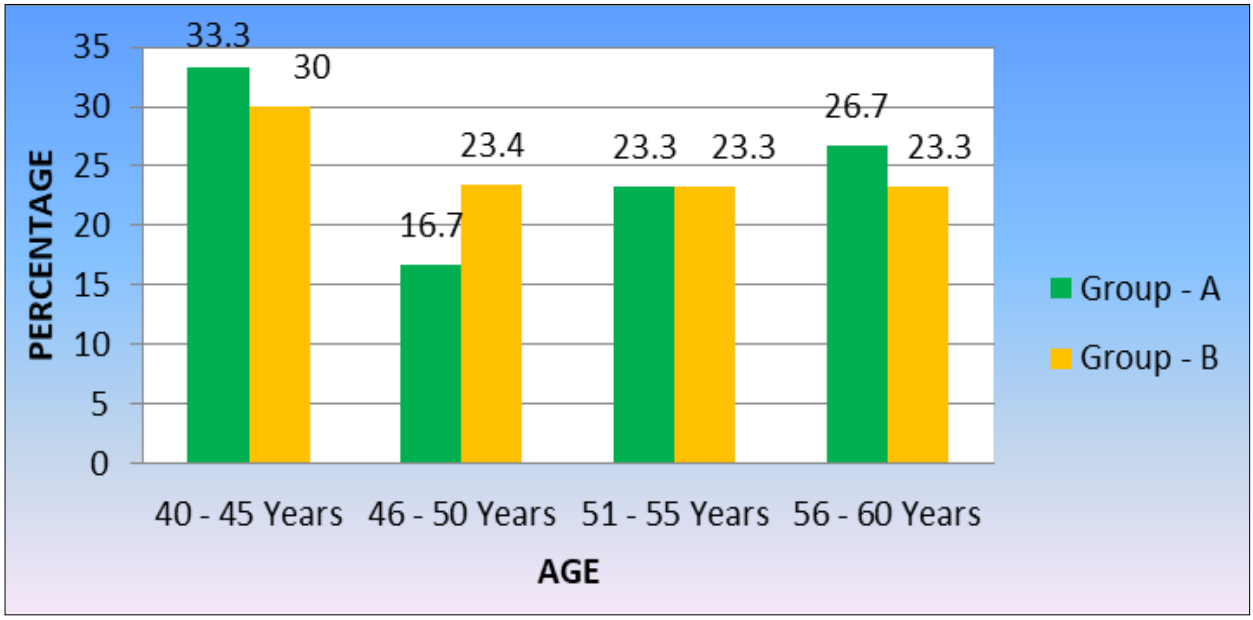
### Section 1

**Table 1:** Frequency and Percentage distribution of Age for Group A and Group B N=30

| AGE | Group A | | Group B | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| 40 - 45 Years | 10 | 33.3 | 9 | 30 |
| 46 - 50 Years | 5 | 16.7 | 7 | 23.4 |
| 51 - 55 Years | 7 | 23.3 | 7 | 23.3 |
| 56 - 60 Years | 8 | 26.7 | 7 | 23.3 |
| | 30 | 100 | 30 | 100 |




**Graph 1A:** Percentage distribution of Age for Group A & Group B

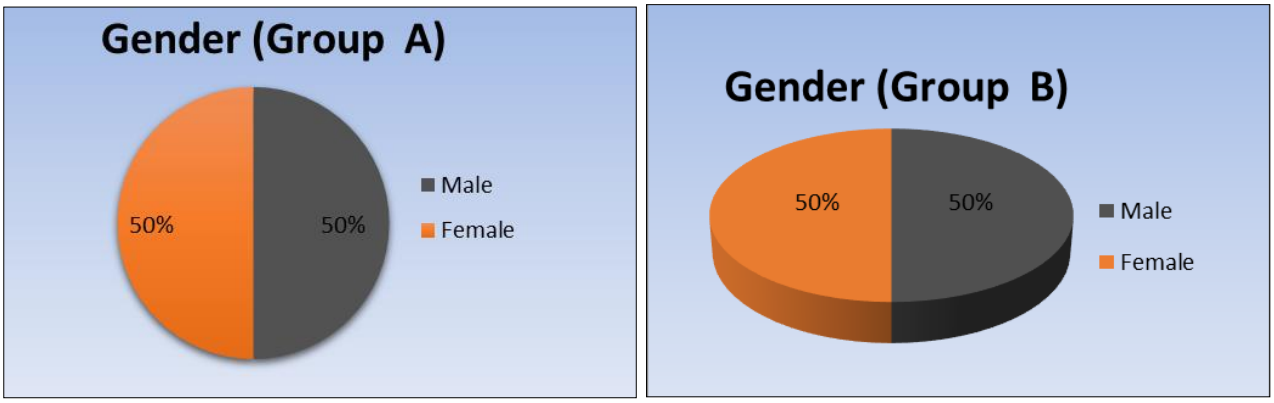



**Graph 1B:** Percentage distribution of Age for Group A and Group B

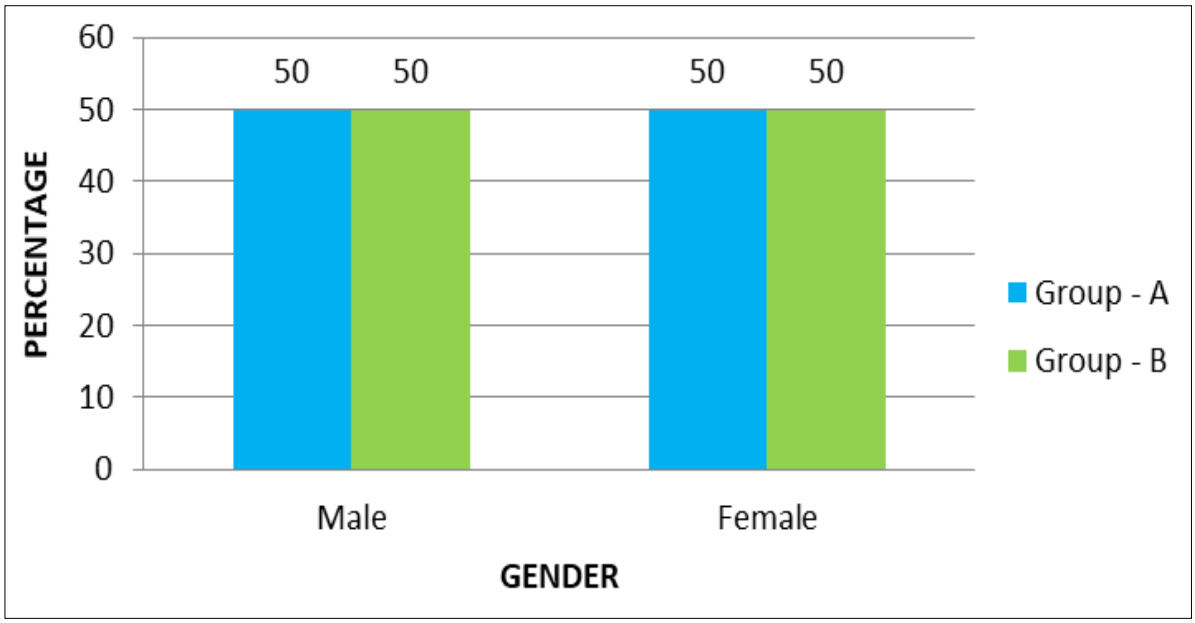
The Frequency and Percentage of age of patients belonging to the study in Group A and Group B were 40 to 60 years. Majority of 33.3 % of participants belonged to the age group 40-45 years, 16.7 % participants belonged to 46-50 years, 23.3 % belonged to age group 51-55 years and 26.7 % belonged to the age group 56-60 years in Group A and in Group B majority of 30 % of participants belonged to the age group 40-45 years and 23.4 % participants belonged to 46-50 years and 23.3 % belonged to 51-55 years and 23.3% belonged to the age group 56-60 years.

**Table 2**: Frequency and Percentage distribution of Gender for Group A and Group B N=30

| Gender | Group – A | | Group - B | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| Male | 15 | 50 | 15 | 50 |
| Female | 15 | 50 | 15 | 50 |
| | 30 | 100 | 30 | 100 |




**Graph 2a:** Percentage distribution of Gender for Group A & Group B




Graph 2.b - Percentage distribution of Gender for Group A and Group B

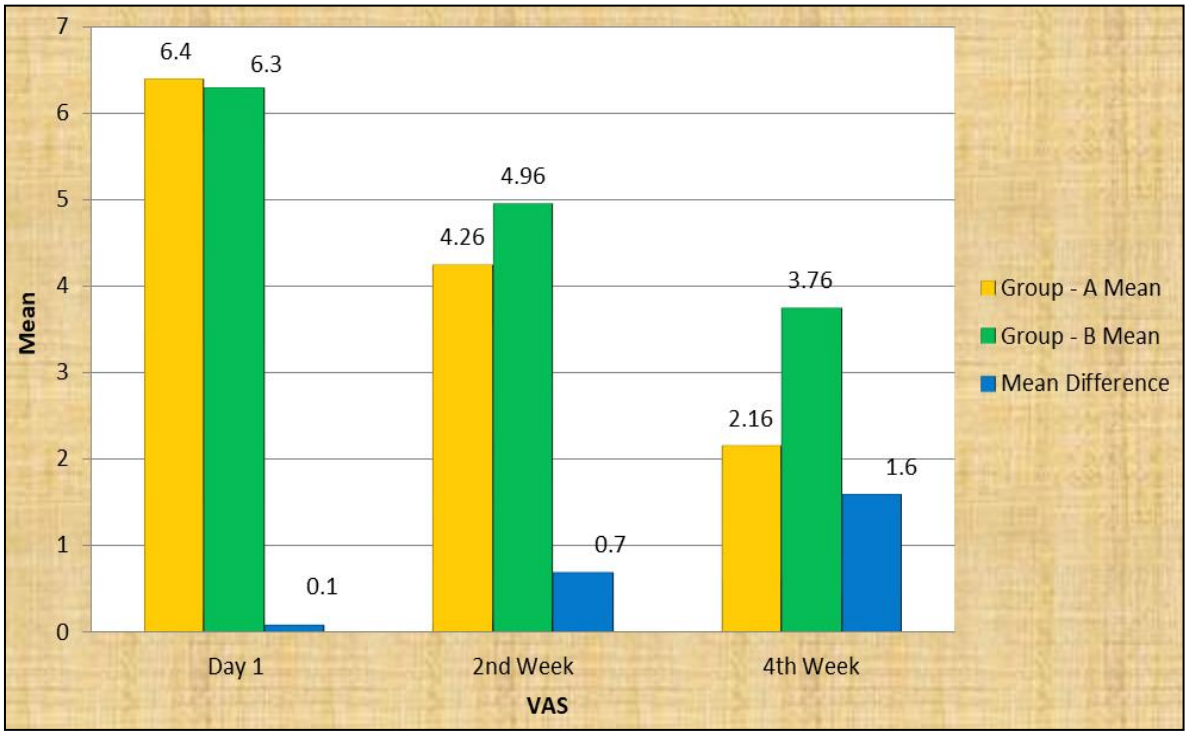
The frequency and percentage distribution of gender for Group A and Group B shows that 50 % male and 50% female participated in both Group A and Group B.

**Section 2**

Comparing the effectiveness of Group A - Muscle Energy Technique (MET) and Interferential therapy (IFT) with Group B- Conventional therapeutic exercises and Interferential therapy (IFT) in reducing pain, improve range of motion (ROM) and functional ability in frozen shoulder.

**Table 3:** Paired 't' Test for comparison between Group A and Group B with VAS score

| VAS | Group - A Mean | Group - B Mean | Mean Difference | Paired 't' Value | P Value |
|---|---|---|---|---|---|
| Day 1 | 6.4 | 6.3 | 0.1 | 0.5 | 0.28 |
| 2nd Week | 4.26 | 4.96 | 0.7 | 3.17* | 0.001 |
| 4th Week | 2.16 | 3.76 | 1.6 | 6.35* | 0.001 |



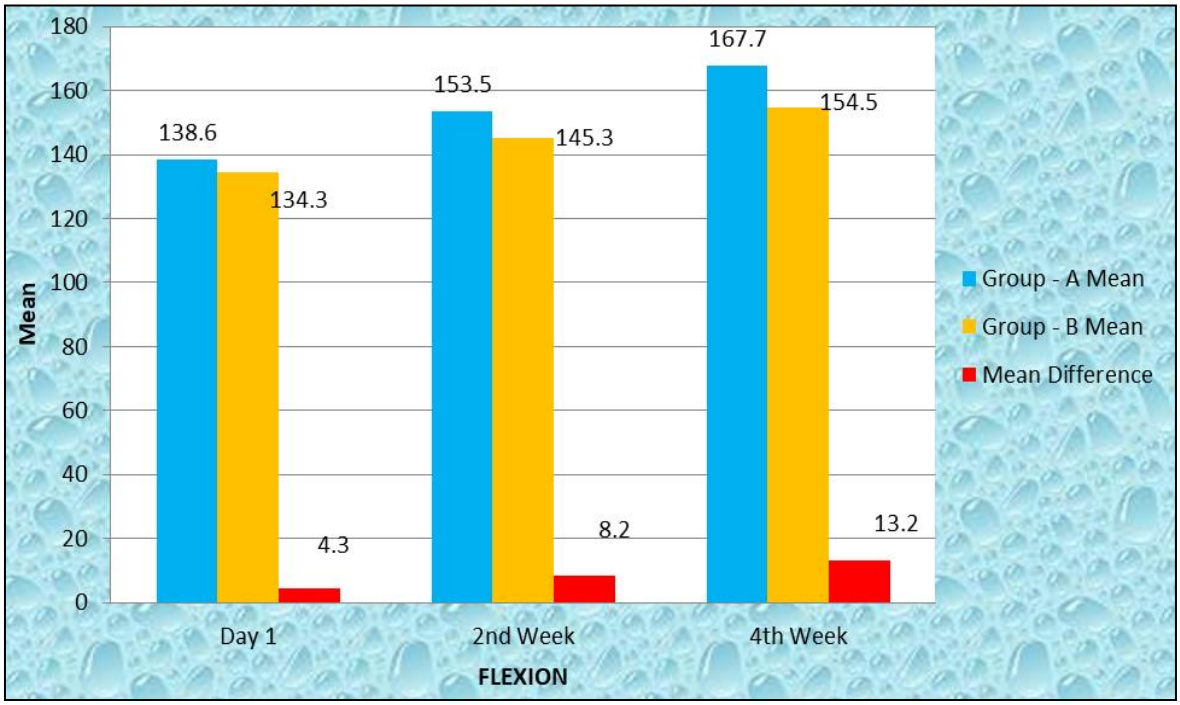

**Graph 3:** Comparison between Group A and Group B with VAS score

In the comparison of group A and group B with VAS score, Group A patients showed more improvement than group B. On the 2nd Week, t=3.17, 4th Week, t = 6.35, values were significant at $p < 0.05$. This showed that there was comparative difference between Group A and Group B.

**Table 4:** Paired 't' Test for comparison between Group A and Group B with ROM [Flexion] score

| Flexion | Group A Mean | Group B Mean | Mean Difference | Paired 't' Value | P value |
|---|---|---|---|---|---|
| Day 1 | 138.6 | 134.3 | 4.3 | 1.36 | 0.25 |
| 2nd Week | 153.5 | 145.3 | 8.2 | 2.63* | 0.04 |
| 4th Week | 167.7 | 154.5 | 13.2 | 4.73* | 0.001 |

*Significant at $p < 0.05$, DF = 29




**Graph 4:** Comparison between Group A and Group B with ROM [Flexion] score

In the comparison of Group A and Group B with ROM [Flexion] score, Group A patients showed more improvement than group B. On the 2nd Week, t=2.63, 4th Week, t=4.73, values were significant at p<0.05. This showed that there was comparative difference between Group A and Group B.

**Table 5:** Paired 't' Test for comparison between Group A and Group B with ROM [Abduction] score

| Abduction | Group A Mean | Group B Mean | Mean Difference | Paired 't' Value | P value |
|---|---|---|---|---|---|
| Day 1 | 123.3 | 115.6 | 7.7 | 1.97 | 0.45 |
| 2nd Week | 135.3 | 125.4 | 9.9 | 2.75* | 0.03 |
| 4th Week | 148.4 | 135.7 | 12.7 | 2.97* | 0.01 |

*Significant at $p < 0.05$, DF = 29

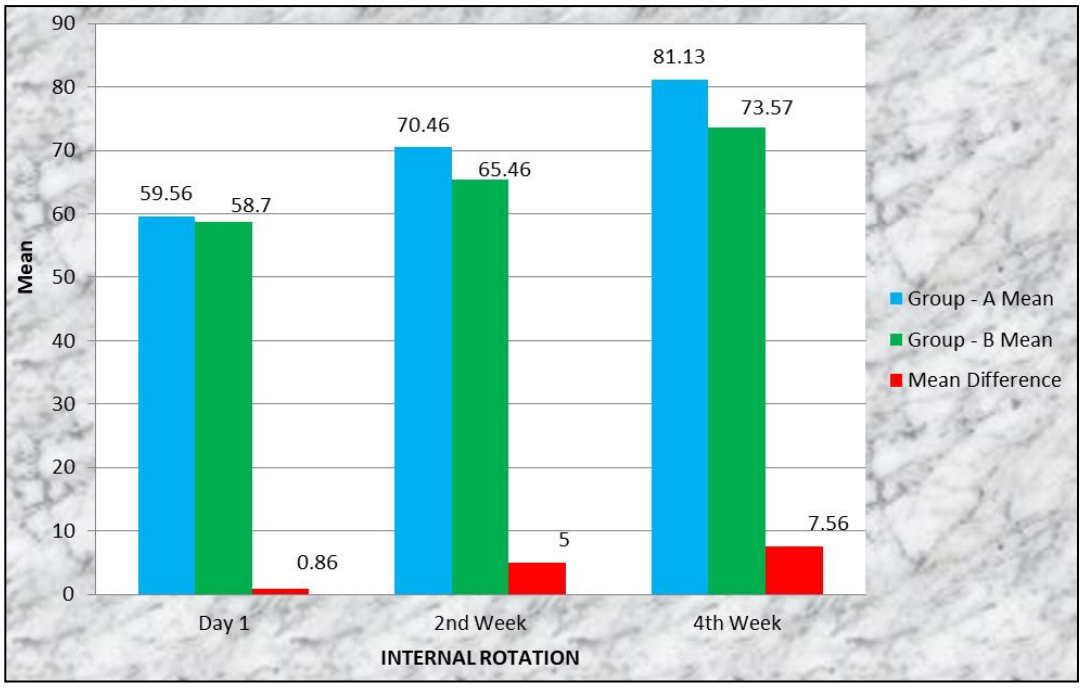

**Graph 5:** Comparison between Group A and Group B with ROM [Abduction] score

In the comparison of Group A and Group B with ROM [Abduction] score Value, Group A patients showed more improvement than Group B. On the 2nd Week, t=2.75, 4th Week, t=2.97, values were significant at p<0.05. This showed that there was comparative difference between Group A and Group B.

**Table 6:** Paired 't' Test for comparison between Group A and Group B with ROM [Internal Rotation] Score

| Internal Rotation | Group A Mean | Group B Mean | Mean Difference | Paired 't' Value | P Value |
|---|---|---|---|---|---|
| Day 1 | 59.56 | 58.7 | 0.86 | 0.38 | 0.70 |
| 2nd Week | 70.46 | 65.46 | 5 | 2.77* | 0.10 |
| 4th Week | 81.13 | 73.57 | 7.56 | 4.33* | 0.001 |

*Significant at $p < 0.05$, DF = 29



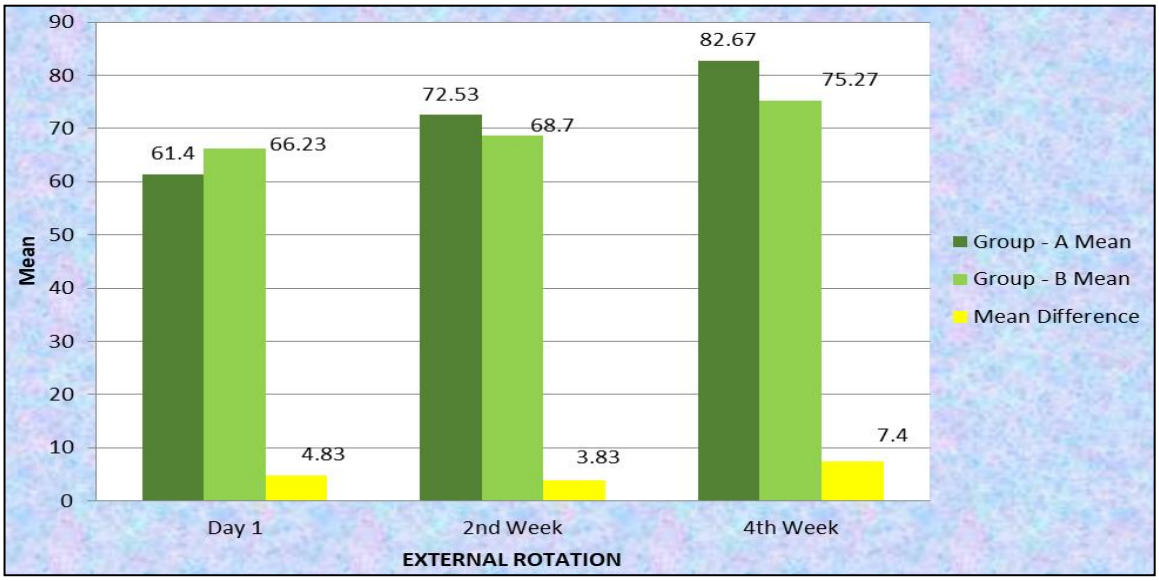

**Graph 6:** Comparison between Group A and Group B with ROM [Internal Rotation] score

In the comparison of Group A and Group B with ROM [Internal Rotation] score, Group A patients showed more improvement than Group B. On the 2nd Week, t=2.77, 4th Week, t = 4.33, values were significant at p<0.05. It showed that there was comparative difference between Group A and Group B.

**Table 7:** Paired 't' Test for comparison between Group A and Group B with ROM [External Rotation] score

| External Rotation | Group A Mean | Group B Mean | Mean Difference | Paired 't' Value | P Value |
|---|---|---|---|---|---|
| Day 1 | 61.4 | 66.23 | 4.83 | 2.03 | 0.05 |
| 2nd Week | 72.53 | 68.7 | 3.83 | 1.62 | 0.11 |
| 4th Week | 82.67 | 75.27 | 7.4 | 3.28* | 0.003 |

*Significant at $p < 0.05$, DF = 29



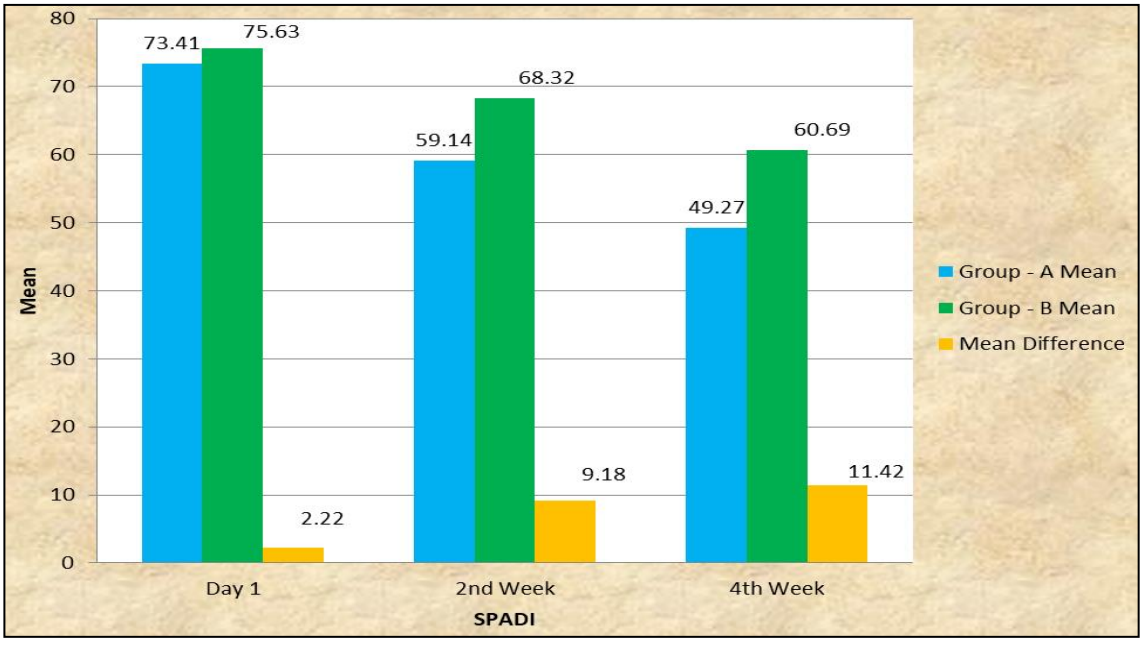

**Graph 7:** Comparison between Group A and Group B with ROM [External Rotation]score

In the comparison of Group A and Group B with ROM [External Rotation] score, Group A patients showed more improvement than Group B. On the 4th Week, t=3.28, values were significant at p<0.05. This showed that there was a comparative difference between Group A and Group B.

**Table 8:** Paired 't' Test for comparison between Group A and Group B with SPADI **score**

| Spadi | Group A Mean | Group B Mean | Mean Difference | Paired 't' Value | P Value |
|---|---|---|---|---|---|
| Day 1 | 73.41 | 75.63 | 2.22 | 1.16 | 0.25 |
| 2nd Week | 59.14 | 68.32 | 9.18 | 3.77* | 0.001 |
| 4th Week | 49.27 | 60.69 | 11.42 | 3.67* | 0.001 |

*Significant at $p < 0.05$, DF = 29




**Graph 8:** Comparison between Group A and Group B with SPADI score

In the comparison of Group A and Group B with SPADI score, Group A patients showed more improvement than Group B. On the 2nd Week t=3.77, 4th Week, t=3.67, values were significant at p<0.05. It showed that there was comparative difference between Group A and Group B.

## 4. Discussion

The aim of the present study was to examine whether muscle energy technique (MET) and interferential therapy (IFT) or conventional therapeutic exercises and interferential therapy (IFT) would lead to better clinical outcomes in the management of frozen shoulder in reducing pain, improving shoulder ROM and functional ability.

In this study 60 subjects of both the gender were equally selected satisfying inclusion and exclusion criteria and were randomly divided into two groups each consisting of 30 subjects. Group A subjects were treated with Muscle energy technique (MET) and interferential therapy (IFT) and Group B subjects were treated with Conventional Therapeutic Exercises and interferential therapy (IFT). Both the groups underwent 4 weeks of treatment interventions.

Descriptive statistics was used to calculate Mean for all scores. Paired t-test was used to compare the effectiveness of Group A- Muscle Energy Technique (MET) and Interferential therapy (IFT) with Group B- Conventional therapeutic exercises and Interferential therapy (IFT) in reducing pain, improving shoulder range of motion and functional ability in frozen shoulder. The effectiveness of treatment was calculated by repeated measures of ANOVA.

According to the statistical analysis, frequency and percentage of age for Group A and Group B of age belonging to 40 to 60 years were participated in the study. 33.3% of participants belonged to the age group 40-45 years, 16.7% participants belonged to 46-50 years, 23.3 % belonged to 51-55 years and 26.7 % belonged to the age group 56-60 years in Group A and in Group B. The frequency and percentage of distribution of gender for Group A and Group B, shows that equal percentage of male and female participated in both the Groups.

In this study pain assessed using VAS, range of motion of shoulder joint was assessed using universal goniometry and functional ability of subjects was assessed using SPADI. The above parameters were evaluated on day 1, 2nd week and 4th week for both the groups. The values are statistically analyzed to determine their effect in reducing pain, improving ROM and functional ability in frozen shoulder.

A cross sectional study conducted by Boonstra *et al*. in 2008 reported that VAS was reliable scale for measuring musculoskeletal pain. Hence in this study the most reliable scale VAS was used to assess pain in subjects with frozen shoulder.

The comparison of Group A and Group B with VAS score was statistically analyzed and showed that Group A subjects had more improvement than Group B. On the 2nd Week, t = 3.17, 4th Week, t=6.35, values are significant at $p < 0.05$ and DF = 29. It means there is a comparative difference between Group A and Group B.

A comparative study conducted by Shah Atika Suril *et al*. in 2013 on shoulder adhesive capsulitis with 30 subjects between age 40-60 years were measured for pain by VAS and reported that MET is effective in reducing pain of acute and chronic nature.

A study conducted by Aarti Dewan *et al*. in 2011 on adhesive capsulitis with 50 subjects where each subject's score on Range of Motion, Constant Murley Assessment and visual analogue scale were recorded. The Range of Motion, Constant Murley Assessment score increased and the visual analogue scale score decreased significantly ($p < 0.0001$) and was reported that IFT is effective in reducing pain intensity and restoring shoulder function in adhesive capsulitis.

In the studies conducted by Morey J. Kolber *et al*. in 2012 and Michael J. Mullaney *et al*. in 2010 reported that goniometry was a valid and reliable instrument in assessing shoulder ROM. Hence in this study valid and reliable instrument goniometer was used to asses shoulder ROM in subjects with frozen shoulder.

The comparison of Group A and Group B with ROM [Flexion] score was statistically analyzed and showed that Group A subjects had more improvement than Group B. On the 2nd Week, t=2.63, 4th Week, t=4.73, values are significant at $p < 0.05$ and DF = 29.

The comparison of Group A and Group B with ROM [Abduction] score Value Showed that Group A subjects had more improvement than Group B. On the 2nd Week, t=2.75, 4th Week, t = 2.97, values are significant at $p < 0.05$ and DF = 29.

The comparison of Group A and Group B with ROM [Internal Rotation] score Value showed that Group A subjects had more improvement than Group -B. On the 2nd Week, t=2.77, 4th Week, t = 4.33, values are significant at $p < 0.05$ and DF = 29.

The comparison of Group A and Group B with ROM [External Rotation] score Value showed that Group A subjects had more improvement than Group B. On the 4th Week, t=3.28, values are significant at $p < 0.05$ and DF = 29. It means there is a comparative difference between Group A and Group B in flexion, abduction, internal rotation and external rotation ranges when analyzed statistically.

A study conducted by Kuwiboonsilp Wanitcha *et al*. in 2015 in shoulder adhesive capsulitis including 24 subjects aged 40-65 years assessed for shoulder ROM and reported that MET was beneficial in improving shoulder ROM.

A cross sectional study conducted by Hmigthanmawiil *et al*. in 2014 and a longitudinal cohort study conducted by Catherine L. Hill *et al*. in 2011 reported that SPADI was a valid scale in assessing pain and disability in adhesive capsulitis. Hence in this study valid scale SPADI was used to assess shoulder pain and disability in subjects with frozen shoulder.

The comparison of Group A and Group B with SPADI score value was statistically analyzed and showed that Group A subjects had more improvement than Group B. On the 2nd Week, t = 3.77, 4th Week, t = 3.67, values are significant at $p < 0.05$ and DF = 29. It means there is a comparative difference between Group A and Group B.

A study conducted by Narayan *et al*. in 2014 with 30 patient samples, of 40-60 years old patients of both genders. It was reported that MET is very much effective on shoulder functional ability in adhesive capsulitis.

A study conducted by Lokesh M. *et al*. in 2015 have in periarthritis of shoulder on 30 subjects, where pain was analysed by VAS, ROM by universal goniometry and functional ability by SPADI, reported that MET had better improvement compared to conventional therapy alone in periarthritis of shoulder.

## 5. Conclusion

Since the mean score of VAS, ROM and SPADI showed improvement in Group A than Group B. Hence by statistical analysis it was found that there is significant improvement

seen using MET and IFT (Group A) than conventional therapeutic exercise and IFT (Group B) in reduce pain, improve range of motion and functional ability in frozen shoulder

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