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International journal of physical education, sports and health effectiveness of interferential therapy and transcutaneous electrical nerve stimulation and Pilates exercise program in non-specific low back pain patients -A comparative study

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Abstract
The study wants to assess the effectiveness of interferential therapy and transcutaneous electrical nerve stimulation and Pilates exercise program individually and assess the effectiveness of both IFT and Pilates exercise program with TENS and Pilates exercise program in treating patients with chronic Non-specific low back pain.
In this study, patients with chronic Non-specific low back ache of both the sex were randomly divided into group A and group B. Group A were treated with Interferential therapy for 30 minutes for 2 weeks and Pilates exercise for 4 weeks,3 days per week. Group B were treated with Transcutaneous electrical stimulation for 30 minutes for 2 weeks and Pilates exercises for 4 weeks, 3days per week. Both the groups were treated for 6 weeks. Patients were evaluated with VAS, MSI and RMDI score on 1stday, 14th day, 28th day and 42nd day.

Keywords: Chronic non-specific low back ache (CNSLBA), visual analog scale (VAS), roland morris disability index (RMDI), modified schober's index (MSI)

1. Introduction
Low back pain is one of the most common health problems in different communities of the world. It is a common disorder involving the muscles and bone of the back. Low back pain (often abbreviated as LBP) may be classified by duration [1]. Low back pain is one of the most foremost common diseases around the world and is the leading cause of years lived with disability in developed countries [2]. Cheric Welles defines Low back pain as with or without stiffness, located in the lower regions of the back between the last coastal arc and the gluteal fold [4].
The nonspecific low back pain is characterized by a mechanical pain of musculoskeletal origin, which lasts more than 12weeks with no defined cause. The prognosis is considered moderately favorable, since 41% of patients are recovered by the end of 12 months [5, 6]. It is also called as Non-specific low back pain where no specific pathologies can be identified. It is usually caused by strain of paraspinal muscles and ligaments. It is aggravated with activity and relieved by rest without radiating to the lower limbs. When the pain persists more than 12 weeks its termed as Chronic nonspecific low back pain [7]. The diagnosis of non-specific low back pain is dependent on the clinician being satisfied that there is not a specific cause for their patient's pain [3].
Globally, about 40% of people have LBP at some point in their lives, with estimates as high as 80% of people in the developed world. In a cross-sectional study from Southern India [9].
The etiological factors are: Muscle strain, Ligament sprain, Poor postural habit, Disc bulge can cause pressure on a nerve, which can radiate pain down the leg, Age - Wear and tear [degeneration of disc and joints], Pathological causes (bladder/kidney infection, endometriosis, cancer, or ovarian issues) and Improper work culture and work activities [8, 9].

In this study the researcher has taken the subjects with chronic non-specific low back pain and were treated with IFT, TENS and Pilates exercise. Samples are selected through simple random sampling technique. Group-A: received Interferential therapy for 2 weeks followed by Pilates exercise program for 4 weeks. Group-B: received transcutaneous electrical stimulation for 2 weeks followed by Pilates exercise program for 4 weeks.

Interferential therapy is a common treatment modality for musculoskeletal pain and has been demonstrated to be effective for managing chronic low back pain. The basic principle of the IFT is to utilize strong physiological effects of the low frequency electrical stimulation of muscle and nerve tissues at sufficient depth. The medium frequency current penetrates the tissues with very little resistance, whereas the resulting interference current (low frequency) is in the range that allows effective stimulation of the biological issues.[4]

TEN Shas been increasingly used in physical therapy for the relief of acute and chronic pain. It is the application of low frequency current in the form of pulsed rectangular currents through surface electrodes to patient's skin to reduce pain. The TENS stimulates the large diameter myelinated fibres as these are highly sensitive to electrical stimulation and conducts electrical impulse to spinal cord. TENS units typically produce a continuous train of pulsed current at frequencies ranges between 1 to 120 Hz. The effect of TENS is clearly understood by pain gate control theory [1, 8].

1.1 Pilates exercise program

A recent focus in the physiotherapy management of patients with CNLBP has been the specific training of muscles surrounding the lumbar spine whose primary role is the provision of dynamic stability and segmental control to the spine.[10] The Pilates method of exercise is among the array of exercises available for the physical therapy practice. A recent systematic review aimed to provide an update on the effectiveness of the Pilates method in the treatment of patients with chronic low back pain, as several relevant clinical trials were published in the last months. The review concluded that Pilates method exercises show a statistically significant improvement in pain and disability in the short-term and a clinically significant improvement in pain compared to usual care and physical activities. However, the Pilates method showed an equal effect compared to other forms of exercise and massage therapy. Pilates exercise can be introduced into a physical therapy program as a procedure incorporating traditional application of physical therapy principles and goals, affecting strength, flexibility, and pain, while enhancing it with a re-education approach. The technique focuses on the ''powerhouse'' what is known today as the core; in Pilates, thus includes the abdominal, gluteal, and paraspinal muscles [19].

Pilates encourages neuromuscular reeducation to occur in functional positions and planes with focus on spinal stabilization. Strength, flexibility, proprioception, postural reeducation, and the challenges of functional activity [11]. Eight basic principles are essential while performing this intervention: diaphragmatic breathing, control, concentration, centering, precision, flowing movements, strength, and relaxation [13]. In this study only basic level of exercises were taught to patients.

1.2 Exercise protocol

Pilate's exercises are performed once a day, for 3 days a week for 3 weeks under supervision of Physiotherapist.

Repetitions: Exercises started with 6 to 10 reps. and hold time for 30 sec. Rest period of 2 mins can be given.

Warm-up Exercises: These exercises prepare the body for more intense movement (basic stretches of upper limb and lower limb), Starting Position - Neutral Spine. Lie on back with arms by sides. Knees should be bent, legs and feet should be parallel to each other. Inhale, Exhale and use abs to press lower spine into the floor, Inhale to release, Exhale and pull lower spine up, creating a small arch of the low back, Instructions: draw the "belly button" up and in toward the spine while exhaling the spineis in their natural position. These instructions must be maintained throughout the exercise program.

3rd and 4th week exercise: Pelvic tilting, Bridging, Supine hamstring stretch, Dead bugs/single knee float, Side lying(single leg lift) These exercises are carried out for 5th and 6th week also followed by progression of exercises. Supine gluteal stretch (figure of 4 stretch), Knee hug, Magic circle squeeze, Prone breathing, Prone thoracic extension, Cat stretch, Camel stretch, Quadruped position-single arm lift - single leg lift & opposite arm and leg lift [16].

2. Materials and methodology

A randomized control trail with 60 subjects, 30 subjects in each group. The patients with non-specific low back pain referred from Kempegowda Institute of Medical Sciences, Department of Orthopaedics to Kempegowda Institute of Physiotherapy and Group A were allotted to IFT and Pilates exercise program. Other group of patients were allocated to TENS and Pilates exercise.

2.1 Materials used

Consent form, Treatment couch, Pillow, Interferential therapy modality, Transcutaneous Electrical Nerve, Stimulation modality, Four Rubber Pad electrodes, Velcro Tape, Electrode gel, Cotton, Measuring tape, Universal goniometer, Exercise mat, Data collection /record sheet, Roland Morris disability questionnaire, VAS.

2.2 Inclusion criteria

Patients suffering with chronic non-specific low back pain for more than 12 months without any injuries, Visual Analog scale>3 points, Age group between 24 -50 years, both the genders, No history of radiating pain, Mild disc bulge without impingement of nerve (Grade 1)

2.3 Exclusion criteria

Inflammatory and Infectious condition like Chikungunya, Pott's spine, Fracture of lumbar vertebrae, Rheumatoid Arthritis, Gouty Arthritis, Psoriatic Arthritis, Any recent surgical intervention of the low back pain, Tumours /malignancy, Pregnancy, Nerve root compression, Cardiac pacemaker

2.4 Measurement tools

Intensity of pain, functional outcome and range of motion were the parameters considered for the study. The pain intensity was assessed using Visual Analog Scale (VAS), the functional outcome was assessed by using Roland Morris questionnaire and range of motion by using Modified Scober's Index.

Pain was assessed with VAS Scale. It consists, a vertical line of which at the bottom end of the scale are the words "No pain" corresponding to a VAS of 0. The words at the top end of the scale are "Worst pain possible" corresponding to a VAS of 10. The participant was instructed to place a line between the top and bottom ends of the line to indicate their level of pain. 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 [20].

RMDQ is used to measure disability of the participant regarding physical limitations caused by pain in lumbar spine in last 24 hours. It is a 24-item questionnaire with each answer scaled either "yes" or "no" and is related to the activities of daily living of the participant - each affirmative response corresponds to one score. The final score is determined by the sum of all the scores obtained for each question. Scores close to zero are the best results (lower disability) and scores near 24 are the worst results (higher disability). Scores greater than 14 points are indicative of severe impairment of the back [4, 14, 15].

2.5 Measurement of Range OF Motion

With the help of measuring tape the lumbar range of movements are assessed by Modified Schober's test. In the original Schober's test the patient stands erect and the examiner marks the skin over the spine at the level of the lumbo sacral junction. The second mark is made over 10cms above the first mark. After the patient bends forward as far as possible, the examiner measures the distance between the two points. The result is given as the increase in the distance over the original 10cm.

Range of Motion was assessed by using Modified Schober' stest, a third mark is placed below the first, i.e., 5cm below the lumbosacral junction. The normal

increase in the 15cm testis 6.2 cm (women 5.5cms &men 7.1cms). An abnormal rest is defined as being less than two standard deviations below the mean after adjusting for age and sex.

Lateral flexion

- Patient position: standing
- Therapist position: stand behind the patient
- Procedure: Fulcrum placed over S1 process. Stable arm is placed perpendicular to ground and movable arm straight to C7 process. Patient is asked to do right and lateral flexion and degree is measured. The normal range is between 30º- 35º

Rotation

- Patient position: sitting on stool
- Therapist position: standing behind the patient

Procedure: Fulcrum placed over S1 process. Stable arm is place d perpendicular to ground and movable arm straight to C7 process. Patient is asked to do right and lateral flexion and degree is measured. The normal rangeis between 30º- 35º

2.6 Sampling technique

Randomized sampling technique was used for this study. 60 subjects were selected for thestudy, 30 subjects in each group based on the inclusion and exclusion criteria. Both the groups were treated for 2 weeks followed by pilates exercise program for 4 weeks.60 Subjects were divided into two groups which are Group A and Group B. Each group consisted of 30 subjects.

Group-A: treated with Interferential therapy for 2 weeks followed by pilates exercise program for 4 weeks. Brief explanation about the procedure was given to the patient. The therapist set the parameters of the IFT, the Frequency is set at 4000Hz, Quadripolar mode, Triangular waveform, Treatment is given for 30mins, 5times a week for 2weeks [12] Patient will be positioned on the couch in prone lying with the treatment part exposed. The skin must be clean before starting the treatment. The electrodes are placed in such a way that the crossing point of two currents lie around the pain area. By a strong but comfortable intensity adjusted according to patient's sensitivity. The intensity is increased for every 5mins depending upon subjects tolerable level [12].

Group-B treated with transcutaneous electrical nerve stimulation for 2 weeks followed by Pilates exercises for 4 weeks [12]. Brief explanation about the procedure was given to the patient. Subject will be positioned on the couch in prone lying with the treatment part exposed. The skin must be clean before starting the treatment. The electrodes are placed with the dimension of 5*5cm over T12 and S1 lines. The TENS will be adjusted to a frequency of 20 Hz, with a pulse width of 330ms, with 2 channels. By using a strong but comfortable intensity adjusted according to patient's sensitivity. The intensity is increased for every 5mins depending upon subject's tolerable level. Each session will last for 30 minutes, 5 times a week for 2 weeks [12].

After the first two weeks, the participants of both Group A and Group B underwent pilates exercise program. Pilates exercises are performed once a day, for 3 days a week for 3 weeks under supervision of Physiotherapist. Repetitions: Exercises Started with 6 to 10 reps. and hold time for 30 sec. Rest period of 2 mins can be given. Warm-up Exercises: These exercises prepare the body for more intense movement (basic stretches of upper limb and lower limb), Starting Position - Neutral Spine. Lie on back with arms by sides. Knees should be bent, legs and feet should be parallel to each other.Inhale, Exhale and use abs to press lower spine into the floor, Inhale to release, Exhale and pull lower spine up, creating a small arch of the low back, Instructions: draw the "belly button" up and in toward the spine while exhaling the spine is in their natural position. These instructions must be maintained throughout the exercise program.

3rd and 4th week exercise: Pelvic tilting, Bridging, Supine hamstring stretch, Dead bugs/single knee float, Side lying (single leg lift)

These exercises are carried out for 5th and 6th week also followed by progression of exercises. Supine gluteal stretch (figure of 4 stretch), Knee hug, Magic circle squeeze, Prone breathing, Prone thoracic extension, Cat stretch, Camel stretch, Quadruped position-single arm lift - single leg lift & opposite arm and leg lift [16].

3. Statistical analysis

All the analysis was done by using SPSS 16.0 software.

Following are the statistical analysis

- Descriptive statistics were used to calculate Mean, SD
- In both Group, Patients who received interferential therapy and pilates exercise program in patients with chronic nonspecific low back pain (Group A) and patients who received Transcutaneous Electrical Nerve Stimulation and Pilates exercise program in patients with chronic nonspecific low back pain (group B). Effectiveness of treatment were calculated by Repeated measure ANOVA.

Independent t-test was used to compare the effect of interferential therapy and pilates exercise program with Transcutaneous Electrical Nerve Stimulation and Pilates exercise program in patients with chronic nonspecific low back pain

Section 1

Table 1: Frequency and Percentage distribution of age for Group-A and Group – B, N=30

Age	Group - A		Group – B	
	Frequency	%	Frequency	%
24 – 30 Year	8	26.6	11	36.7
31 – 40 Year	11	36.7	5	16.6
41 – 50 Year	11	36.7	14	46.7
Total	30	100	30	100

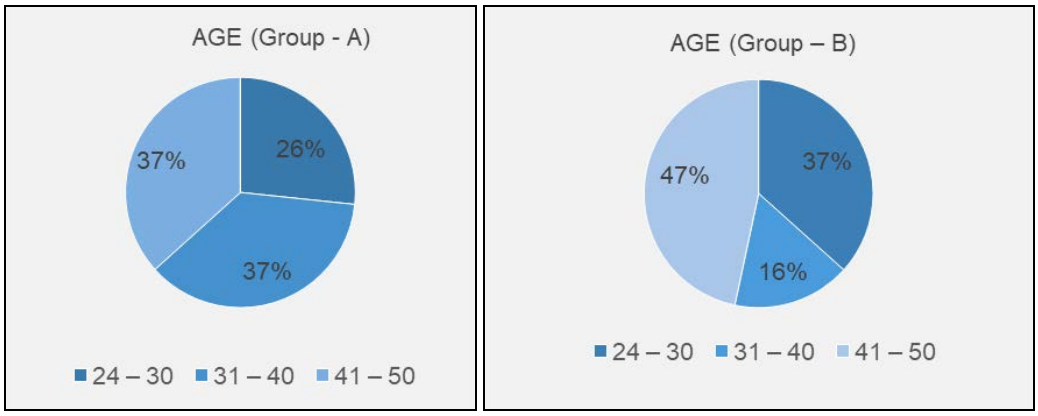

Fig 1: Percentage Distribution of Age for GroupA and Group B

Above table shows Frequency and Percentage of age for Group-A and Group-B. Overall24-to-50-year age group subjects were participated in the study. Majority of 36.7% of participants were belongs to the age group 31- 40 years and 41-50 years in Group-A and in Group-B. Majority of 46.7% of participants were belongs to the age group of 41-50 years.

Table 2: Frequencies and Percentage of Distribution of Gender for Group-A and Group – B, N=30

Gender	Group – A		Group - B	
	Frequency	%	Frequency	%
Male	19	63.3	17	56.7
Female	11	36.7	13	43.3
Total	30	100	30	100

Above table shows Frequency and Percentage of distribution of gender for Group-A and Group – B. 63.3% male and 36.7% female were participated in Group-A and 56.7% male, 43.3% female were participated in Group-B.

Section 2

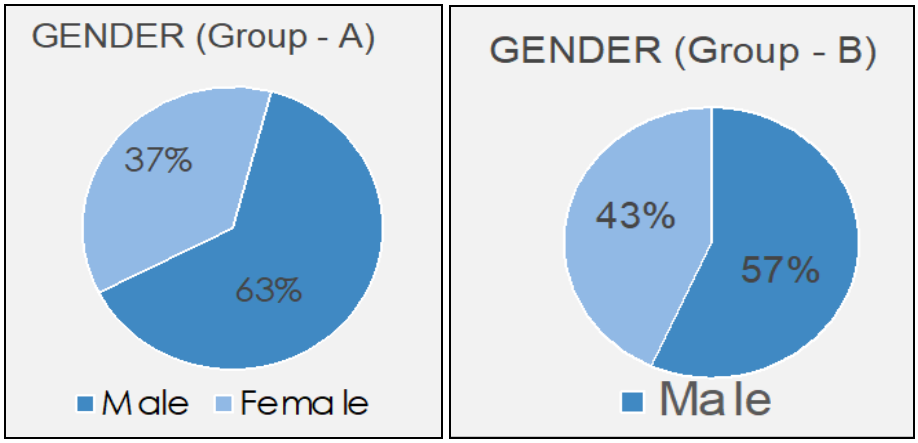

Fig 2: Percentage distribution of Gender for Group-A and Group B

Table 3: Independent's' test for comparison between Group -A and Group -B with VAS score Value

VAS	Group - A Mean	Group - B Mean	Mean Difference	't' Value	p' Value
1st day	7.2	7.13	0.06	0.163	0.872
14th day	5.5	6.03	0.53	1.878	0.07*
28th day	4.2	4.73	0.53	2.598	0.03*
42nd day	3	3.83	0.83	3.74	0.001*

*Significant at $P<0.05$

Above table shows for comparison of Group-A and Group-B with VAS score Value. Group-A client shows more improvement than Group-B. On the Day of 14th t=1.878, 28th day t=2.598, 42nd't'=3.74 values are significant at $P<0.05$. It means there is a comparative difference between Group-A and Group-B.

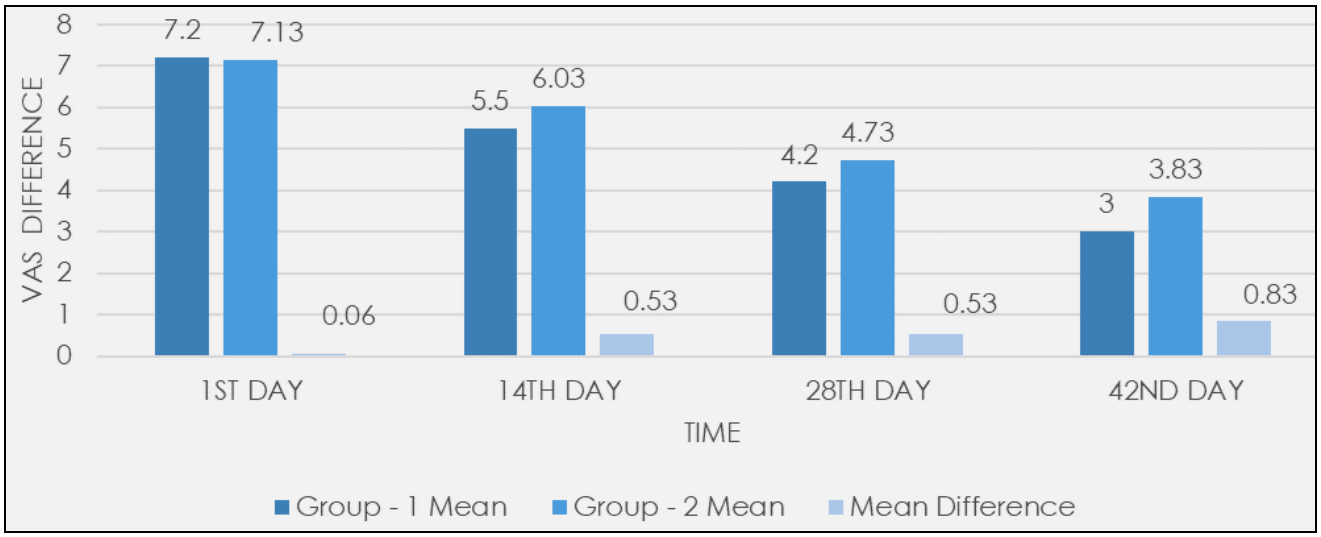

Fig 3: Comparison between Group -A and Group -B with VAS score Value

Table 4: Independent 't' test for comparison between Group-A and Group-B with Modified Schobber's Index [Flexion] score Value

Modified Schobber's Index [flexion]	Group - A Mean	Group - B Mean	Mean Difference	't' Value	p' Value
1st DAY	2.72	2.7	0.02	0.59	0.953
14th DAY	3.81	3.14	0.67	2.348	0.026*
28th DAY	5.02	3.81	1.21	4.395	0.001*
42nd DAY	6.12	4.55	1.57	4.077	0.001*

*Significant at $P<0.05$

Interpretation

Above table shows for comparison of Group-A and Group-B with MODIFIED SCHOBBER'S INDEX [Flexion] score Value. Group-A client shows more improvement than Group-B. On the Day of 14th't'=2.348, 28th day't'=4.395, 42nd 't' =4.077 values are significant at $P<0.05$. It means there is a comparative difference between Group-A and Group-B.

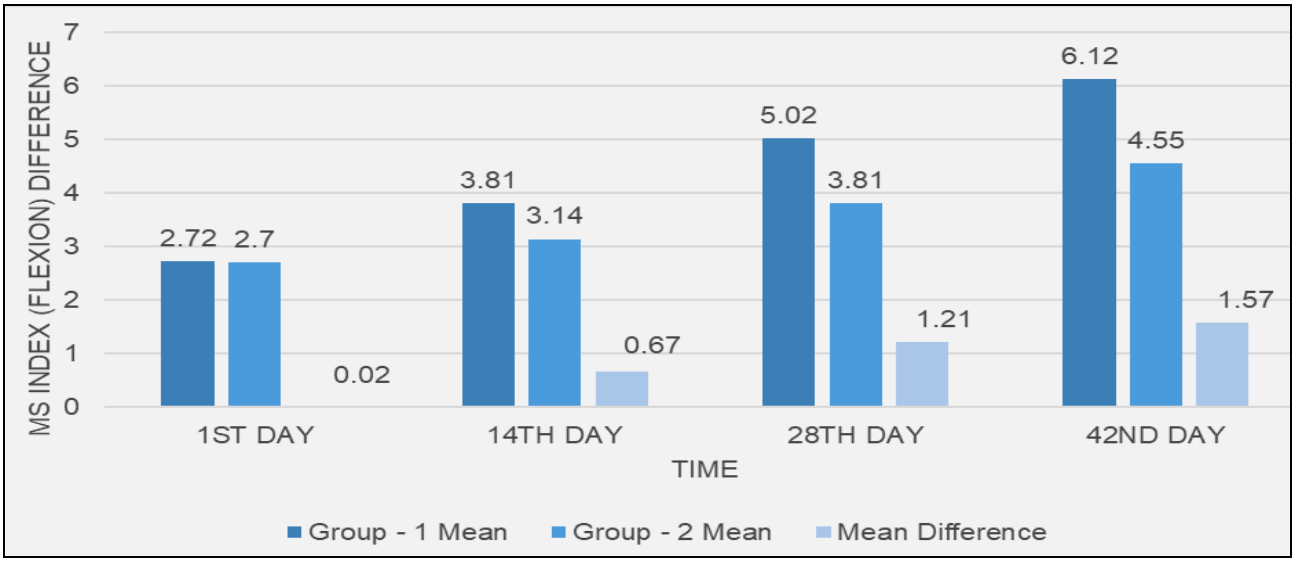

Fig 4: Comparison between Group-A and Group -B with Modified Schobber's Index [Flexion] score Value

Table 5: Independent't' test for comparison between Group-A and Group-B with Modified Schobber's Index [Extension] score Value

Modified Schobber's Index [extension]	Group - A Mean	Group - B Mean	Mean Difference	't' Value	p' Value
1stday	2.37	2.64	0.26	1.204	0.239
14thday	2.99	2.74	0.25	1.104	0.279
28thday	4.04	3.15	0.88	5.407	0.001*
42ndday	4.75	3.87	0.87	5.57	0.001*

*Significant at $P<0.05$

Interpretation

Above table shows for comparison of Group-A and Group-B with MODIFIED SCHOBBER'S INDEX [Extension] score Value. Group-A client shows more improvement than Group-B.

On the Day of 28th day t=5.407, 42nd't' =5.57 values are significant at $P<0.05$. It means there is a comparative difference between Group-A and Group-B.

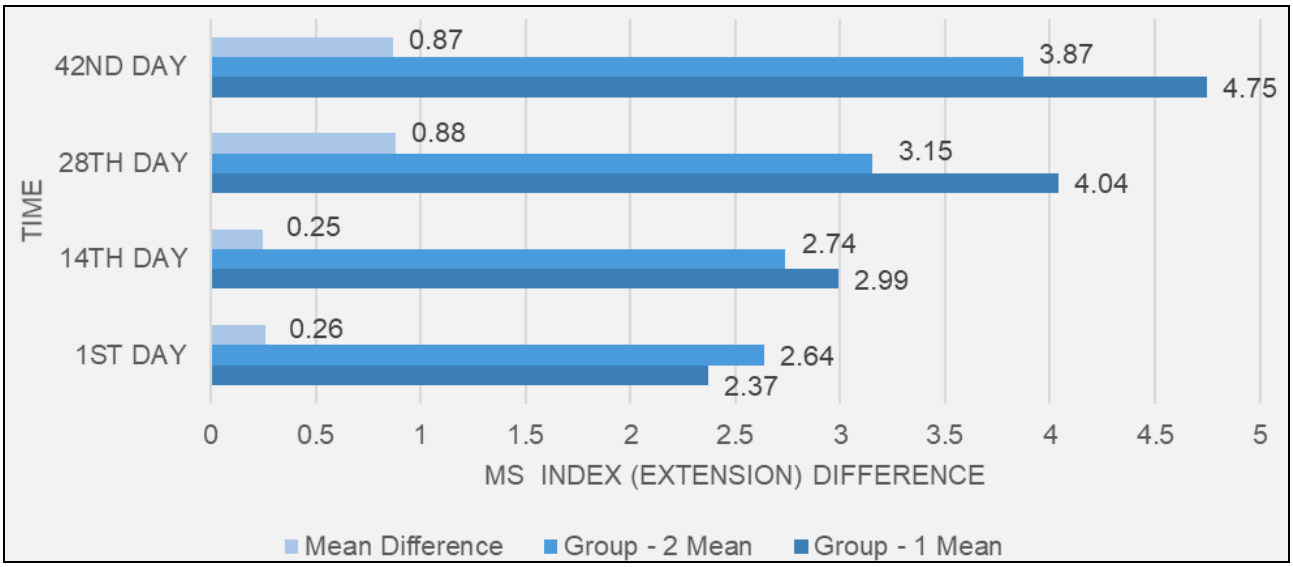

Fig 5: Comparison between Group-A and Group-B with Modified Schobber's Index [Extension] score Value

Table 6: Independent 't' test for comparison between Group-A and Group-B with Roland Morris Disability Index (RMDI) score Value

Roland Morries Disability Questionnaire	Group - A Mean	Group - B Mean	Mean Difference	't' Value	p' Value
1st DAY	18.67	19.13	0.46	0.396	0.695
14th DAY	15.43	17.13	1.7	1.516	0.14
28th DAY	12.46	15.33	2.87	2.285	0.03*
42nd DAY	9.2	12.93	3.73	2.412	0.02*

*Significant at $P<0.05$

Interpretation

Above table shows for comparison of Group-A and Group-B with Roland Morris Disability Index (RMDI)score Value. Group-A client shows more improvement than Group-B. On the Day of 28th day t=2.285, 42nd't' =2.412 values are significant at $P<0.05$. It means there is a comparative difference between Group-A and Group-B.

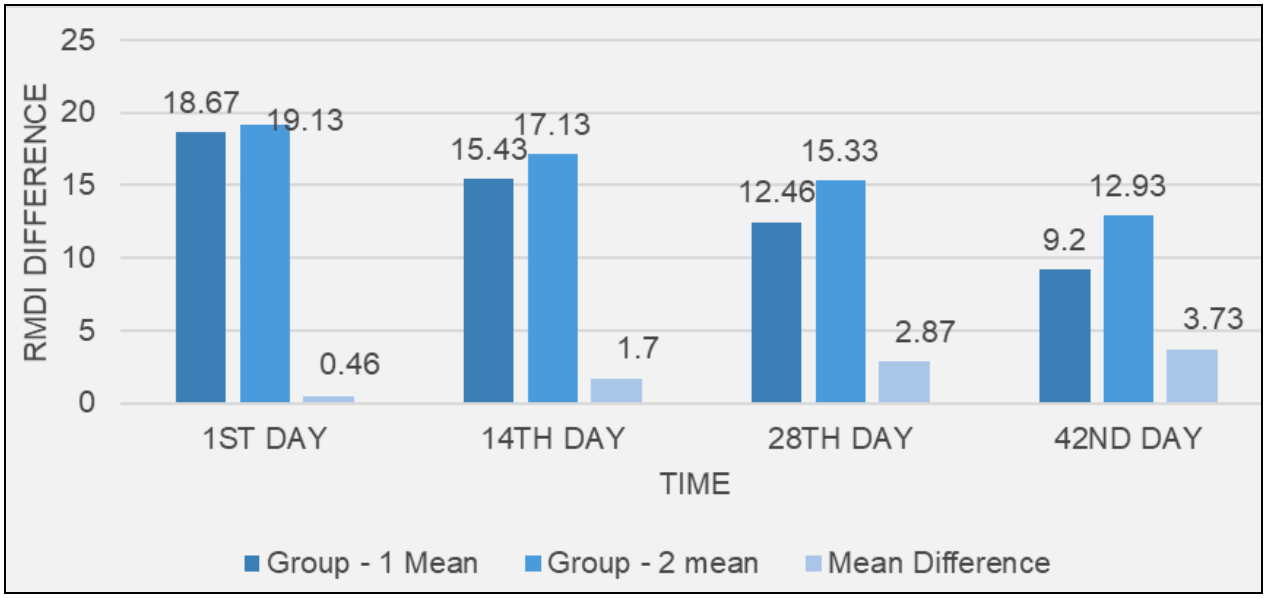

Fig 6: Comparison between Group-A and Group-B with Roland Morris Disability Index (RMDI) score Value

3.1 Testing Hypothesis

By statistical analysis we found that there is a significant difference in the measure of pain (V.A.S.), significant difference seen between measure of Schober's Test [Extension and Flexion], and score of Roland Morris Disability Index (RMDI), in subjects with chronic nonspecific low back pain treated with interferential therapy and Pilates exercise program when compared with the subjects treated with Transcutaneous Electrical Nerve Stimulation and Pilates exercise program. Hence null hypothesis is rejected, and Alternative Hypothesis is accepted.

4. Discussion

Low back ache which was known as an ancient curse and is now known as international epidemic. Low back pain is a common disorder where everyone is affected by it at some time. Most of the people who are affected by low back pain, substantial pain or disability is short lived and they soon

return to normal activities regardless of any advice or treatment they receive. The lower back is commonly defined as the area bounded by the bottom of the rib cage and the buttock creases. Some people with non-specific low back pain may also feel pain in their upper legs. The pre-treatment assessment was taken by using the following outcome measures: VAS, MSI, RMDI and their assessment was repeated on 14th day,28th day and 42nd day respectively. This study comprising of 60 subjects with Chronic Non-Specific Low Back Ache (CNSLBA) were selected with age ranging from 24yrs to 50yrs and divided into Group A and Group B respectively, each consisting of 30 patients. There were 8 patients (26.6%) in group A and 11 patients (36.7%) in group B with their age group between 24 to 30 years. The age group between 31 to 40 years has 11 patients (36.7%) and 05(16.6%) in group A and group B respectively. The age group between 41 to 50 years 11 patients (36.7%) in group A and 14 patients (46.7%) in group B.

The comparison between Group A and Group B, the VAS score p value of 1st day p=0.872, at 14th day p=0.05, at 28thday p=0.03 and at 42nd day p=0.001, where p value was found to be significant (p<0.05).

The comparison between Group A and Group B, the MSI for flexion score p value of 1st day p=.953, at 14th dayp=0.026, at 28th day p=0.001 and at 42nd day p=0.001, where p value was found to be significant (p<0.05).

The comparison between Group A and Group B,the MSI for extension score p value of 1st day p=0.239, at 14th day p=0.279, at 28th day p=0.001 and at 42nd day p=0.001, where p value was found to be significant (p<0.05).

The comparison between Group A and Group B, the RMDI score p value of 1st day p=0.695, at 14th day p=0.14, at 28thday p=0.03 and at 42nd day p=0.02, where p value was found to be significant (p<0.05).

5. Conclusion

Since the mean score of VAS, MSI and RMDI showed improvement in both the groups. But Group A; Interferential therapy and Pilates exercises showed better improvement when compared with Group B; Transcutaneous electrical nerve stimulation and Pilates exercises. Hence, Interferential therapy and pilates exercise are the better line of treatment than Transcutaneous electrical nerve stimulation and Pilate's exercises in treating chronic non-specific low back ache

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