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A Comparative Study to See Effectiveness of Mckenzie Exercises versus Wii-Fit Yoga on Pain and Disability in Patients with Chronic Non-Specific Low Back Pain

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Abstract

Introduction: Chronic Non-specific Low Back Pain (CNSLBP) is one of the common health conditions that persists for more than 12 weeks and not attributed to a recognizable known specific pathology. It occurs in similar proportions in all cultures, causes disability and interferes with quality of life and work performance. Both male and female populations are affected. Exercises play an important part in the management of patients with Low Back Pain. Therefore, this study was done to compare the effectiveness of McKenzie exercises versus Wii-Fit Yoga on pain and disability in patients with Chronic Non-specific Low Back Pain.

Objectives: The objective of the study is to compare effectiveness of McKenzie exercises versus Wii-Fit Yoga on pain and disability in patients with Chronic Non-specific Low Back Pain.

Material and methods: The total duration of the study was one and half year. Total of 45 subjects with Chronic Non-specific Low Back Pain between 20-50 years of age were selected for the study. The subjects were randomly allocated to 3 groups- Group A, Group B and Group C with 15 subjects in each group. Group A was a Control group received SWD and TENS only. Group B was treated with SWD, McKenzie Exercises and TENS. Group C was treated with SWD, Wii-Fit Yoga and TENS. Total 15 treatment sessions was given to each group 5 times a week for 3 weeks. Data was collected on 1st (pre-treatment), 7th (post-treatment) and 15th (post-treatment) session.

Results: The result showed significant improvement in NPRS and ODI scores within the three groups. Between groups analysis showed that there is statistically non-significant difference between effectiveness of McKenzie exercises and Wii-Fit Yoga on pain and disability in patients with chronic non-specific low back pain. Hence, this study supports the null hypothesis.

Conclusions: This study concluded that McKenzie exercises and Wii-Fit Yoga are equally effective in the treatment of chronic non-specific low back pain.

Keywords: Chronic non-specific low back pain; McKenzie exercises; Wii-Fit Yoga; Pain; Disability

Introduction

Low Back Pain (LBP) is one of the most prevalent health conditions and the most expensive which affects the developed world [1]. It affects both genders and all ages. About 70% to 85% of population has low back pain at some point in life [2]. Now days, especially due to industrialization, the number of occurrences is increasing [3].

Low back pain is defined as pain, muscle tension or stiffness localized below the costal margin and above the inferior gluteal folds with or without leg pain [4]. According to the World Health Organization, low back pain is a leading cause of disability. It occurs in similar proportion in all cultures, interferes with quality of life and work performance and is the most common cause of medical consultations [5]. Low back pain recently was rated by the Global Burden of Disease Study as one of the seven health conditions that most affect the world's population and it is considered a debilitating health condition that affects the population for the greatest number of years over a lifetime [6].

In India, occurrence of low back pain is also alarming; it has been reported to be 23.09% [7]. In 2008, Koley et al. surveyed and found that in India 45.63% males and 33.77% females were moderately disabled and 3.35% males and 8.68% females were crippled because of low back pain [8].

Based on the etiology, Low Back Pain is classified as Specific LBP and Non-specific LBP. Specific LBP is defined as back pain attributable to recognizable known specific pathology like nerve root compression, vertebral fracture, tumor, infection, inflammatory diseases, spondylolisthesis or spinal stenosis. Non-specific low back pain is defined as low back pain not

attributable to a recognizable known specific pathology. It is characterized by the absence of any structural change. Of all the LBP patients, 90% are attributed to non-specific low back pain, a disorder which is a health problem of high economic importance [9,10].

According to the duration, Non-Specific Low Back Pain (NSLBP) is sub-classified as acute (less than 6 weeks), sub-acute (6 weeks-3 months) and chronic (more than 3 months) [11].

Chronic Non-specific Low Back Pain (i.e., Low Back Pain of at least 12 weeks duration and without any specific cause) is one of the most common health conditions worldwide that is responsible for reduced functional performance, disability, work absenteeism, emotional distress and high economic costs for its treatment. Given that chronic low back pain is very prevalent, the costs associated with this condition are very high. Approximately 60% of the patients with chronic low back pain did not consider themselves recovered in a period of 1 year from the onset of symptoms, with moderate levels of pain and disability persisting over time [12,13].

The McKenzie approach is one of the most frequently used types of physiotherapy treatment for back pain. The McKenzie method is an active therapy that involves repeated movements or sustained positions with the purpose of minimizing pain and disability and improving spinal mobility. Based on the books titled The Lumbar Spine: Mechanical Diagnosis & Therapy: Volume Two and Treat Your Own Back, the McKenzie method aims to make the patients as independent of the therapist as possible and thus capable of controlling their pain through the practice of specific exercises for their problem. The review by Clare et al demonstrated that the McKenzie method showed better results in short-term pain relief and improvement of disability compared with other active interventions [7].

Nintendo Wii-Fit exercise program has been used for therapeutic effect in various populations. The Nintendo Wii-Fit console is an instrument of biofeedback-based exercise. A user controls a game character in a virtual environment using a remote controller with a motion sensor. The Nintendo Wii-Fit is commercially available and inexpensive.

The Wii-Fit Yoga program from Nintendo, which requires completion of yoga activity in a virtual reality environment, is known to be effective for actually following the yoga movement without any prior professional yoga instructions and training [3].

Material and Methods

Study Design and Setting

An experimental study design was performed in Out-patient Department (OPD) of D.A.V. Institute of Physiotherapy and Rehabilitation, Jalandhar.

Duration of Study and Sample Size

Total duration of the study was one and half year. A total of 45 patients both males and females between the age group of 20-50 years with chronic non-specific low back pain were selected for the study.

Sampling

Convenient sampling was done.

Selection criterias

All the subjects were selected on the basis of following criteria.

Inclusion criteria

- Age group between 20-50 years.
- Gender- both males and females.
- Subjects with chronic non-specific low back pain of at least 3 months duration.
- NPRS - Mild to moderate pain (0-6).
- ODI score should be at least 10%.

Exclusion criteria

- History of spinal surgery.
- Patients with “red flags” for a serious spinal condition (e.g. fever, infections, tumors).
- Patients with impaired balance.
- Spinal pathologies like spondylolisthesis, spinal canal stenosis, caudaequina syndrome, slip disc, radicular symptoms and inflammatory diseases like Ankylosing Spondylitis and Rheumatoid arthritis.
- Neurological conditions (hemiplegia, peripheral nerve injuries, head injuries, diabetic neuropathy).
- Musculoskeletal problems (spinal fracture, structural deformity, recent lower limb fracture, lower limb deformity, leg length discrepancy).
- Pregnancy (few exercises and modalities are contraindicated).
- Uncooperative patients.

Variables

Independent variables

- SWD (Short Wave Diathermy)
- TENS (Transcutaneous Electrical Nerve Stimulation)
- McKenzie Exercises
- Nintendo Wii Fit Yoga

Dependent variables

- Numeric Pain Rating Scale (NPRS)
- Oswestry Disability Index (ODI)

Instrumentation

- Nintendo Wii-Fit
- SWD (Short Wave Diathermy)
- TENS (Transcutaneous Electrical Nerve Stimulation)

Method of collection of data

Total of 45 subjects who met the inclusion criteria were selected in the study. A written consent was obtained from all the subjects. After doing the required assessment, all the subjects were assessed for pain level with the help of Numeric Pain Rating Scale (NPRS) and for functional disability with the help of Oswestry Disability Index (ODI). Then the subjects were conveniently allocated to three groups i.e. Control group - Group 'A' and Experimental groups - Group 'B' and Group 'C' with 15 subjects in each group. In Group A, the treatment was Short Wave Diathermy (SWD) and Transcutaneous Electrical Nerve Stimulation (TENS). In Group B, the treatment was SWD, McKenzie Exercises and TENS. In Group C, the treatment was SWD, Wii-Fit Yoga and TENS.

Total 15 treatment sessions were given to each group over the course of 3 weeks with 5 sessions each week. Data was collected on 1st (pre-treatment) session, 7th (post-treatment) session and 15th (post-treatment) session.

Procedure

Intervention for Group A

In all the subjects of 'Group A', SWD was given for 15 minutes by coplanar method at the lumbo-pelvic region [14,15]. Then, TENS was applied for 15 minutes. The four electrodes were securely placed over the lumbar region. The frequency of the output was set at 5Hz and a pulse width of 150 µs. A comfortable intensity was adjusted according to each patient's sensitivity [16-18].

Intervention for Group B (McKenzie exercise group)

Firstly, SWD was applied for 15 minutes by condenser method. Then patient performed McKenzie exercises for 30 minutes including resting period. Five exercises were performed: three extension type and two flexion type exercises. The extension type exercises were performed in prone and standing positions and the flexion type exercises were carried out in the supine and sitting positions. The final position of each exercise was maintained for 10 seconds. About 10 repetitions of each exercise were performed. At last TENS was applied for 15 minutes with frequency of 5 Hz and pulse width of 150 µs [4,19,20].

Intervention for Group C (Wii-Fit Yoga group)

SWD was applied for 15 minutes before patient performed Wii-Fit Yoga and TENS (5 Hz, 150 µs) was applied after patient performed the Wii-fit Yoga. 30-minute virtual reality-based Yoga program using Wii Fit activities was performed. There were five Yoga poses: half-moon pose, warrior pose, knee to chest pose (standing knee pose), palm tree pose and chair pose. Participants had readily checked their posture and weight bearing on a screen as they shifted their weight or changed their postures on the Wii-fit board. Four minutes of exercises were performed followed by one minute of rest. A longer resting period was also provided where desired [3].

Data Analysis and Results

Data analysis was performed using SPSS software version 16.0. Inter group comparisons were done. Following tests were used

- For within group analysis, repeated measure ANOVA was used.
- For between group analysis, one way ANOVA and post hoc analysis by Tukey's method were used.

Table 1. Comparison of Mean for AGE.

GROUPS	MEAN ± SD	F-value	p-value	SIGNIFICANCE
A	34.20 ± 10.394	1.330	>0.05	NS
B	32.13 ± 9.628			
C	28.60 ± 8.399			

Table 1 and Figure 1: One way ANOVA was done to value for age was 1.330 (p>0.05). There was statistical non- compare the mean of age between group A, B and C. The F- significant difference in age between all 3 groups.

Table 2. Comparison of Mean between group A, B and C for NPRS.

DAYS	GROUP A	GROUP B	GROUP C	F-value	p-value	SIGNIFI-CANCE

	MEAN ± SD	MEAN ± SD	MEAN ± SD			
DAY 1	5.40 ± 0.737	5.33 ± 0.724	5.07 ± 0.884	0.758	>0.05	NS
DAY 7	4.60 ± 0.737	2.93 ± 1.033	2.47 ± 0.915	23.125	<0.05	S
DAY 15	3.87 ± 0.834	1.33 ± 1.047	0.60 ± 0.737	56.657	<0.05	S

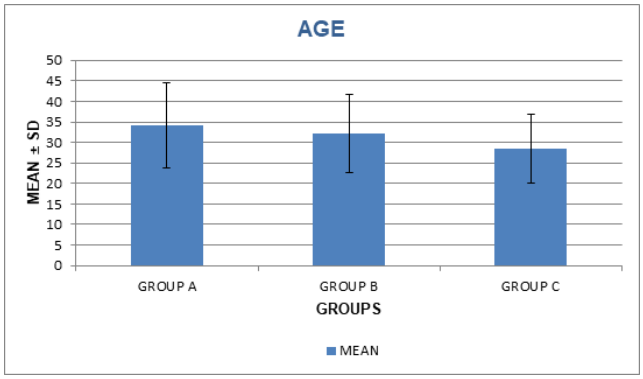

Figure 1. Comparison of Mean for AGE.

Table 2 and Figure 2: One way ANOVA was done between the group A,B and C for variable "NPRS" to check for the difference between the groups. The F-values for NPRS were 0.758 (p>0.05), 23.125 (p<0.05) and 56.657 (p<0.05). There was non-significant difference between all 3 groups: group A, group B and group C on day 1 and statistically significant difference between control group (group A) and experimental groups (group B and Group C) at day 7 and day 15.

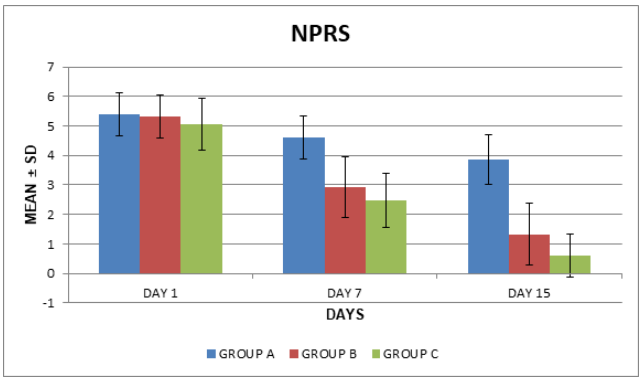

Figure 2. Comparison of Mean between group A, B and C for NPRS.

Table 3. Post hoc Comparison of Mean between groups A, B and C for NPRS.

GROUPS	DAY 15 MEAN ± SD	p-value	SIGNIFICANCE
GROUP A Vs GROUP B	3.87 ± 0.834 1.33 ± 1.047	<0.05	S
GROUP B Vs GROUP C	1.33 ± 1.047 0.60 ± 0.737	>0.05	NS
GROUP A Vs GROUP C	3.87 ± 0.834 0.60 ± 0.737	<0.05	S

Table 3: Post hoc analysis by Tukey's method was done between group A, B and C for variable NPRS. It concludes that there was statistical significant difference (p<0.05) between control group- group A (3.87 ± 0.834) and experimental groups- group B (1.33 ± 1.047) and group C (0.60 ± 0.737) at day 15 in case of NPRS. There was statistical non-significant difference (p>0.05) between both experimental groups- group B (1.33 ± 1.047) and group C (0.60 ± 0.737) at day 15 which showed that both the groups (B and C) are equally effective in reduction of pain in patients with chronic non-specific low back pain.

Table 4 and Figure 3: One way ANOVA was done between the group A,B and C for variable "ODI" to check for the difference between the groups. The F-values for ODI were 0.596 (p>0.05), 23.560 (p<0.05) and 51.967 (p<0.05). There was non-significant difference between all the 3 groups at day 1 and statistically significant difference between control group (group A) and experimental groups (group B and group C) at day 7 and day 15.

Table 4. Comparison of Mean between groups A, B and C for ODI.

DAYS	GROUP A MEAN ± SD	GROUP B MEAN ± SD	GROUP C MEAN ± SD	F-value	p-value	SIGNIFICANCE

DAY 1	30.84 ± 7.487	28.89 ± 7.134	28.11 ± 6.507	0.596	>0.05	NS
DAY 7	27.49 ± 6.856	17.54 ± 6.079	12.61 ± 5.078	23.560	<0.05	S
DAY 15	23.00 ± 7.292	6.93 ± 5.167	3.39 ± 3.840	51.967	<0.05	S

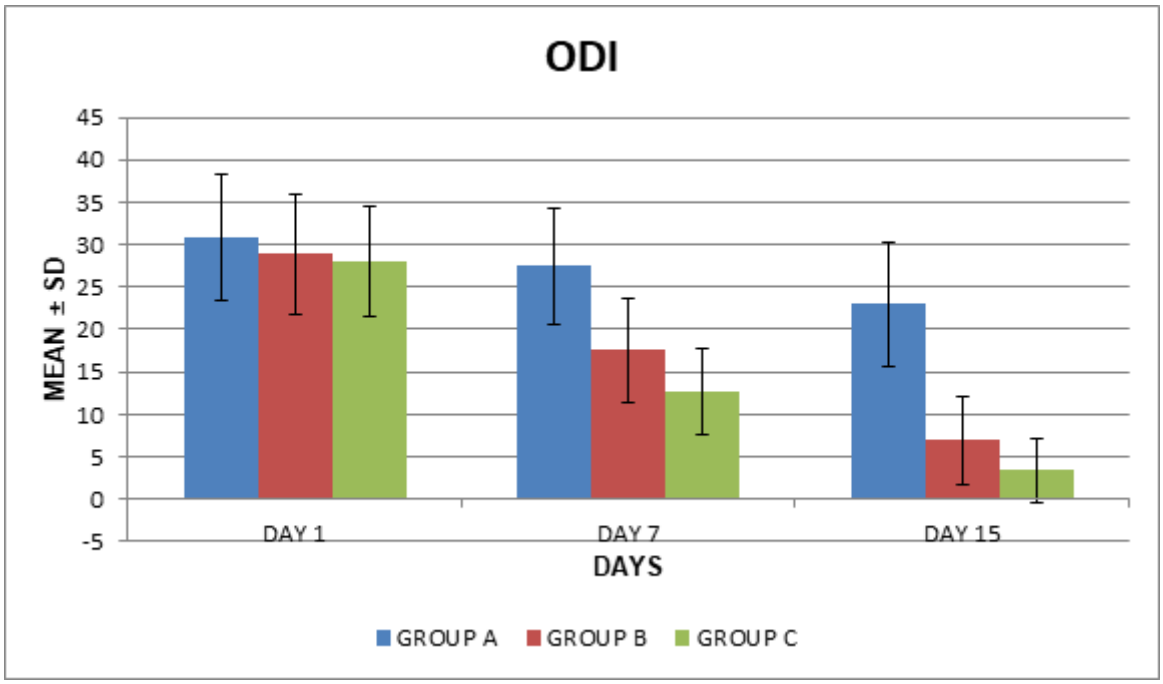

Figure 3. Comparison of Mean between groups A, B and C for ODI.

Table 5. Post hoc Comparison of Mean between groups A, B and C for ODI.

GROUPS	DAY 15 MEAN ± SD	p-value	SIGNIFICANCE
GROUP A Vs GROUP B	23.00 ± 7.292 6.93 ± 5.167	<0.05	S
GROUP B Vs GROUP C	6.93 ± 5.167 3.39 ± 3.840	>0.05	NS
GROUP A Vs GROUP C	23.00 ± 7.292 3.39 ± 3.840	<0.05	S

Table 5: Post hoc analysis by Tukey's method was done between the group A, B and C for variable ODI. It concludes that there was statistical significant difference ($p<0.05$) between control group- group A (23.00 ± 7.292) and experimental groups- group B (6.93 ± 5.167) and group C (3.39 ± 3.840) at day 15 in case of ODI. There was statistical non-significant difference ($p>0.05$) between both experimental groups- group B (6.93 ± 5.167) and group C (3.39 ± 3.840) at day 15 which showed that both groups (B and C) are equally effective in reduction of disability in patients with chronic non-specific low back pain.

Discussion

The study was aimed to find and compare the effectiveness of McKenzie exercises and Wii-Fit Yoga on pain and disability in patients with Chronic Non-specific Low Back Pain. In group A i.e. control group, within group analysis of variables NPRS and ODI showed significant improvement. From this study, it is noticed that SWD and TENS are effective to decrease pain and disability in chronic non-specific low back pain.

There could be various possible reasons for improvement in control group. According to Khan et al. (2013) and Ahmed et al. (2009) shortwave diathermy is a deep heating modality of physical treatment. It has significant effect on relief of pain and increased temperature in the tissues due to heat causes

increased arterioles and capillary dilatation followed by increased blood flow to the area. The increase in temperature alter the physical properties of fibrous tissue as found in the tendons, joint capsules, scars and tissues yield more readily to stretch when heated. According to Debsarma et al. (1999) deep heating modality is more effective than superficial heat in pain management in chronic low back pain patients [14,15].

Therefore, it has been concluded that application of SWD is effective for the treatment of patients with chronic low back pain.

The reduction of pain in all the 3 groups can also be due to application of TENS. Transcutaneous Electrical Nerve Stimulation (TENS) has been increasingly used in physical therapy for the relief of acute and chronic pain. There are a number of mechanisms that helps to reduce pain by the application of TENS. The development of pain relief with application of TENS was based on the Gate control theory conceptualized by Melzack and Wall. [16,17,21].

So from the above discussion, it is clear that SWD and TENS have attributed to reduce pain and disability in all the three groups.

In group B (i.e. experimental group), within group analysis for variables NPRS and ODI have shown significant improvement. From this analysis, it is noted that SWD, McKenzie exercises and TENS are effective to decrease pain and disability in chronic non-specific low back pain.

The McKenzie method is popular amongst physiotherapists as a management approach for spinal pain. The McKenzie method utilizes an assessment process which aims to identify patients within the non-specific spinal pain population whose symptoms behave in a similar way when subjected to mechanical forces. It is one of the widely considered to be a highly effective program for patients with non-specific spinal pain. After the treatment, there is significant improvement in pain reduction and spinal elasticity and movements. During this exercise program, postural correction is needed as well as observation of all changing in pain intensity and location. McKenzie program can start in acute pain and performed in all pain stages. [22,23]

The McKenzie method is one of the few methods used in physical therapy that advocates for the independence of patients and this method also provides patients with tools to promote their autonomy in managing the current pain and even future recurrences. [6]

Brian et al, in reviewing the literature concluded that the McKenzie method is a highly effective program for reducing the pain in the spine. So this method appears to be an effective technique for patients with non-specific low back pain. [1]

In group C (i.e. experimental group), within group analysis of variables NPRS and ODI have shown significant improvement. From this analysis, it is noticed that Wii-Fit Yoga is an effective technique in reducing pain and disability in patients with chronic non-specific low back pain.

Wii-Fit Yoga and stretching are known to be effective for relief of LBP symptoms and are widely utilized as rehabilitative therapeutic exercises. Unique positions of Wii-Fit Yoga are reported to increase activities of the parasympathetic system, which in turn increase the levels of thalamic GABA and it also increases the level of peripheral nerve activity. Wii-Fit Yoga promotes strengthening and relaxing of muscles and ligaments and the right alignment of the body can be sustained. It can aid in alleviation of pain through activation of weakened muscles. In addition, adequate relaxation of muscles allows for effective muscle contraction. Thus, it can be suggested as a strengthening exercise program for weakened muscles. The isometric poses of the Wii-Fit Yoga program trains the smaller muscles around the spinal joints to bear more pressure and make the person performing the poses work harder to stabilize themselves. Poses that force us to balance on one leg while standing and change elevation or rotate train supporting muscles to work in ways strictly for stability and balance.

Use of a virtual reality system using a computerized environment in which people can experience a similar situation can be helpful in obtaining interactive simulation. Especially in rehabilitation therapy, where repetitive feedback and motor learning are necessary, a virtual reality system can provide adequate motivation of such a mechanism. By providing direct feedback, the virtual reality system created with Wii Fit not only provides fun for participants but also promotes greater balance. A virtual reality-based yoga program can improve functional level and reduce the fear of low back movement. Carpenter et al. (1999) reported that in patients with chronic LBP, a decrease in physical activity would lead to a decrease in lumbar muscle size and power, thus causing a repeated increase in LBP and stress, eventually resulting in a vicious circle. For this reason, he suggested that strengthening major weakened muscles such as the lumbar extension muscles could be a method for prevention of such repeating cycles. In addition, feedback provided from the virtual reality program would have increased the participant's motivation and concentration. [3]

The gaming components of Nintendo Wii exercise program encourage participants to enjoy exercise and significantly improved both the physical and mental composites of health-related qualities of life. [24]

The result of between group analysis supports the null hypothesis that there is non-significant difference between the effectiveness of McKenzie exercises and Wii-Fit Yoga on pain and disability in patients with chronic non-specific low back pain. Hence, both McKenzie exercises and Wii-Fit Yoga are equally effective.

We could not compare our data to other studies because no similar calculations or comparison of these two exercise protocols has been reported and no study was found comparing these two protocols to the best of my knowledge.

Limitations of the Study

- The sample size for the study was small.

• Home exercise program was not advised because it could not be monitored.

• External factors affecting the progress could not be controlled.

• The study was limited to 15 intervention sessions only and absence of follow up after the termination of intervention period.

Conclusion

The result of the study concludes there is statistically non-significant difference between effectiveness of McKenzie exercises and Wii-Fit Yoga in decreasing pain and disability in patients with chronic non-specific low back pain. Therefore, this study supports the null hypothesis. In conclusion, it is clear that both McKenzie exercises and Wii-Fit Yoga are equally effective in reducing pain and disability associated with Chronic Non-specific Low Back Pain.

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