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Comparative Effects of Pulsed Electromagnetic Field Therapy Versus Pulsed Ultrasound Therapy on the Range of Motion in Knee Osteoarthritis

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Abstract

This randomized controlled study compared the effectiveness of pulsed electromagnetic field (PEMF) therapy and pulsed ultrasound therapy on the range of motion in 40 knee osteoarthritis patients. Divided into two groups of 20, Group A received PEMF therapy, while Group B underwent pulsed ultrasound therapy over an 8-week period. Data analysis using SPSS version 23.0 revealed significant improvements in both groups. The ultrasound group showed an increase in the range of motion from 110.1 ± 1.651 to 113.75 ± 0.786 degrees ($p=0.001$), and the PEMF group showed an increase from 109.65 ± 1.725 to 113.75 ± 0.786 degrees ($p=0.000$). Both therapies were effective in improving the range of motion in patients with knee osteoarthritis. The pre and post-operatively range of motion of the US group was 109.65 ± 1.725 degrees and 113.75 ± 0.786 degrees respectively with a p-value of 0.000 which is significant. When assessing range of motion, both ultrasound and pulsed electromagnetic field therapy are used.

Keywords: Knee Osteoarthritis, Pulsed Electromagnetic Field Therapy (PEMF), Pulsed Ultrasound Therapy, Range of Motion, Randomized Controlled Trial, Physical Therapy, Joint Mobility, Pain Management

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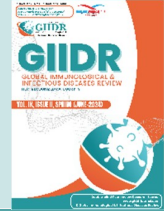
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Comparative Effects of Pulsed Electromagnetic Field Therapy Versus Pulsed Ultrasound Therapy on the Range of Motion in Knee Osteoarthritis

Abstract

This randomized controlled study compared the effectiveness of pulsed electromagnetic field (PEMF) therapy and pulsed ultrasound therapy on the range of motion in 40 knee osteoarthritis patients. Divided into two groups of 20, Group A received PEMF therapy, while Group B underwent pulsed ultrasound therapy over an 8-week period. Data analysis using SPSS version 23.0 revealed significant improvements in both groups. The ultrasound group showed an increase in the range of motion from 110.1 ± 1.651 to 113.75 ± 0.786 degrees ($p=0.001$), and the PEMF group showed an increase from 109.65 ± 1.725 to 113.75 ± 0.786 degrees ($p=0.000$). Both therapies were effective in improving the range of motion in patients with knee osteoarthritis. The pre and post-operatively range of motion of the US group was 109.65 ± 1.725 degrees and 113.75 ± 0.786 degrees respectively with a p-value of 0.000 which is significant. When assessing range of motion, both ultrasound and pulsed electromagnetic field therapy are used.

Keywords: [Knee Osteoarthritis](#), [Pulsed Electromagnetic Field Therapy \(PEMF\)](#), [Pulsed Ultrasound Therapy](#), [Range of Motion](#), [Randomized Controlled Trial](#), [Physical Therapy](#), [Joint Mobility](#), [Pain Management](#)

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Introduction

Osteoarthritis is a commonly found degenerative disease of the cartilaginous systems of the body and is associated with hypertrophy of the bone (Sinusas, 1961). Osteoarthritis is said to be one of the leading

causes of disability around the world (Mora, Przkora, & Cruz-Almeida, 2018). These types of degenerative diseases are said to affect more than 250 million individuals around the globe, with 27 million of these individuals affected only in the United States (Bannuru,



2015; Nelson, 2014; da Costa, 2016). The prevalence of different types of arthritis is said to be similar to that of Western nations, but there are some inherent differences in the clinical and biochemical presentation of the diseases (Akhter, 2011). The various risk factors that are associated with osteoarthritis include genetic predilection, female sex, aging, obesity, and trauma (Yucesoy, 2015). When it comes to the largest synovial joint of the human body, the knee joint is one of them, it bears the entire weight of the body and due to its immense use and stress on the body, it is said to be a frequent area for the development of osteoarthritis. Knee osteoarthritis (OA) is classified as either primary being idiopathic or non-traumatic in nature, or secondary, being due to either trauma or misalignment mechanically. It is now believed that OA is a multifactorial disease that has many causative agents such as trauma, forces, inflammation, metabolic changes, and biochemical reactions (Ayhan, 2014). The inflammation process is still not fully understood when it comes to OA, however, it is known that the inflammation in OA is chronic and low grade in nature. The synovial fluid in OA is said to possess many inflammatory mediators (Richards, 2016). Sadly, OA is a progressive disease with no signs of regression or restoring of damaging structure, thus treatment is primarily down to symptom control, lifestyle modifications, and if need be surgical intervention of the involved joint. Pulsed electromagnetic field (PEMF) is a procedure in which pulsed energy waves are generated into the damaged or wounded body parts of the body and studies indicate they are used to treat depression and non-union fractures of the body (Martiny, 2010). Furthermore, PEMF is said to alleviate the pain of arthritis (Sutbeyaz, 2005). Similarly, Ultrasound (US) is a form of mechanical energy that uses mechanical vibrations. compare the effectiveness of pulsed electromagnetic field versus pulsed ultrasound therapy on the range of motion in knee osteoarthritis patients. Pulsed US is also available and many clinicians prefer to use this as a way of therapy. Pulsed US has been used as a therapeutic agent, with studies indicating that the US is said to have an anti-inflammatory effect, leading to the normalcy of inflammatory events, and ultimately leading to total healing (Wilkin, 2004). Considering that both of these therapeutic agents have an effect on the healing mechanism in the body, a study was conducted to assess the comparative effects of pulsed electromagnetic field therapy versus pulsed ultrasound therapy in knee osteoarthritis.

Methodology

This randomized control trial was conducted at the "Body Works Ortho- Neuro- Sports Physical Therapy & Megnatotherapy Center". Using a randomized sampling technique, 40 knee Osteoarthritis patients from Karachi were selected after attaining ethical approval from the institutional review board. The study lasted for a period of six months after the approval of the synopsis. All the patients with intermediate osteoarthritis were randomized into two clinical groups of 20 patients randomly. Before the commencement of the study, all the patients were given informed consent and then therapy was performed. In Group A pulsed electromagnetic field therapy was used while in Group B pulsed ultrasound therapy was used as the treatment modality. This randomized control study consisted of 40 patients with confirmed diagnoses of knee osteoarthritis and divided participants of the study into two different groups of 20 each. Group A consisted of 20 patients who were treated with Pulsed electromagnetic field therapy (PEMF) and Group B consisted of 20 patients who were treated with Pulsed ultrasound. The intervention period spanned for 8 weeks, after which post-treatment assessment was carried out. Data was collected and analyzed using SPSS version 23.0. Therapeutic intervention was carried out for 8 weeks after which post-treatment assessment outcomes were measured and collected. Data was collected using the goniometry of the knee joint using a universal goniometer. All the data was analyzed using SPSS version 23.0, with descriptive data represented as mean and standard deviation, as well as frequency and percentage. T-test was applied in this case to analyze the pre and post-results. The p-value was set at <0.05 .

Results

Table 1, shows the descriptive statistics of the ultrasound group in which the mean age was 52.45 years with a standard deviation of ± 4.55 , and the mean duration of pain was 2.05 months with ± 0.686 .

Table 2, shows the descriptive statistics of the pulsed electromagnetic field therapy group in which the mean age was 49.15 years with a standard deviation of ± 3.60 and the mean duration of pain was 1.55 months with ± 0.686 .

Table 3, and Figure 1 show the gender of the ultrasound group which the 50% male and 50% female.

Table 4, and Figure 2 show the gender of the pulsed electromagnetic field therapy group which the 65% male and 35% female.

Table 5, and Figure 3 show the affected knee of the ultrasound group in which 4, 40% participants have affected right knee whereas 60% left knee.

Table 6 and Figure 4 show the affected knee of the pulsed electromagnetic field therapy group in which 35% of participants have affected right knee whereas 65% left knee.

Table 7 and Figure 5 shows the comparison mean of the Range of motion of the ultrasound group in which the pre-treatment mean of knee flexion was 110.10 degrees with a standard deviation of ± 1.651 and a post-treatment mean was 113.75 degrees with a standard deviation of ± 0.786 . The t-value was -10.908 and the p-value was 0.001 which is significant.

Table 8 and Figure 6 show the comparison mean of the Range of motion of the pulsed electromagnetic field therapy group in which the pre-treatment mean of knee flexion was 109.65 degrees with a standard deviation of ± 1.725 and post-treatment mean was

113.75 degrees with a standard deviation of ± 0.786 . The t-value was -8.252 and the p-value was 0.000 which is significant.

The mean age of the patients in the US group and PEMF group were 52.45 ± 4.55 & 49.15 ± 0.36 years respectively. The mean duration of pain in the US group and PEMF group was 2.05 ± 0.686 and 1.55 ± 0.686 months respectively. The pre and post-operatively range of motion of the US group was 110.1 ± 1.651 degrees and 113.75 ± 0.786 degrees respectively with a p-value of 0.001 which is significant. The pre and post-operatively range of motion of the US group was 110.1 ± 1.651 degrees and 113.75 ± 0.786 degrees respectively with a p-value of 0.001 which is significant. The pre and post-operatively range of motion of the US group was 109.65 ± 1.725 degrees and 113.75 ± 0.786 degrees respectively with a p-value of 0.000 which is significant. Conclusion: When assessing range of motion, both ultrasound and pulsed electromagnetic field therapy showed improved range of motion in patients with knee osteoarthritis.

Table 1

Descriptive Statistics (Ultrasound Group)

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age of the Participants in years	20	42	59	52.45	4.559
Duration of Pain in months	20	1	3	2.05	.686

Table 2

Descriptive Statistics (PEMF Group)

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age of the Participants in years	20	40	60	49.15	6.360
Duration of Pain in months	20	1	3	1.55	.686

Table 3

Gender of the Participants (Ultrasound Group)

Variable	Frequency	Percent
Male	10	50.0
Female	10	50.0
Total	20	100.0

Table 4

Gender of the Participants (PEMF Group)

Variable	Frequency	Percent
Male	13	65.0
Female	7	35.0
Total	20	100.0

Table 5

Affected Knee (Ultrasound Group)

Variable	Frequency	Percent
Right Knee	8	40.0
Left Knee	12	60.0
Total	20	100.0

Table 6

Affected Knee (PEMF Group)

Variable	Frequency	Percent
Right Knee	7	35.0
Left Knee	13	65.0
Total	20	100.0

Table 7

Range of motion (Ultrasound Group)

Variable	Pre-Treatment Mean, S.D	Post-Treatment Mean, S.D	t-Value	P-Value
Knee Flexion in degree	110.10, \pm 1.651	113.75, \pm .786	-10.908	0.001

Table 8

Range of motion (PEMF Group)

Variable	Pre-Treatment Mean, S.D	Post-Treatment Mean, S.D	t-Value	P-Value
Knee Flexion in degree	109.65, \pm 1.725	113.75, \pm .786	-8.252	0.001

Figure 1

Gender of the Participants (Ultrasound Group)

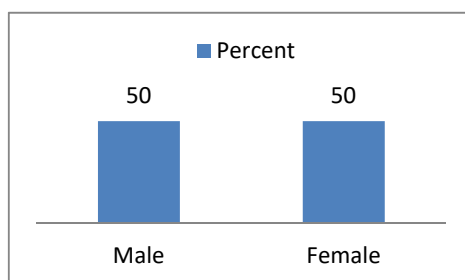


Figure 2

Gender of the Participants (PEMF Group)

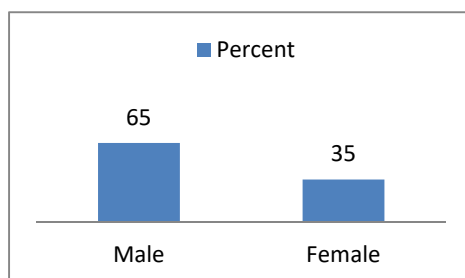


Figure 3

Affected Knee (Ultrasound Group)

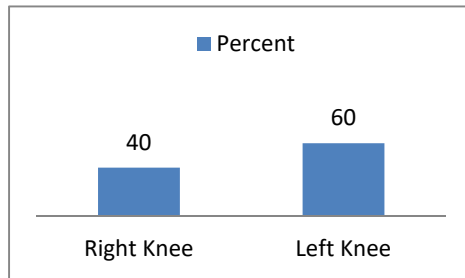


Figure 4

Affected Knee (PEMF Group)

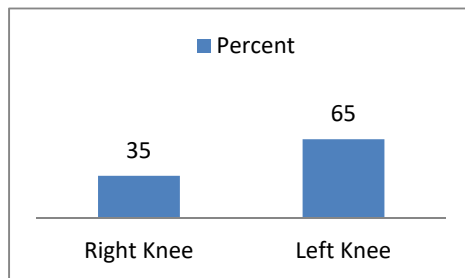


Figure 5

Range of motion (Ultrasound Group)

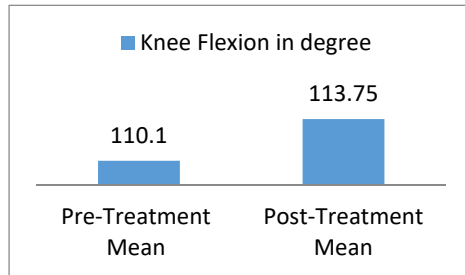
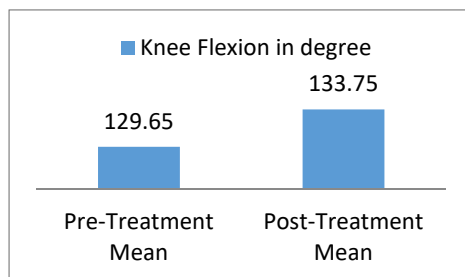


Figure 6

Range of motion (PEMF Group)



Discussion

Knee OA is said to increase, most likely due to aging and the increasing number of the population becoming obese (Heidari, [2011](#)). The symptoms of knee osteoarthritis vary according to the cause of the problem. The most common symptom of knee OA is pain which is either dull, sharp, intermittent, or constant in nature. The range of motion of the knee also decreases. Upon further clinical examination, popping or grinding sounds may also be heard with reported muscle weakness as well. These features usually manifest as things related to difficulty in walking, climbing stairs, performing house chores, and ultimately have a negative psychological impact on life (Mahir, [2016](#)). Malik et al., in their study, determined the prevalence along with the quality of life in people with Knee OA in Pakistan and found that the mean age of the participants was 48.96 ± 6.804 years, with the majority of the individuals being female. Furthermore, it was found that the prevalence of Knee OA was seen in middle-aged adults and the people affected with this disease had a moderately affected quality of life (Malik, [2022](#)). This study was designed to assess the benefits of PEMT and US on knee OA patients on the basis of range of motion. The current study was successfully able to see that the range of motion did improve significantly in both groups. Both the PEMT and US groups showed similarly significant difference differences. These findings are in line with another study conducted by Pipitone et al, who found a statistically significant effect in terms of range of motion and pain in individuals with knee OA (Pipitone, [2001](#)). Another study conducted by Samaan et al used high-

intensity laser therapy and low-level pulsed ultrasound to see its effect and found that both were effective in improving knee range of motion (Samaan, [2022](#)). Another study conducted compared high-level laser therapy and pulsed electromagnetic field on chronic nonspecific lower back pain and found that both of these physiotherapeutic modalities can be useful in treating chronic nonspecific lower back pain (Abdelbasset, [2021](#)). Using PEMFT leads to a reduction in joint and muscular discomfort, reduces edema in the joint, improves mobility of the joint, decreases disability, and overall improves the quality of life. These findings can be compared to our study as well (van Nguyen, [2002](#)). Studies pertaining to ultrasound's efficacy on knee OA are said to be few in number. However, one study, conducted by Kozanglu et al compared the efficacy of ibuprofen and US treatment and concluded that both modalities were helpful in improving knee range of motion, a finding consistent with our own (Kozanoglu, [2003](#)). It is safe to say that both therapeutic modalities are beneficial, however, it is necessary to conduct more studies and larger randomized clinical trials to validate the findings.

Conclusion

The study compared the effects of ultrasound (US) and pulsed electromagnetic field (PEMF) therapy on knee osteoarthritis. Pulsed electromagnetic field treatment and pulsed ultrasound were shown to be beneficial in lowering discomfort during activities, according to the findings of this study both ultrasound and pulsed electromagnetic field therapy effectively improved the range of motion in patients with knee osteoarthritis.

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