

Efficacy of Applying Mild-Magnetic Compression versus Massage Therapy on Hand-Joints' Functional Disability Symptoms among Patients with Rheumatoid Arthritis

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Abstract

Background: Functional disability of hand-joints' usually preceded by pain, stiffness, swelling, and tenderness that are the foremost disturbing symptoms for rheumatoid arthritis patients, that adversely affects their capacity to carry out daily tasks and, as a result, degrades their whole quality of life. **The aim of the current study was to** evaluate the efficacy of applying mild magnetic compression versus massage therapy on hand-joints' functional disability symptoms among patients with rheumatoid arthritis. **Design:** The research design used in this study was quasi-experimental. **Setting:** The present study was carried out at the Menoufia University Hospital's rheumatology and rehabilitation outpatient clinics, Menoufia Governorate, Egypt. **Subjects:** A purposive sample of 100 adult rheumatoid arthritis patients who volunteered to participate in the study and met the inclusion criteria were randomly divided evenly into two groups. **Tools:** **1.Participants' characteristics questionnaire** to assess their socio-demographic features, past, present medical and family history. **2. THE SF-SACRAH** (Short Form Assessment and Quantification Score of Chronic Rheumatic Affections of the Hands), had been adopted to assess the degree of hand joints' pain, stiffness and functional disability **3. Ritchie Articular Index**, which is a self-reported questionnaire, had been adopted to quantify the magnitude of hand joints' swelling and tenderness. **Results:** The study's primary findings demonstrated significant post-intervention improvements in a variety of hand-joints' functional disability symptoms along all the three domains of **SF-SACRAH** scale including; pain, stiffness and functional disability subscales especially among patients of mild-magnetic compression group than in massage therapy group. Additionally, the **Ritchie Articular Index** mean total scores concerning hand-joints' functional disability symptoms including; swelling and tenderness subscales revealed a high significant improvement post-intervention than pre- among mild-magnetic compression group than massage therapy group. **Conclusion:** There was a beneficial positive relationship between mild magnetic compression and different hand-joints' functional disability symptoms as the daily application of mild-magnetic compression gloves led to improvements in a variety of hand-joints' functional disability symptoms including; pain, stiffness, swelling, tenderness and function more efficiently than did massage therapy. **Recommendations:** A mild-magnetic compression glove is simple, safe, easy and inexpensive therapy that should be incorporated into the daily medication schedule of patients with rheumatoid arthritis. Study replications with extended follow-up periods to enable a better understanding of the impact of mild-magnetic compression and to give the potential for results' generalization and to ascertain the true therapeutic efficacy, safety, and cost-effectiveness of mild-magnetic compression therapy for particular clinical disorders, larger and more stringent randomized controlled trials are also required.

Keywords: Mild-Magnetic Compression, Massage Therapy, Hand joints' Functional Disability symptoms, Rheumatoid Arthritis

Introduction

Functional disability of hand-joints' usually preceded by pain, stiffness, swelling, and tenderness, which considered the foremost disturbing symptoms among patients with rheumatoid arthritis (RA) and negatively impact their daily activities and quality of life

(Hochberg et al., 2017). The World Health Organization (WHO) ranked rheumatoid arthritis as the second leading cause of disability and reported that between 2020 and 2030, disability related to musculoskeletal disorders will rise by 48 percent (WHO, 2020).

More frequent than back pain and heart diseases, arthritis causes pain, tenderness, stiffness, swelling, and loss of joint function, making it the most common cause of disability worldwide (Hochberg et al., 2017) and (Lawrence et al., 2020). Rheumatoid arthritis, gout, lupus, and fibromyalgia are the most prevalent kinds of arthritis (Hochberg et al., 2017). According to estimations of the (Centers for Disease Control and Prevention, National Center for Health Statistics, 2022), 54.4 million American adults, equating about 25% of the U.S.A. population had at least one form of arthritis; and by 2040, that number is expected to rise to 78 million (Centers for Disease Control and Protection, 2021) & (Arthritis Foundation, 2019).

The most common theory for the origin of arthritis is that eventually as people age, the cartilage that protects and lubricates the ends of their joints will wear away then becomes thinner and thinner until one-bone rubs up against another leading to loss of function and disability (Michaud et al., 2019).

The damage caused by rheumatoid arthritis (RA), is a chronic systemic autoimmune disease that is primarily involving the joints, is mediated by cytokines, chemokines, and metalloproteases (American Rheumatology Association, 2018). Characteristically, peripheral joints like wrists, metacarpophalangeal and proximal interphalangeal joints are prone to a symmetrical inflammation, leading to progressive destruction of their articular structures, typically followed by functional disability and accompanied by systemic symptoms (National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2014).

The systemic and joint symptoms of rheumatoid arthritis (RA) frequently appear together in an insidious manner. Joint symptoms typically include early morning stiffness of affected joints, excruciating pain, tenderness and swelling along with, systemic symptoms that include generalized afternoon fatigue and malaise, anorexia and weakness at the same time joint symptoms usually include early morning stiffness of (American Rheumatology Association, 2018).

In particular, in the first year of the disease's progression 80 percent of patients develop some kind of irreversible joint abnormality; the disease advances quickly during its first six years, mostly at the first year (Majithia & Geraci, 2017). Individual patients' disease course is unpredictable, but once the condition worsens, numerous joints may become involved resulting in gradual degradation of joint structures resulting in deformations, deterioration of joint function and ultimately a functional disability of the joints (Minor et al., 2017 & Rausch et al., 2018).

Typically, joints become stiff for more than 60 minutes after waking up in the morning and after any prolonged period of inactivity; this condition is known as gelling, where the involved joints become tender, erythematic, warm, swollen, and associated with a restriction of movement leading to functional disability (Park & Chang, 2019). The most frequently affected joints are the wrists and the index (second finger) and middle (third finger) metacarpophalangeal and proximal interphalangeal joints (Symmons et al., 2021). Millions of RA patients worldwide may simultaneously, experience functional disability, which could lead to unemployment, decreased productivity at work, higher healthcare costs, and a lower quality of life since it has been noted that their risk of developing functional disability increases as the disease progresses (Lozano et al., 2021).

Concurrently, little progress has been made despite the significant effort being expended into understanding the causes and treatments for RA (Majithia & Geraci, 2017). Additionally, the goal of all frequently prescribed medications for RA treatment such as DMARDs (Disease Modifying Anti-Rheumatic Drugs), Non-steroidal anti-inflammatory drugs (NSAIDs) and Corticosteroids is solely intended to alleviate symptoms such as pain and inflammation. Furthermore, despite the fact that these medications are frequently linked to serious side effects, they do not provide a full cure, and both medical practitioners and patients have worries about them (Smolen et al., 2016 & Singh et al., 2016). For instance, because of their high levels of toxicity, DMARDs cannot be tolerated for lengthy periods and NSAIDs have reportedly been linked to the development of stomach ulcers that can lead to perforation, bleeding, and even death (Wang et al., 2019) hence, patients are

constantly looking for a treatment without potentially harmful side effects (Vaysbrot et al., 2011).

Along with scientific and technological advancement, physical medicine provides creative and innovative treatment alternatives (Vaysbrot et al., 2011). One of these possibilities is Magnetotherapy or magnetic therapy, where research indicated that it has been shown some genuine promise for treating rheumatoid arthritis, since it can enhance healthy circulation in the arthritic joints, reducing swelling and improving quality of life (Smolen et al., 2018).

Magnetotherapy, also known as magnetic therapy, is the usage of a weak, static magnetic field to relieve pain by promoting blood flow. Magnets are typically made of iron, steel or rare-earth elements that can be taped to a joint, worn as a bracelet, or incorporated into other products like a mattress pad, hand gloves or shoe soles (Smolen et al., 2018). Magnet therapy is believed to be safe for the majority of individuals; however, it should not be used on patients who have pacemakers or insulin pumps (Segal et al., 2021).

Additionally, as blood contains iron, it can act as a conductor of magnetic energy, causing blood flow to rise and, in turn, the supply of nutrients to the cells so, static mild magnetic compression might modify how cells function, magnets can alter or restore the equilibrium between cell death and growth (Richmond et al., 2019). Furthermore, nerve cells' reactions to pain may be impacted by mild pulsed electromagnets. Pulsed electromagnets may alter the brain's perception of pain and can influence the production of white blood cells that fight infections and inflammation (Segal et al., 2021).

According to the reports of (National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2014) (NIAMSD), magnets can aid in reducing arthritis pain and enhancing flexibility of muscles, joints, and tendons. Magnets can aid in reducing inflammation and easing stiffness of the joints brought on by arthritis via boosting circulation that results in enhanced blood flow to arthritic joints, improved movement, and reduced pain (Segal et al., 2021).

Permanent magnet-based therapeutic devices are widely accessible and simple to use

(Felson et al., 2021). A more natural and risk-free substitute for analgesic drugs may also be shown in magnetic compression therapy (Segal et al., 2021). The prospect that magnet therapy could lessen the financial burden associated with treating chronic musculoskeletal illnesses is intriguing to researchers in health care service (Richmond et al., 2019). Manufacturing magnets is incredibly inexpensive, and prolonged medical care entails high standards for quality, safety, efficacy, and cost-effectiveness (Felson et al., 2021).

The management of chronic pain brought on by musculoskeletal disorders like RA has drawn the attention of the public, and magnetic therapy today seems to be one of the most popular rehabilitation treatment alternatives (National Collaborating Centre for Chronic Conditions, 2019). Numerous individuals are displaying their readiness to purchase magnetic products, as the estimated worldwide annual sales of these products, which are marketed for health purposes, are accounted to be between one and four billion dollars (Richmond, 2018).

Besides, massage therapy is another traditional form of physical therapy. The practice of massage therapy entails the manual or mechanical manipulation of the body's skin, muscles and connective tissues (Leśniewicz et al., 2021).

Massage therapy requires a qualified professional individual to apply it otherwise; it can result in harmful effects. Depending on who applies it, massage therapy may be either relaxing and calming, or rough and intense. The use of therapeutic massage on affected joints or during flare-ups of rheumatoid arthritis must be avoided, even if it can be useful in relieving pain by relaxing sore muscles, tendons, and joints (Macfarlane et al., 2019). Because some massage techniques may involve applying intense pressure to sensitive tissues and joints or moving limbs into positions that may be difficult for rheumatoid arthritis patients, it is crucial to first consult the patient's rheumatologist or primary care physician to ensure that massage is safe (Leśniewicz et al., 2021 & Macfarlane et al., 2019).

Additionally, there is an evidence to support the theory that various physical therapy interventions, such as magnetic compression

and massage; may slightly minimize intensity of pain, slightly enhance physical function of the joints, and may lead to a slight difference in joints' stiffness, swelling and tenderness, all of which may help to delay the progression of functional disability (Grote et al., 2017).

Accordingly, creating a plan of consistent and routine use of mild-magnetic compression therapy instead of the intermittent use of massage therapy has numerous advantages for rheumatoid arthritis patients, including increasing joints' range of motion through reducing inflammation and swelling consequently, reducing joint pain, tenderness and preventing or even delaying the progression of functional disability. Thus, the present study's aim was to assess the efficacy of mild-magnetic compression versus massage therapy on hand-joints' functional disability symptoms among patients with rheumatoid arthritis.

Significance of the study:

RA affects 1% of the world's population while, the annual worldwide RA incidence is approximately between 5 and 50 cases per 100,000 populations newly developing the condition each year (Lozano et al., 2021). Globally, it resulted in about 49,000 deaths in 2020, and the national prevalence estimates approximately 1% increasing with age and peaking between the ages of 35 and 50 years (Lozano et al., 2021 & Symmons et al., 2021). Whilst according to the (WHO, 2020), RA affects about 1.3% of the population in Egypt, with women being affected three to five times more frequently than men. Furthermore, approximately 80% of arthritis patients, according to the (CDC's)(Centers for Disease Control and Prevention, National Center for Health Statistics, 2022), are functionally independent, but over time and as the disease progresses, significant functional disability is usually observed thus, the prevention of functional decline is a key objective in those patients' rehabilitation.

The current study can be used to promote the RA patients' rehabilitation as it provides an opportunity for those patients to use more natural treatment options with fewer side effects, while maintaining adherence to their medication.

Aim of the study:

The present study aimed at assessing the efficacy of mild-magnetic compression versus massage therapy on hand-joints' functional disability symptoms among patients with rheumatoid arthritis.

Research hypotheses:

The following research hypotheses were formulated to accomplish the study's aim:

1. Patients who apply mild magnetic compression (study group I) will exhibit a decreased intensity of hand-joints' pain, stiffness, swelling and tenderness than massage therapy (study group II) patients will do.
2. Patients who apply mild magnetic compression (study group I) will exhibit a greater improvement in the function of hand-joints' than massage therapy patients (study group II) will do.
3. There will be a significant difference concerning severity of hand-joints' functional disability symptoms between the two study groups, mild-magnetic compression group (study group I) and massage therapy group (study group II)

Operational definition:

- **Mild magnetic compression** is the practice of utilizing a weak, static magnetic field to alleviate or decrease joints' discomfort by enhancing circulation (Richmond et al., 2019 & Grote et al., 2017). In this study, mild magnetic compression was applied through using hand gloves where magnets are built into its cloth.
- **Massage therapy** is the manual or mechanical manipulation of the body's skin, muscles and connective tissues. In the current study, massage was applied on patients' hand joints according to the specified regimen prescribed by rheumatologist (Leśniewicz et al., 2021 & Macfarlane et al., 2019).
- **Functional disability** is referred to the loss of some or all of a joint's functioning ability or the inability of a joint to perform its functions. **Functional disability** symptoms of hand-joints in this study include **Pain**,

stiffness, swelling and tenderness, that are the primary complaints of rheumatoid arthritis patients and are considered to be the classic distressing symptoms (Lozano et al., 2021).

Pain is discomfort, ache or soreness of a joint, while stiffness is the difficulty or limited movement of a joint, which consequently results in pain and functional disability, whereas tenderness is the pain that worsens with movement of the affected joint through its normal range of motion or with pressure applied to its skin surface (American Rheumatology Association, 2018). Additionally, swelling refers to the enlargement of a joint as a result of fluid accumulation in the soft connective tissues surrounding the joint called synovitis (Minor et al., 2017).

II. Subjects and Method

Design: This study used a quasi-experimental research approach, which involves manipulating independent variables without subject randomization, pretest-posttest analysis, and generally has higher internal validity than correlational studies but lower internal validity than actual experiments. **Setting:** This study was carried out at the Menoufia university hospital's outpatient clinics' waiting room of rheumatology and rehabilitation. **Subjects:** One hundred adult rheumatoid arthritis patients made up a purposive sample were randomly assigned equally into two study groups (mild magnetic compression (study group I) and massage therapy (study group II). The sample size was calculated according to the following formula (Daniel, 1999) :

Where z = level of confidence as stated by the standard normal distribution (for a level of confidence of 95%, $z = 1.96$). p = estimated proportion of population that have the characteristic (when unknown we use $p = 0.5$), d = (d is considered 0.05).

The following criteria were taken into consideration when selecting the present study participants:

Inclusion criteria:

- Adult diagnosed with rheumatoid arthritis
- Male or female

- Complain of persistent or intermittent pain of at least three months prior to study
- Within the last 24 hours and despite taking medications, the current level of pain is greater than 30/100 mm on a pain visual analogue scale (VAS)
- Adherence to the recommended RA treatment regimen for at least 4 weeks prior to study entry

Exclusion criteria:

- Pacemakers or similar implanted devices
- lack of adherence to the prescribed medications as directed
- Has deformity in hand joints
- Has cancer or is currently receiving treatment for it
- Using of a magnetic device on a regular basis
- Taking any medications that might have an impact on hand function, such as high-dose prednisone (>10 mg/day) or medications with a similar effect
- Had another disorder, such as fibromyalgia, neurological disorders, peripheral vascular diseases

Tools: In this study, three instruments were utilized to gather data:

1. **Participants' characteristics questionnaire** created by the researcher to gather information about participants' characteristics of socio-demographic features and medical data. This questionnaire asked about subjects' age, gender, marital status, place of residence, occupation, level of education and income, past, present medical and family history.

2. **The Short Form Score for Assessment and Quantification of Chronic Rheumatic Affections of the Hands (SF-SACRAH)**, which was adapted from (Rintelen et al. 2009), is based on patients' self-reports and covers three domains; function, stiffness, and pain. It consisted of five questions to be answered on visual analogue scales (VASs: 0-100 mm) to quantify the magnitude of hand-joints' functional disability, pain and stiffness; three questions

$$n' = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\epsilon^2 N}}$$

on function, one question on stiffness and one question on pain.

Scoring system for (SF-SACRAH) scale (Rintelen et al., 2009):

- For the three questions concerning function domain, a score of 0 indicates “no functional disability /or/ possible function with no difficulty” while, a score of 10 indicates “function is impossible / unable to do”
- For the question concerning stiffness domain, a value of 0 denotes “no stiffness” and value of 10 denotes “unbearable stiffness”
- For the question concerning pain domain, a score of 0 indicates “no pain” and value of 10 indicates “unbearable pain.”

The total score of SF-SACRAH is calculated by finding the sum up of the answers given to each question with a subsequent division by five (the number of questions). Thus, the SF-SACRAH is easily calculated on a visual analogue scale ranges from 0 to 10 with higher scores indicating more functional disability, stiffness and pain (Rintelen et al., 2009)

For the Total SF-SACRAH score:

0 = no pain/stiffness or functional disability (function is possible).

(1-3) = mild pain/stiffness/ functional disability.

(4-6) = moderate pain/stiffness/ functional disability.

(7-9) = severe pain/stiffness/ functional disability.

(10) = unbearable pain/stiffness and function is impossible.

Reliability:

The SF-SACRAH with its Likert scale format from 0 to 10 appeared to provide strong internal consistency (standardized item alpha 0.731 and 0.837, respectively), ensuring simple completion and speedy calculation in less than 1 min, making it simple to use by non-rheumatologists (Sautner et al., 2009). The average alpha and gamma for the SF-SACRAH, were calculated by (Leeb et al., 2003) and amounted to be 0.869 and 0.897, respectively, indicating high internal consistency. While,

(Bombardier et al., 2016) came to the conclusion that the SF-SACRAH proved to be an efficient, concise and practicable instrument to evaluate how well rheumatoid arthritis met the requirements of daily routine with regard to hand involvement.

3. Ritchie Articular Index is an adopted 4-point rating scale used to evaluate the degree of hand joints' tenderness and swelling, where each hand joint is given a rating from 0 to 3. (0= No tenderness or no swelling, 1= mild Tenderness or swelling, 2= moderate Tenderness or swelling and 3= severe Tenderness or swelling), in response to pressure on the joint margin or by passive movement of the joint. Since anatomically, the two human hands contain 30 joints are; 2 wrists, 10 Metacarpophalangeal/ MCP (bases of fingers and thumb), 10 Finger proximal interphalangeal /finger PIP (middle of fingers and thumb) and 8 Distal interphalangeal /DIP (tips of fingers) ¹⁸¹. Hence, the overall score of RITCHIE ARTICULAR INDEX can range from 0 to 90 with higher scores indicating increased severity of symptoms and more disease activity (Ritchie et al., 1986).

- A score of 0 noted no tenderness or swelling for all hands' joints
- A score of 1-30 noted mild tenderness or swelling for hands' joints
- A score of 31-60 noted moderate tenderness or swelling for hands' joints
- While a score of 61-90 noted severe tenderness or swelling for all hands' joints

Reliability:

Test-retest reliability done by (Prevo et al., 1993) concluded that the Pearson correlation between the baseline and retest scores was 0.96, suggesting an excellent reproducibility for the RITCHIE ARTICULAR index score. They discovered that it correlates well with changes in the patient's condition and the standardized responses mean (SRM) of 0.74 was equivalent to the Brigham score's 0.76 for such joint specific outcome measures. This demonstrates the RITCHIE ARTICULAR index's ability to change in accordance with alterations in the patient's condition and its capacity to detect even minute changes. Additionally, the internal

consistency and reliability of the RITCHIE ARTICULAR index were evaluated using Cronbach's alpha and intra-class correlation coefficients (ICC), when (Norman et al., 2015) tested its reliability and validity, and displayed good reproducibility and were within the ranges of 0.87-0.95 and 0.55-0.81 for RA and 0.87-0.94 and 0.66-0.78 for OA, respectively.

Methods:

The current study was conducted over a five-month period beginning on January 1 and ending on May 31, 2020.

- **Approval:** After describing the purpose of the study, the director of Menoufia University hospital, medical director of outpatient clinics as well as the outpatient rheumatology and rehabilitation clinics' chief nurses gave their official permission to carry out this study.
- **Human rights and ethical considerations:** just patients who consented to participate and met the requirements of inclusion and exclusion were chosen. All subjects from both groups gave their informed consent during the initial interview after explaining the study's purpose. The researcher reaffirmed the confidentiality of all data and the voluntariness of study participants and participants are free to leave the study whenever they wanted.
- **Validity:** A board of five experts specialized in medical surgical nursing reviewed and evaluated the current study's instruments and modifications were made as necessary to ascertain relevance and thoroughness.
- **Reliability:** Cronbach's alpha coefficients were used to calculate the internal consistencies of The SF-SACRAH scale and RITCHIE ARTICULAR index internal consistencies and results were 0.94 and 0.95, respectively indicated strong reliability. Test-retest reliability of the SF-SACRAH scale and RITCHIE ARTICULAR index internal ICCs ranged from 0.77 to 0.94 and 0.80 to 0.98, respectively.
- **Pilot study:** Prior to data collection, a pilot study was carried out on ten patients (10%) in order to evaluate tools of the present

study for their clarity, objectivity, thoroughness, applicability, practicability, and relevance. Additionally, it was carried out to determine if there would be any challenges or issues that might arise throughout the data collection process, and for estimating the precise amount of time required for each patient to complete the study tools also aided in making the appropriate adjustments. The pilot study's data were not included in the current study findings.

Data collection Procedure:

- For the aim of participating in the study, feasibility visits were made at the Menoufia university hospital's outpatient clinics of rheumatology and rehabilitation.
- Every patient involved in this study underwent two separate interviews. RA patients were required to schedule two appointments per week on Saturdays and Wednesdays. Patients of both study groups, mild-magnetic compression group (I) and massage therapy group (II), were asked to complete the SF-SACRAH questionnaire and RITCHIE ARTICULAR INDEX at two subsequent consultations in the outpatient clinic. Each interview lasted about 25 minutes.
- Using tool I, the researcher conducted the initial interview with each study group participant to gather information about his or her sociodemographics, past medical and family history.
- The researcher next assessed the pre-intervention SF-SACRAH and RITCHIE ARTICULAR INDEX scores regarding hand-joints' functional disability symptoms for both study groups using tools II and III.
- Afterward, the researcher gave each participant in study group (I) one pair of mild magnetic compression gloves with built-in static magnets, instructed him/her to wear them through the whole daytime and take them off before going to bed until the next appointment date.
- Besides, the researcher performed a simple massage for hands' joints of each participant in study group (II) according to the

rheumatologist's recommendations, and instructed them to continue applying it daily by the same technique until their next consultation.

- All patients of both study groups maintained taking their prescribed medications.
- The second individual interview was conducted by the researcher to assess the post-intervention **SF-SACRAH** and **RITCHIE ARTICULAR INDEX** scores regarding hand-joints' functional disability symptoms for participants of both study groups at the next appointment date of each patient at the Menoufia university hospital's outpatient clinics of rheumatology and rehabilitation through using tool II and III.
- All participants of both studied groups were assessed twice for their hand joints' pain, stiffness, swelling, tenderness and functional disability using instruments II, and III; the first time immediately during the first interview and the second time after one week of intervention.
- In order to evaluate the effectiveness of mild magnetic compression versus massage therapy on hand joints' pain, stiffness, swelling, tenderness and functional disability, scores of both study groups were compared.

III. Statistical Analysis

Using SPSS software, arrangement, tabulation, and statistical analysis were done for the collected data (Statistical Package for Social Sciences, version 21, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean, and standard deviation were computed, while Chi-square test (χ^2) was used for qualitative data to compare between two groups and more.

The means of two related groups (pre and post-test data) of parametric data, were compared using the paired t-test, whilst correlation between variables was assessed using the Pearson's correlation coefficient (r) and significance was set at $p < 0.05$ for the purposes of interpreting the results.

IV. Results:

According to table (1), there were no statistically significant differences existed between study and control group subjects regarding their sociodemographic features, where the participants' mean age was 43.2 ± 13.4 years for patients of mild magnetic compression (group I) and 40.1 ± 11.6 years for massage therapy (group II) patients. More than half of studied patients were females (53%) and married (56%), lived in rural areas (62%), did not have a job (62%), and (39%) of them had elementary education. Concerning income, 77% of them had insufficient monthly earnings.

Table (2) revealed that about half (49%) of participants in this study had a history of the illness in their families, but there was no statistically significant difference between the two study groups ($P=0.7$). Regarding hospitalization, approximately half of studied patients (45.4%) had previously been hospitalized twice and majority (56.3%) of those patients reported that their hospitalization was due to surgical reasons with a statistical significance regarding the number of hospitalizations between the two groups of patients ($P=0.02$).

Table (3) displayed the percentage distribution of pre- and post-intervention total SF-SACRAH scale scores for patients of both studied groups. It highlighted that both study groups had high rates of functional disability at the pre-intervention stage, ranging from 52.5% to 77.50%. In addition, patients of both groups had high rates of stiffness and pain at 77.50% and 70%, respectively across all three SF-SACRAH domains, with mean total SF-SACRAH scores that were more or less similar (17.3 ± 1.2 & 16.5 ± 1.7 respectively) and no statistically significant differences ($P=0.6$).

In addition, this table illustrated that, at the post-intervention stage, there was significant percentage distribution of SF-SACRAH scale total scores, particularly among patients who received mild magnetic compression (group I), ranged from 2.5% to 77.5% at all the three domains of SF-SACRAH scale. Additionally, using the Independent Simple T test technique, the mean post-intervention total SF-SACRAH scores were (9.3 ± 1.01) for mild magnetic compression

(group I) & (13.6±1.8) for massage therapy (group II) patients, with a highly significant statistical difference ($P=0.000$). Moreover, among patients with mild magnetic compression (group I), a high significant difference was seen when comparing the mean total SF-SACRAH scale scores before and after the intervention, (paired t test = 1.2, and $P=0.000$)

Table 4: highlighted that, in the pre-intervention stage, patients of both mild magnetic compression (group I) and massage therapy (group II), had higher percentages of RITCHIE ARTICULAR INDEX total scores ranged from 2.5% to 50% for "Wrists, Finger Metacarpophalangeal, proximal and distal interphalangeal joints" with a mean total RITCHIE ARTICULAR INDEX scores (4.7.5±0.9&5.1±0.8 respectively). This difference was statistically significant ($P=0.04$).

Moreover, this table's post-intervention stage data revealed that patients with mild magnetic compression (group I) had improvement in percentages of RITCHIE ARTICULAR INDEX total scores for "Wrists, Finger Metacarpophalangeal, proximal and distal interphalangeal joints" ranged from 0.0 % to 47.5 %. In addition, the mean post-intervention total RITCHIE ARTICULAR INDEX scores were {2.8±0.9 for mild magnetic compression (group I) & 6.1±1.5 for massage therapy (group II) patients}, with a high significant difference statistically ($P=0.000$) through using Independent sample T test procedure. Additionally, patients with mild magnetic compression (group I) showed a highly significant difference between their mean total RITCHIE ARTICULAR INDEX scores pre and post-intervention, (paired t test = 1.4, $P=0.000$).

Table 5: revealed a high significant post-intervention improvement in various hand-joints' functional disability symptoms ($p=0.000$) than pre-intervention was seen particularly for mild magnetic compression (group I) patients. Concerning hand joints' function disability, at pre-SF-SACRAH intervention, majority of patients of both studied (I) & (II) groups experienced severe functional disability with their hands (70% & 67.5% respectively).

In addition, the results of post-SF-SACRAH intervention showed that approximately half (42.5%) of patients within magnetic compression group (I) had mild hand joints' function disability and the remaining percentage (52.5%) of patients had moderate hand joints' function disability.

At the same time, the difference was highly significant statistically ($P=0.000$) among those of group II, where the majority of them (85%) experienced severe hand joints' function disability, while only (15%) reported moderate hand-joints' function disability. Additionally, when group I patients' pre and post SF-SACRAH intervention was compared across different categories of hand-joints' functional disability, as well as mean total hand-joints' functional disability scores, it revealed a highly significant post-intervention reduction in hand-joints' functional disability. Unfortunately, patients of group II did not experience these results since none (0%) of them had mild hand joints' function disability.

Regarding hand-joints' stiffness, at the pre SF-SACRAH intervention stage, hand-joints' stiffness comprised a problem for both studied groups, where the majority had stiffness (65% & 77.5% respectively). The post SF-SACRAH intervention results showed almost all (97.5%) of group I patients were found to have mild stiffness, whereas of group II the percentage of patients who experienced moderate stiffness increased to be (87.5%), this difference was highly statistically significant ($P=0.000$). Additionally, when comparing the various stiffness categories and the mean total stiffness score between group I patients before and after the SF-SACRAH intervention, it was shown that the stiffness of the hand joints had significantly decreased post-intervention. Unfortunately, patients of group II did not experience this outcome, since just 12.5 % suffering from mild joint stiffness.

Concerning hand-joints' pain in pre SF-SACRAH intervention data revealed that, majority of both studied groups (I&II) patients experienced severe pain (87.5% & 90% respectively). The post SF-SACRAH intervention results illustrated that majority (67.5%) of patients within mild magnetic compression group (I) reported moderate pain, whereas almost all

(97.5%) patients of (group II) reported severe pain, this difference was statistically very significant ($P=0.000$). Furthermore, comparing various categories of pain, as well as mean total pain score, between patients of group (I) before and after SF-SACRAH intervention, showed a quite substantial post-intervention pain reduction in the hand joints. Unfortunately, group II patients did not experience this outcome, since 90% of them continue to experience excruciating hand joints' pain.

On the more, according to the SF-SACRAH total scores, the pre SF-SACRAH intervention data showed that, majority (65% & 62.5% respectively) of both studied groups of patients had moderate pain/stiffness/functional disability.

The results of post SF-SACRAH intervention demonstrated that almost all (88%) of group I patients had mild pain/stiffness/functional disability, whilst a rise from 8% to 17% in the proportion of group II patients with severe pain/stiffness/functional disability, this difference was highly significant statistically ($P=0.000$). Additionally, a considerable level of improvement in hand-joints' pain, stiffness, and functional disability was found post-intervention when comparing group I patients' pre- and post-intervention mean total pain/stiffness/functional disability scores as well as various categories of pain/stiffness/disability. Unfortunately, group II participants did not experience this outcome, with three-quarters of them (75%) reported moderate pain/stiffness/ functional disability.

Table (1): Distribution of Socio-demographic characteristics for studied groups (N=100)

Sociodemographic characteristics	Groups				Total		P value	
	Mild Magnetic Compression (group I)		Massage Therapy (group II)		No	%		
	No	%	No	%				
Age groups	20–30 Y	9	18 %	11	22 %	20	20%	$\chi^2=4.6$, P=0.07 NS
	31 - 40 Y	11	22 %	16	32 %	27	27%	
	41 - 50 Y	19	38%	7	14 %	26	26%	
	51 -60 Y	11	22 %	16	32 %	27	27%	
X ± SD	43.2±13.4 years		40.1±11.6 years				t=1.4, P=0.08NS	
Gender	male	29	58%	18	36%	47	47%	Fisher exact test=0.26 NS
	female	21	42%	32	64%	53	53%	
Marital status	Single	17	34%	11	22%	28	28%	LR=1.35,P=0.71 NS
	Married	29	58%	27	54 %	56	56%	
	Widowed/ Divorced	4	8%	12	24%	16	16%	
Residence	rural	33	66%	29	58%	62	62%	Fisher exact=0.33 NS
	Urban	17	34%	21	42%	38	38%	
Occupation	work	17	34%	21	42%	38	38%	Fisher exact =0.33 NS
	no work	33	66%	29	58%	62	62%	
Education	Read & write	9	30%	11	22%	20	20%	LR=0.09, P=0.7 NS
	Elementary education	17	44%	22	44%	39	39%	
	secondary education	16	32%	10	20%	26	26%	
	high education	8	16%	7	14%	15	15%	
Income	enough	14	28%	9	18%	23	23%	Fisher exact= 0.36 NS
	not enough	36	72%	41	82%	77	77%	
Total		50	100%	50	100%	100	100%	

LR = Likelihood Ratio

NS= not significant

Table 2: Distribution of past medical and family history among studied groups (N=100)

past medical and family history	Groups		Total	P value
	Mild Magnetic Compression (I) No %	Massage Therapy (II) No %		
Family history				
• Yes	27 54%	22 44%	49 49%	$\chi^2=0.4$, P=0.7
• No	23 46%	28 56%	51 51%	NS
Duration of Disease				
• 5< 10 years	14 28%	20 40%	34 34%	LR=6.4, P=0.02
• 10< 15 years	13 26%	16 32%	29 29%	Sig.
• More than 15 years	23 46%	14 28%	37 37%	
Hospitalization				
Yes	37 74%	18 36%	55 55%	$\chi^2=3.9$, P=0.02 Sig.
If Yes, cause of it(N=55):	No			
Medical	13 26%	32 64%	45 45%	$\chi^2=11.2$, P=0.000 HS.
Surgical	16 43.2%	10 55.6%	26 47.3%	
	21 56.8%	8 44.4%	29 52.7%	
Subtotal	37 100%	18 100%	55 100%	
number of hospitalization (N=55):				
• Once	9 24.3%	7 38.9%	16 29.1%	LR=5.3, P=0.01 Sig.
• Twice	17 46%	8 44.4%	25 45.4%	
• ≥ 3 times	11 29.7%	3 16.7%	14 25.5%	
Subtotal	37 100%	18 100%	55 100%	
Total	50 100%	50 100%	100 100%	

LR = Likelihood Ratio NS= not significant **Sig.** = significant **HS.** = highly significant

Table 3: Percentage distribution of pre and post intervention SF-SACRAH scale total score among studied patients (N=100)

Three Domains of SF-SACRAH scale	SF-SACRAH Scale									
	0=no pain/stiffness /functional disability (%)		(1-3) = mild pain/stiffness/ functional disability (%)		(4-6) = moderate pain/stiffness/ functional disability (%)		(7-9) = severe pain/stiffness/ functional disability (%)		(10) = unbearable pain/stiffness and function is impossible (%)	
	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II
PRE- INTERVENTION										
Function How difficult was it for you during the last 48 h to: Unlock your door with a key To do up or undo a zip To turn the pages of the newspaper	0	0	10	12.5	15	12.5	22.5	12.5	52.5	62.5
	0	0	0	0	5	5	22.5	25	72.5	70
	0	0	0	0	2.5	0	22.5	22.5	75	77.5
Stiffness How severe was your joint stiffness immediately after waking up first thing in the morning?	0	0	0	0	0	0	22.5	22.5	77.5	77.5
pain How severe was your pain at times of inactivity in the evening?	0	0	0	0	0	0	30	30	70	70
Mean total SF-SACRAH pre-intervention score for (Mild magnetic compression study group I)	17.3±1.2*									
Mean total SF-SACRAH pre-intervention score for (Massage therapy study group II)	16.5±1.7									
POST- INTERVENTION										
Function How difficult was it for you during the last 48 h to: Unlock your door with a key To do up or undo a zip To turn the pages of the newspaper			35	0	35	7.5	30	22.5	0	70
			22.5	20	77.5	80	0	0	0	0
			40	0	37.5	0	20	25	2.5	75
Stiffness How severe was your joint stiffness immediately after waking up first thing in the morning?			20	0	80	0	0	27.5	0	72.5
pain How severe was your pain at times of inactivity in the evening?			57.5	0	37.5	2.5	5	20	0	77.5
Mean total SF-SACRAH post-intervention score for (Mild magnetic compression study group I)	9.3±1.01**									
Mean total SF-SACRAH post-intervention score for (Massage therapy study group II)	13.6±1.8									

* t-pre=0.4,P=0.6 NS

**t-post=1.2,P=0.000HS

Table 4: Pre and post-intervention distribution of tenderness and swelling among groups of studied patients (N=100)

Groups of Hands' Joints		RITCHIE ARTICULAR INDEX							
		0 = no Tenderness/ swelling (%)		(1-30) = mild Tenderness/ swelling (%)		(31-60) = moderate Tenderness/ swelling (%)		(61-90) = severe Tenderness/ swelling (%)	
		Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II
PRE- INTERVENTION									
1	Wrists	0	0	22	50	45.5	22.5	32.5	27.5
2	Metacarpophalangeal/ MCP (bases of fingers and thumb)	20	22.5	22.5	22.5	27.5	27.5	30	27.5
3	Finger proximal interphalangeal /finger PIP (middle of fingers and thumb)	17.5	13.5	9.5	33.5	27.5	27.5	45.5	25.5
4	Distal interphalangeal /DIP (tips of fingers)	2.5	42.5	12.5	17.5	42.5	27.5	42.5	12.5
Mean RITCHIE ARTICULAR INDEX total score for (Mild magnetic compression study group I) (pre intervention):		4.7±0.9*							
Mean RITCHIE ARTICULAR INDEX total score for (Massage therapy study group II) (pre-intervention):		5.1±0.8							
t test/pre=2.1, P=0.04 Sig.									
POST- INTERVENTION									
1	Wrists	42.5	12.5	42.5	17.5	12.5	47.5	2.5	27.5
2	Metacarpophalangeal/ MCP (bases of fingers and thumb)	47.5	2.5	27.5	12.5	12.5	42.5	12.5	42.5
3	Finger proximal interphalangeal /finger PIP (middle of fingers and thumb)	27.5	4.5	42.5	42.5	22.5	27.5	7.5	25.5
4	Distal interphalangeal /DIP (tips of fingers)	27.5	27.5	45	22.5	27.5	32.5	0	17.5
Mean RITCHIE ARTICULAR INDEX total score for (Mild magnetic compression study group I) (post intervention):		2.8±0.9**							
Mean RITCHIE ARTICULAR INDEX total score for (Massage therapy study group II) (post-intervention):		6.1±1.5							
t test/post=1.4, P= 0.000HS									

Table 5: Efficacy of applying mild magnetic compression versus massage therapy on hand joints' functional disability symptoms among groups of studied patients (N=100)

SF-SACRAH scale total score groups		Patients Groups				Total	P value	
		Mild Magnetic Compression (Group I)		Massage Therapy (Group II)				
Degree of functional disability pre-Intervention	Moderate functional disability(4-6)	22	44.0%	17	34.0%	39	39.0%	X ² =0.3 P=0.7 NS
	Severe functional disability (7-9)	28	56.0%	33	66.0%	61	61.0%	
Degree of functional disability post-intervention	Mild functional disability (1-3)	21	42.0%	0	0.0%	21	42.0%	X ² = 63.4 P=0.000 HS
	Moderate functional disability (4-6)	29	58.0%	19	38.0%	48	48.0%	
	Severe functional disability (5-9)	0	0.0%	31	62.0%	31	31.0%	
Degree of Stiffness pre-intervention	Mild stiffness(1-3)	16	32.0%	11	22.0%	27	27.0%	X ² =1.7 P=0.4 NS
	Moderate stiffness(4 - 6)	34	68.0%	39	78.0%	73	73.0%	
Degree of Stiffness post-intervention	Mild stiffness(1-3)	41	82.0%	13	26.0%	54	54.0%	X ² =62.3 P=0.000 HS
	Moderate stiffness(4 - 6)	9	18.0%	37	74.0%	46	46.0%	
Pain total score pre-intervention	unbearable pain (10)	8	16.0%	11	22.0%	19	19.0%	Fisher exact test=1.0 NS
	Sever pain (7-9)	42	84.0%	39	78.0%	81	81.0%	
Pain total score post-intervention	Mild pain (1-3)	16	32.0%	0	0.0%	16	16.0%	X ² =79 P=0.000 HS
	Moderate pain (4-6)	34	68.0%	15	30.0%	49	49.0%	
	Sever pain (7-9)	0	0.0%	35	70.0%	35	35.0%	
SF-SACRAH total score pre-intervention	Mild pain/stiffness/ functional disability (1-3)	12	24.0%	11	22.0%	33	33.0%	X ² =0.09 P=0.7 NS
	Moderate pain/stiffness/ functional disability (4-6)	29	58.0%	31	62.0%	60	60.0%	
	Sever pain/stiffness/ functional disability (7-9)	9	18.0%	8	16.0%	17	17.0%	
Mean±SD		54.6±18.9		53.1±19.1				t=0.14,P=0.6 NS
SF-SACRAH total score post-intervention	Mild pain/stiffness/ functional disability (1-3)	44	88.0%	0	0.0%	44	50.0%	X ² =78 P=0.000 HS
	Moderate pain/stiffness/ functional disability (4-6)	6	12.0%	33	66.0%	39	39.0%	
	Sever pain/stiffness/ functional disability (7-9)	0	0.0%	17	34.0%	17	17.0%	
Mean±SD		23.6 ± 2.3		56.2±13.6				t=17.3 P=0.000 HS
Total		50 100.0%		50 100.0%		100 100.0%		

V. Discussion

According to the **American Rheumatology Association, (2018)**, hand-joints' main functional disability symptoms usually including; pain, stiffness, swelling and tenderness that are most frequently experienced by rheumatoid arthritis patients, and they are subsequently linked to a reduced capacity for performing activities of daily living (**Symmons et al., 2021**). Thus to carry out their regular physical activities, those patients require greater effort and assistance from their surroundings (**Park & Chang, 2019**). As a result, a variety of restorative and rehabilitative treatment options including magnetic and massage therapy are performed to help those patients in restoring the normal function of their hand joints' and accordingly minimizing other functional disability symptoms like pain, stiffness, swelling and tenderness (**Rausch et al., 2018**).

The current study's findings on patients' **socio-demographic characteristics** showed that, around one third of studied group I patients their age were in the range of (21-30 years), with a mean age of (43.2 ± 13.4), and one third of studied group II patients were in older age ranged between (51- 60 years), with a mean age of (40.1 ± 11.6). These results were comparable with **Leśniewicz et al., (2017)** "who evaluated the influence of specific physical treatments on mobility in women with rheumatoid arthritis" however, the difference was not statistically significant ($P > 0.05$). More or less than half of patients in the current study were females, married, lived in rural area and did not have a job while, approximately one third and three quarters of this study participants respectively had only received an elementary education and didn't had enough monthly income. Despite these findings disagreed with **Park et al., (2019)**, who ascertained that "around half of their study subjects were secondary school graduates and their mean age were 45.14 ± 23.13 years", **Rausch et al., (2018)** concurred with these findings, noting that "the majority of studied patients were females (85%) married (68%)".

The current study's findings regarding **past, present medical and family history** revealed that nearly half of studied patients were known to have a family history of the illness; yet, statistically, there was no significant difference

between the two studied groups regarding their family history. In addition, around half of studied patients were hospitalized and about two thirds of them said that their hospitalization was related to surgical reasons, with group I showing a significantly greater rate of hospitalization than group II. Furthermore, less than half of patients of both studied groups were received two hospital stays, and the number of hospitalizations varied significantly between the two groups of studied patient ($P = 0.02$). Findings of the existing study corroborated with **Smolen et al., (2018)**'s statement that "most rheumatoid arthritis patients had a family history of the condition and had at least two hospital stays". On the other hand these findings were in direct conflict with **Lozano et al., (2021)**'s claim, "Most studied patients with rheumatoid arthritis have frequent hospital stays for medical reasons".

According to the current study's pre-intervention findings, **concerning hand joints' functional disability**, the functional disability of the hand joints was more prevalent in both groups of studied patients, besides the mean total functional disability scores improved post-intervention compared to pre-intervention, with a highly significant statistical difference observed between patients of group I than those of group II. Furthermore, patients of group I showed highly significant variations in the mean total functional disability score pre and post-intervention. These results may be owing to the compliance of group I patients for wearing the mild magnetic compression gloves, as it is easy to apply and does not necessitate effort than massage, so regular wearing of mild magnetic compression gloves is a sufficient treatment method to maintain improvement in hand joints' functional disability.

The findings of the current study are consistent with those of **Chwieśko et al., (2017)**'s research who mentioned, "Functional disability of hand-joints' associated with rheumatoid arthritis could be improved with the regular use of low-mild frequency magnetic field therapy". Furthermore, the current study results are reliable with those of **Dortch & Johnson (2017)** who stated, "Regular use of low-mild frequency magnetic field therapy should reduce functional impairment of hand joints associated with rheumatoid arthritis".

Regarding hand joints' stiffness, the current study's pre-intervention findings showed that, for both groups of studied patients, a higher percentages of moderate stiffness in hand-joints, with a statistically significant difference in the mean total stiffness subscale scores. This outcome is in correspondence with **Mathers & Pflieger (2018)**'s pronounced that "majority of arthritis patients who complain of joint stiffness typically do so first thing in the morning or shortly after awakening, according to their research on "Physical and Occupational Therapy in the Management of Arthritis".

The current study also demonstrated that, following the application of mild magnetic compression gloves, patients in group I experienced greater improvements in hand-joint stiffness subscale scores than did subjects in group II, with a high statistically significant difference between the two groups. Although this information was not gathered, it is possible that participants stopped receiving daily massage therapy in order to maintain the recovery of their hand joints' functional disability symptoms, which may be the cause of these results due to group II subjects' decreased adherence. Furthermore, according to the current study results it was noted that group I patients' mean total hand-joint stiffness subscale scores pre and post-intervention showed a high significant difference.

The findings of the current study are consistent with those of **Greaves and Harlow (2018)** who concluded, "Utilizing weak magnets significantly reduced joint stiffness scores". Besides **Richmond et al., (2019)** also agreed with these results as they stated "Mild frequency magnetic bracelets have good therapeutic effects for patients with arthritis if maintained on hands for at least 12 hours daily for two consecutive weeks as it had a greatest influence to decrease intensity of hand-joints' stiffness". Nevertheless, these results were not in accordance with **Grote et al., (2017)** who revealed, "Weak pulsed electromagnetic fields had only a short-term effect for patients with arthritis".

The current study's findings on **hand-joints' pain** showed that both studied groups of patients experienced higher percentages of severe hand-joints pain reporting prior to intervention, even though the mean total pain subscale scores were

more or less identical and there was no statistically significant difference. These findings corroborated **Segal et al. (2021)**'s statement that "Currently, magnetic therapy is used in a variety of ways for the relief of pain and inflammation associated with rheumatoid arthritis and other musculoskeletal disorders. The majority of patients with rheumatoid arthritis experienced joints' pain at different joints, particularly with movement, and verbalized their pain as throbbing, cramping, aching, or stabbing.

Furthermore, the current study findings showed that a highly statistical significant post-intervention improvement in hand-joint pain subscale scores obviously seen among group I patients than did group II individuals. These findings are consistent with **Richmond's (2018)** randomized placebo-controlled crossover experiment on "Magnet therapy for the relief of pain and inflammation in rheumatoid arthritis which showed that using magnets on a daily basis by any method may modestly lessen the intensity of joint pain"

The results of this study also showed that group I patients had a highly significant difference between their mean total pre- and post-intervention pain subscale scores. These findings were confirmed by those of **Trock's (2017)** research who stated that "using magnets for 12 weeks while continuing to take prescribed medications under the supervision of medical professionals could lessen RA patients' pain and disability". Additionally, findings of the present study were supported by multiple studies **Dortch & Johnson (2017)**, **Kumaret et al., (2015)** and **Hurkmans et al., (2011)**, which declared that "continuing exposure to a mild frequency magnetic field is beneficial for arthritis patients for boosting patient's joints physical functioning capacities and successful in improving patient's quality of life".

According to the current study's findings, there were higher total scores of RITCHIE ARTICULAR INDEX for all Finger proximal and distal interphalangeal joints between both studied groups of patients in the pre-intervention stage, with a statistically significant mean total RITCHIE ARTICULAR INDEX scores for both groups of patients. Moreover, the present study's post-intervention results revealed that, there was a high statistically significance was found for the

mean total scores of RITCHIE ARTICULAR INDEX, with higher improvement in percentages of RITCHIE ARTICULAR INDEX total scores for "Finger Metacarpophalangeal, proximal and distal interphalangeal joints" among patients of group I than for group II. Furthermore, group I patients showed a highly significant difference in their mean total RITCHIE ARTICULAR INDEX scores before and after the intervention. These results could be attributed to the fact that mild magnetic compression gloves are simple to use and typically associated with feelings of increased warmth and comfort, encouraging patients to wear them for longer periods of time. Regular use of mild magnetic compression gloves is therefore an easy way to maintain improvement in hand joints' tenderness and swelling.

The present study's results were in harmony with **Leśniewicz et al., (2017)** who revealed that "physical procedures including massage therapy had no pleasant effect in enhancing mobility in women with rheumatoid arthritis nevertheless it can increase inflammation, swelling and tenderness of the joints especially if it were not well professionally supervised". On contrary **Macfarlane et al. (2019)** illustrated that "magnetic therapy had no benefit in decreasing joints' swelling and tenderness in patients with rheumatic arthritis".

Regarding the efficacy of applying mild magnetic compression versus massage therapy on hand-joints' functional disability symptoms among patients with rheumatoid arthritis the current study showed that, for group I patients, the post-intervention SF-SACRAH scale total score showed a highly significant improvement in all hand-joint functional disability symptoms, including pain/stiffness/function. Nevertheless, patients of group II did not show this significant outcome. The degenerative and contentious nature of rheumatoid arthritis disease may be to blame for this outcome, as both improvement and deterioration of the patients' condition were anticipated. However, improvement of symptoms typically depends on patients' adherence to the recommended treatment regimens and the effectiveness of the employed interventions. The findings of **Biundo et al., (2015)** and **Gajewski et al., (2018)**, which claimed that "no sort of therapy, other than steroids and regular drugs, ever lessened or resolved joints' pain, stiffness, and difficulty experienced by rheumatoid arthritis

patients.", were in conflict with these findings. As well, **Thomas et al., (2019)** and **Astin (2018)** demonstrated, "Physical therapy may only be a treatment method supplementing medication or rehabilitation because therapy using physical and natural factors requires high standards of safety and experience of a referring doctor and a therapist".

Quite the opposite, several studies, **Arthritis Research Campaign, (2017)** and **Schenker et.al, (2021)**, were in harmony with the current study's results and affirmed that "natural earth elements like copper, magnets and gold will be the future treatments for multiple diseases including arthritis". Similar to what **Wang et al., (2016)** stated, "Rheumatoid arthritis patients' pain, exhaustion, stiffness, and functional disability of joint motions are considerably minimized within 4 to 8 weeks of low frequency magnetic field exposure". In addition, **Genesan et al., (2019)** and **Shupak et al., (2017)** avowed, "Patients' pain perception and stiffness levels improved with magnetic use".

What is more, the findings of those previous studies, **Weintraub, (2019)**, **Colbert, (2017)** and **Ratterman, (2017)**, which noted that "joints' pain and stiffness was reduced and the overall functioning abilities were enhanced with each passing day of utilizing the mild magnetic compression by different degrees for all RA patients depending on the magnetic frequency level", confirmed the conclusions of the current study. Likewise, **Hinman, (2012)** and **Ernst (2014)** supported the current study findings as they stated, "rheumatoid arthritis patients when they have tenderness, inflammation and/or swelling at any joint it is being impossible to afford the pain resulted from massaging that joint".

Conversely, **Basford's (2019)** results contradicted the current study findings, which ascertained, "However, such devices don't seem to have a clearly defined mechanism of action, and all reported theoretically scientific evidence relating to the efficacy of magnet therapy is being ambiguous. This is despite the widespread claims that such devices can help with a variety of musculoskeletal disorders by alleviating pain and reducing inflammation". Additionally, the **ICNIRP Statement (2018)** was in contrast with the current study results as it affirmed, "The use

of medical magnetic field therapy procedures necessitates an intensive development of knowledge and theoretical background about the impact of this field for enhancing protection of patients". Besides, according to the consumer survey done in 2017 by The American Massage Therapy Association's (AMTA) (2017) stated, "In the preceding year, roughly, one in five American adults received at least one massage and of those, 42% did so for health or medical purposes, such as including pain relief, muscle aches and stiffness, or injury recovery".

VI. Conclusion

This study suggests that the use of mild magnetic compression on a daily basis led to improvements in a variety of hand-joints' functional disability symptoms, such as pain, stiffness, swelling, tenderness, and function more efficiently than did massage therapy.

VII: Recommendations:

The subsequent recommendations are suggested in light of the study's findings:

- Mild-magnetic compression gloves are an easy, safe, affordable therapy that should be incorporated into all rheumatoid arthritis patients' daily treatment plan to enhance improvement in different hand-joints' functional disability symptoms, including, pain, stiffness, swelling, tenderness, and function, unless there is severe deformity of hand joints.
- To ascertain the true therapeutic efficacy, safety, and cost-effectiveness of mild-magnetic compression therapy for particular clinical disorders, larger and more stringent randomized controlled trials are also required.
- Study replications with extended follow-up periods to enable a better understanding of the impact of mild-magnetic compression and to give the potential for results' generalization

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