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EFFECT OF EXTRACORPOREAL SHOCK WAVE THERAPY ON PAIN, RANGE OF MOTION AND FUNCTION IN SUBJECTS WITH PERIARTHRITIS SHOULDER

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Abstract: **Background and Objective:** It is a musculoskeletal condition characterised by progressive loss of active and passive shoulder motion, causing pain, reduced range of motion and muscle weakness. It can be treated using Conventional physiotherapy to control pain, improving range of motion and function but Extracorporeal shock wave therapy (ESWT) is different from Conventional physiotherapy and it is not much practiced in clinical sittings for Periarthritis Shoulder. The objective of the study was to compare the effect of ESWT along with Conventional physiotherapy versus Conventional physiotherapy alone on pain, range of motion and function in subjects with Periarthritis Shoulder.

Methods: Quasi Experimental Study Design. This study included 84 subjects with a mean age of 51.4 years have clinically diagnosed with Grade 1 and 2 Periarthritis Shoulder. The subjects were randomly allocated into 2 groups. In Group A (n=42) subjects were treated with ESWT and Conventional Physiotherapy where Group B (n=42) received Conventional physiotherapy alone. Participants were treated thrice a week for 4 weeks. The outcome measures of this intervention were measured in terms of VAS for pain, Universal Goniometer for Shoulder Range of Motion and SPADI for Function.

Results: Independent —t test was used to compare the mean significance difference between continuous variables. Paired —t test was used to assess the Statistical significance difference between Pre and Post test scores. Statistical analysis of the data revealed that within the group comparison, both groups showed significant improvement in all parameters. Whereas, in between the group‘s comparison Extracorporeal Shock Wave Therapy combined with conventional physiotherapy showed better improvement compared to Conventional Physiotherapy alone**.**

Conclusion: After 4 weeks of intervention both Extracorporeal Shock Wave Therapy (ESWT) combined with Conventional Physiotherapy and Conventional Physiotherapy alone showed significant

improvement on reducing Pain, improving Range of Motion and Function. However, Extracorporeal Shock Wave Therapy combined with Conventional Physiotherapy group was found to be more effective when compared to Conventional Physiotherapy alone. From the findings of the current study, it can be recommended that the Extracorporeal Shock Wave Therapy can be prescribed to the participants with periarthritis shoulder.

KEYWORDS: Periarthritis Shoulder, Extracorporeal Shock Wave Therapy, Short Wave Diathermy, Visual Analogue Scale, Universal Goniometer and Shoulder Pain and Disability Index.

I. INTRODUCTION

Periarthritis of the shoulder is a musculoskeletal condition marked by a gradual decrease in both active and passive shoulder mobility, resulting in pain, restricted range of motion, and muscle weakness[1].The American Academy of Orthopaedic Surgeons (AAOS) describes it as a syndrome defined by limited active and passive shoulder movement without any radiological findings besides osteopenia[2]. In 1892, Duplay was the first to identify the painful stiff shoulder, naming the condition 'HUMERO SCAPULAR PERIARTHRITIS'[3].

Periarthritis Shoulder is a common condition that leads to pain in the shoulder joint and decreased mobility[4]. This condition can also impact various parts of the body that includes tendons, ligaments, and bursae. In severe instances, it can cause difficulty in sleeping and diminish overall quality of life[5].Approximately 7%-21% of individuals suffer from this painful shoulder condition[6]. The prevalence appears to be fairly consistent across different age groups; however, it has been noted to vary from 2.3% to 5.3% among those aged 40-60[7]. Women are more frequently affected than men, and it can occur bilaterally[8].

The periarthritis phase is marked by a limited range of motion (ROM) and a gradual alleviation of pain, which typically occurs between 10 to 36 weeks[9]. Neviaser and Hannafin have recognized four stages of this condition. Painful stage: it involves a gradual onset of discomfort and a slight reduction in range of motion, with these symptoms persisting for over three months. Freezing Stage: following the initial onset, there is a high occurrence of night time pain, accompanied by a loss of both active and passive range of motion, lasting from three to nine months. Frozen Stage, pain occurs at the limits of motion, resulting in considerable shoulder stiffness, and symptoms are present for approximately nine to fourteen months. The final stage, is the Thawing Stage: this phase experiences minimal pain and a gradual enhancement of range of motion, with symptoms lasting from fifteen to twenty-four months[10].

Periarthritis of the shoulder may be classified as either primary (of unknown cause) or secondary. Secondary periarthritis can result from factors such as trauma, dysfunction and impingement of the rotator cuff, cardiovascular conditions, hemiparesis, or diabetes (which some believe to be a primary cause in diabetic patients), and is referred to as Periarthritis Shoulder[11].

The exact cause of Periarthritis Shoulder remains unclear and is usually considered idiopathic. It is believed that the condition arises from synovitis affecting the shoulder joint, which triggers inflammatory contracture of the joint capsule and the activation of cytokines like TGF-B, TNF-a, and interleukins, along with the involvement of B-lymphocytes, T- lymphocytes, and macrophages, ultimately contributing to the pain experienced in the shoulder joint[12].

The clinical symptoms of Periarthritis Shoulder include gradual onset of shoulder stiffness, intense pain often experienced at night, and a reduction in both active and passive shoulder movement[13].Periarthritis Shoulder can be associated to multiple medical conditions such as diabetes, thyroid disorders, Dupuytren's contracture, as well as various cardio respiratory and autoimmune diseases[14]. Factors that may contribute to the development of periarthritis shoulder have been investigated, including extended shoulder immobility due to injury or surgical procedures, cardiovascular diseases, and Parkinson's diseases[15].

Periarthritis Shoulder can be resolved with suitable medications and surgical interventions. Treatment alternatives includes, either individually or frequently in combination like pharmacologic therapies (which may include NSAIDs or oral corticosteroids), intraarticular injections, suprascapular nerve

blocks, arthrographic joint distension, or surgical options (such as manipulation under anesthesia, arthroscopic capsular release or in rare cases open capsulotomy) for persistent cases[16].

Periarthritis of the shoulder can be managed through physical therapy. This therapy aims to prevent the tightening of the capsule and restore joint motion and functionality[17]. Treatment techniques includes heat or cold applications, both active and passive range-of-motion exercises, strengthening routines, manipulation, mobilization methods, stretching, electrotherapy treatments, patient education, and guided home exercises. Conventional physiotherapy involves a specific protocol that includes shortwave diathermy, followed by a series of therapeutic exercises aimed at alleviating pain, enhancing joint mobility, and improving overall functional performance[18].

In addition to these treatments, Extracorporeal Shock Wave Therapy (ESWT) has recently surfaced as a non-invasive solution for various musculoskeletal issues impacting both the upper and lower extremities. Initially developed in the 1980s, ESWT has gained clinical importance across numerous medical fields. It has demonstrated promising outcomes in promoting the healing of bone and soft tissues, alleviating pain, and supporting functional rehabilitation[19].

Extracorporeal Shock Wave Therapy (ESWT) is considered as one of the most effective methods in physical rehabilitation. This treatment involves generating high-amplitude sound waves that are directed to a specific area of the body. ESWT is a highly effective technique for promoting tissue repair, as it encourages the growth and differentiation of fibroblasts into myofibroblasts[20]. Additionally, it enhances the repair of soft tissues, increases local blood flow, supports the healing processes associated with inflammation, and improves the flexibility of collagen fibers in the affected region[21]. Studies indicate that ESWT can lead to multiple biological effects, including tissue regeneration, wound healing, the formation of new blood vessels, bone remodeling, and reducing inflammation. It has proven to be particularly effective in treating chronic pain, arthritis, and tendinopathies[22].

In recent years, there are several studies conducted on the effectiveness of extracorporeal shock waves in treating muscle, bone, joint, and ligament conditions. But there are limited studies done on the combination of both conventional physiotherapy and ESWT. Therefore, this study is an attempt to evaluate the efficacy of ESWT combined with conventional physiotherapy and conventional physiotherapy alone in treating subjects with periarthritis shoulder.

11. AIM OF THE STUDY

The aim of the study was to find out the effect of extracorporeal shock wave therapy on pain, range of motion and function in subjects with Periarthritis shoulder.

III. NEED OF THE STUDY

Shoulder is the main complex joint in the upper limb which involves in performing more functional activities. Periarthritis shoulder (PA), is a painful condition occurs in the shoulder due to progressive loss of both active and passive shoulder range of motion. This results in stiffness, pain and dysfunction, nocturnal pain which disrupts subjects daily life. Stress, Sedentary life style, diabetes, cardio vascular diseases and prolonged working hours which may also leads to the high prevalence of Periarthritis Shoulder. There are numerous physiotherapeutic interventions available for the management of periarthritis shoulder which include cryotherapy, hydrotherapy, stretching, mobilizations and modalities. Recent studies suggests extracorporeal shockwave therapy is effective in reducing pain, improving range of motion and function.

As there is limited literature available on extracorporeal shockwave therapy in combination with conventional physiotherapy. Hence need of study arises to determine the effects of extracorporeal shockwave therapy on reducing pain, improving range of motion and function in periarthritis shoulder subjects.

IV. OBJECTIVES OF THE STUDY

1. To determine the effect of extracorporeal shock wave therapy on reducing pain, improving range of motion and function in subjects with Periarthritis Shoulder.
2. To determine the effect of conventional physiotherapy on reducing pain, improving range of motion and function in subjects with Periarthritis Shoulder.

3. To compare the effect of extracorporeal shock wave therapy versus conventional physiotherapy on reducing pain, improving range of motion and function in subjects with Periarthritis Shoulder.

V. HYPOTHESIS

RESEARCH HYPOTHESIS (H1) : Extracorporeal shock wave therapy along with conventional physiotherapy is more effective than conventional physiotherapy alone in reducing pain, improving range of motion and function in subjects with periarthritis Shoulder.

ALTERNATE HYPOTHESIS (H0) : There is no significant difference between extracorporeal shock wave therapy along with conventional physiotherapy and conventional physiotherapy alone in reducing pain, improving range of motion and function in subjects with Periarthritis Shoulder.

VII. MATERIALS AND METHODS

This is a Quasi experimental study design approved by ethical committee of GSL Medical College And General Hospital The study was conducted for period of 1 year, from July 1st 2024 to June 30th 2025 at GSL General Hospital. 84 subjects were screened between the age group of 18 years and above, and according to inclusion and exclusion criteria 80 subjects were selected who were randomly allocated through systematic random sampling into two groups, each group containing 40 subjects. Informed consent will be obtained from the participants, and demographic data will be recorded. Group-A received Extracorporeal shock wave therapy along with conventional physiotherapy, and Group-B received conventional physiotherapy alone. Subjects received 4 sessions in a week for 4 weeks. VAS for pain, Goniometry for Range of motion and SPADI for function was used to evaluate both the groups before and after the intervention.

INCLUSION CRITERIA :

1. Subjects with stage 1 and 2 Periarthritis Shoulder diagnosed by Orthopaedician.
2. Age group above 18 years.
3. Unilateral shoulder involved.
4. Subjects who give consent to participate in the study.

EXCLUSION CRITERIA :

1. Recurrent adhesive capsulitis
2. Any surgical procedures of Shoulder joints
3. Malignancy
4. Pregnancy

VIII. Outcome Measures :

Pre-test and post-test measures were taken by using VAS for pain,Goniometry for range of motion and SPADI for function. All the subjects underwent a protocol treatment of 4 days per week for 4 weeks duration.

Measurement of pain severity (VAS)[23] : The VAS scale is a reliable, valid, responsive and frequently used Pain outcome measure. The instrument used consists of horizontal lines, 10cm long with anchor points of 0 (no Pain) and 10 (severe Pain). It located at either end of the line. Patients are instructed to draw a vertical mark on the line indicating their pain level. The severity of Periarthritis shoulder was evaluated by VAS

Universal Goniometer[24]: The goniometer is an instrument that is used to measure the joint range of motions in each plane passively and actively. Universal Goniometer has two arms movable arm and stable arm. Stable arm must be placed at the proximal part of the joint where as movable arm has to be placed over the distal part of joint.

SPADI [25]: The Shoulder Pain and Disability Index (SPADI) is a self-administered questionnaire that consists of two dimensions one for Pain and the other for Functional activities. The Pain dimension consists of five questions regarding the severity of an individual's Pain. Functional activities are assessed with eight questions designed to measure the degree of difficulty an individual has with various activities of daily living that require upper-extremity use. The SPADI takes 5 to 10 minutes for a patient to complete and is the only reliable and valid region- specific measure for the Shoulder.

Scoring instructions to answer the questions, patients place a mark on a 10cm visual analogue scale for each question. Verbal anchors for the pain dimension are 0 no Pain at all‘ and 10 worst Pain imaginable‘ and those for the functional activities are no difficulty‘ and so difficult it requires help‘. The scores from both dimensions are averaged to derive a total score[25].

IX. INTERVENTION:

The study consists of 4 weeks of intervention. Group A subjects were treated with Extracorporeal shockwave therapy along with Conventional physiotherapy whereas Group B subjects were treated with Conventional physiotherapy alone. Before the commencement of the treatment a brief demonstration about the intervention was given. Pre-test was done to measure Pain and Function by Visual Analogue Scale [VAS], Universal goniometer and Shoulder Pain And Disability Index [SPADI]. Intervention duration for a period of 4 weeks. After 4 weeks post treatment outcome data was analysed for results.

GROUP A*:*Extracorporeal Shock Wave Therapy along with Conventional Physiotherapy.

Extracorporeal Shock Wave Therapy[26] :

The patient should be positioned either sitting or lying down, with the shoulder exposed and relaxed. Identify the most painful or affected region through palpation. Choose the appropriate ESWT device. Apply a coupling medium, such as ultrasound gel, over the targeted area to facilitate the transmission of shock waves. Adjust the settings (energy flux density, frequency, total impulses) based on the patient's comfort level. Firmly place the applicator head on the painful area of the shoulder, which is typically located at the supraspinatus tendon insertion, the subacromial region, or the bicipital groove.

Fig:1 Extracorporeal Shock Wave Therapy

Dosage**:** 10–15 minutes/session,3 session per week for 4 weeks.
Following ESWT the subjects received Conventional physiotherapy which includes Short wave Diathermy, Shoulder Wheel Exercises, Finger Ladder Exercise, Pendular Exercises and Wand Exercises.
Dosage: 15- 20 minutes per session,3 session per week for 4 weeks.

GROUP B*:*Conventional Physiotherapy***:**

Conventional physiotherapy consists of Short Wave Diathermy, Shoulder Wheel Exercise, Finger Ladder exercises, Pendular Exercises and Wand Exercises.

Short Wave Diathermy[27]*:*

Ensure the subject is seated or lying down, with the affected shoulder adequately exposed and relaxed. Inspect the SWD unit, including the cables and electrodes/plates. Choose the suitable application technique: Condenser field method. Clean and dry the skin thoroughly to prevent burns. Use towels between the skin and electrodes to soak up sweat and avoid overheating. For the Condenser field method, position two drum or plate electrodes on each side of the shoulder joint (covering the front and back areas). Keep equal distance between them for consistent heating. Fasten the electrodes in place without letting them come into direct contact with the skin.

Fig:2 Short Wave Diathermy

Dosage: 10 -15 minutes/session, 3 sessions per week for 4

weeks. Shoulder Range of Motion exercises include:

Shoulder Wheel Exercise[28]*:*

The subject is positioned either standing or sitting comfortably in front of the shoulder wheel, which should be attached to a wall or a stand. Adjust the height of the wheel so that the handle aligns with the shoulder level. The subject should grasp the handle using the affected arm. For Forward or Clockwise Rotation, the patient should rotate the wheel forward (in a clockwise direction) using a smooth, circular motion. Begin with small circles and gradually expand to larger ones. For Backward / Anti-clockwise Rotation, the patient should rotate the wheel backward (in an anti-clockwise direction).

Fig:3 Shoulder Wheel Exercise

Dosage:. : Perform 2- 3 sets of 10–15 repetitions

Finger Ladder Exercise[29]:

The subjects should stand facing the wall where the finger ladder is installed. Maintain a shoulder-width stance for stability. Position the fingers of the affected arm at the lowest point of the ladder. Keep the elbow slightly bent and relaxed. Gradually walk the fingers upward one step at a time on the ladder, raising the arm as high as is comfortable. Ensure the shoulder is engaged in the movement by avoiding any shrugging of the neck. Pause briefly at the highest point you can reach without experiencing pain. Slowly walk your fingers back down to the starting position. Keep the movements steady and refrain from any jerky actions.

Fig:4 Finger Ladder Exercise

Dosage: Perform 2- 3 sets of 10–15 repetitions.

Pendullar Exercises[30]:

The subject should position themselves standing next to a table or chair. Lean forward at the waist approximately 90°, allowing the affected arm to hang down freely. Use the other hand to support yourself on the table for stability. Relax the shoulder and let the arm dangle loosely. Gently move the arm using the natural sway of the body (avoiding shoulder muscles). Execute small, controlled movements in: forward-backward, side-to-side, and circular (both clockwiseand counterclockwise).

Fig: 5 Pendullar Exercises

Dosage: Do each movement for 2-3 sets of 10-15 repetitions.

Wand Exercises[31]*:*

The subject typically assumes a standing or sitting posture while grasping a stick, dowel, cane, or umbrella. Maintain an upright position, whether seated or standing, with both hands gripping the wand. Ensure that movements are slow and deliberate. For Flexion: grasp the wand with both hands, palms facing down, and lift the arms forward and upward. For Abduction: hold the wand in front of you, palms down, and extend the arms out to the sides and upward. For Internal Rotation / Extension: position the wand behind your back with both hands and lift the affected arm upward and backward.

Fig: 6 Wand Exercises

Dosage: Do each movement for 2-3 sets of 10-15 repetitions.

x. ENROLLMENT:

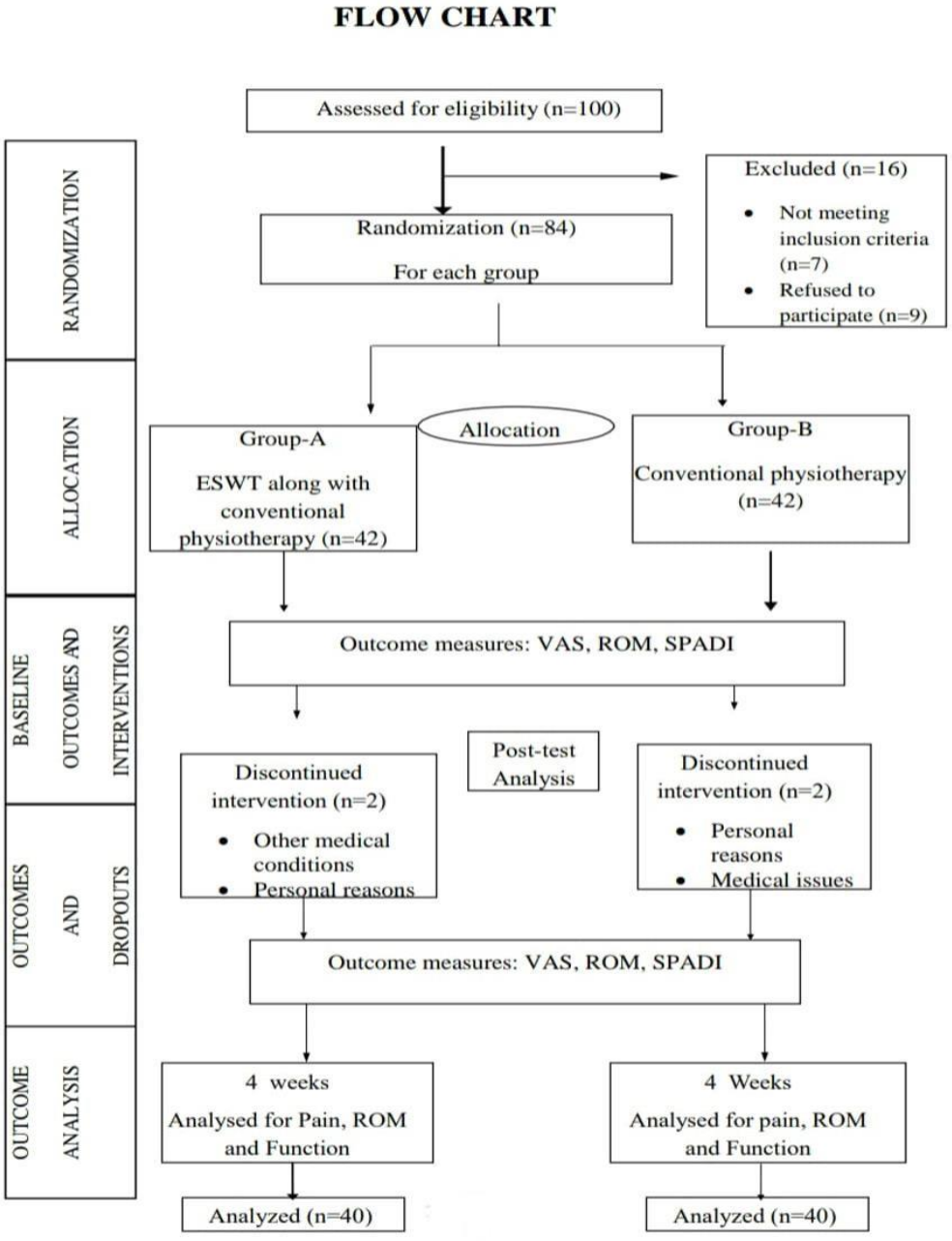

FIG. 7: CONSORT FLOW CHART OF STUDY PARTICIPANTS FROM ENROLLMENT TO ANALYSIS

XI. STATASTICAL ANALYSIS :

All statistical analysis will be done by using SPSS software version 20.0 and MS EXEL 2019. All descriptive statistical data will be presented as mean ± standard deviation. **Within the groups**: Paired student —t‖ test values was performed to assess the statistical difference with in the groups for visual Analogue scale for pain, Universal Goniometer for Range of Motion and Shoulder Disability and Index for Function from pre - test and post -test values. **Between the groups**: Independent student —t‘ test values was performed to assess the statistically significant difference in mean value between the groups for Visual Analogue Scale for Pain, Universal Goniometer for Range of Motion and Shoulder Disability and Index for Function. Data also tabulated and graphically represented.For all statistical analysis, p <0.05 was considered as statistically significant.

XII. RESULTS:

The results of this study were analysed in terms of reduction of pain on VAS, improved shoulder range of motion i.e., flexion, abduction, external rotation and internal rotation on Universal Goniometer and improved functional range on SPADI. The consort flow chart of the study showed the study organization in terms of subjects screening, random allocation and analysis following the intervention.

A total of 100 subjects with Periarthritis Shoulder were screened for eligibility, amongst 84 subjects were included in the study trail. All the 84 subjects who met the inclusion criteria had undergone baseline assessment and included subjects were randomized into two groups consisting of 42 participants in group A and 42 participants in group B. In this study 40 participants completed training in Group A and 40 participants completed training in Group B with dropouts of 2 in respective groups.Comparisons were done within the groups as well as in between the groups. So as to evaluate the intra group and inter group effect of Extracorporeal Shock Wave Therapy along with Conventional Physiotherapy and conventional Physiotherapy alone which are under considerations in the present study.

TABLE 1 ANALYSIS OF PRE TEST SCORES OF VAS IN GROUP A AND GROUP B

VAS		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	6.7	0.697939	0.697939	Insignificant
	GROUP B	6.8	1.2025614		

RESULT: The above table 1 indicate that the pre-test mean group A (6.7) and group B (6.8) scores of the VAS between the two groups were found to be statistically insignificant(p>0.05).

TABLE 2 ANALYSIS OF POST TEST SCORES OF VAS IN GROUP A AND GROUP B

VAS		MEAN	SD	P VALUE	INFERENCE
POST TEST	GROUP A	2.89	1.007	0.00024	Highly significant
	GROUP B	3.775	1.025		

RESULT: The above table 2 indicate that the Post -test means of group A(2.897) and group B(3.775) scores of the VAS between the two groups are found to be statastically significant ($p<0.05$).

TABLE 3 ANALYSIS OF PRE TEST SCORES OF SHOULDER FLEXION ROM IN GROUP A & GROUP B

SHOULDER FLEXION		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	99.6052	9.958127	0.95	Highly significant
	GROUP B	99.7368	10.73684		

RESULT: The above table 3 indicate that the pre-test mean group A (99.6) and group B(99.73) scores of the Shoulder Flexion ROM between the two groups are found to be statistically In significant ($p<0.05$).

TABLE 4 ANALYSIS OF POST TEST SCORES OF SHOULDER FLEXION ROM IN GROUP A & GROUP B

RESULT: The above table 4 indicate that the Post -test mean group A (143.42) and group B (134.21) scores of the Shoulder Flexion ROM between the two groups are found to be statistically significant ($p<0.05$).

TABLE 5 ANALYSIS OF PRE TEST SCORES OF SHOULDER ABDUCTION ROM IN GROUP A & GROUP B

SHOULDER ABDUCTION		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	97.5	10.19	0.41	Insignificant
	GROUP B	99.62	12.52		

RESULT: The above table 5 indicate that the Pre-test mean group A (97.5) and group B (99.625) scores of the Shoulder Abduction ROM between the two groups are found to be statistically Insignificant ($p>0.05$).

TABLE 6 ANALYSIS OF POST TEST SCORES OF SHOULDER ABDUCTION ROM IN GROUP A & GROUP B

SHOULDER ABDUCTION		MEAN	SD	P VALUE	INFERENCE
POST TEST	GROUP A	137.375	8.84	0.0002	Highly significant
	GROUP B	127.75	13.25		

RESULT: The above table 6 indicate that the Post -test mean group A (137.375) and group B (127.75) scores of the Shoulder Abduction ROM between the two groups are found to be statistically highly significant ($p<0.05$).

TABLE 7 ANALYSIS OF PRE TEST SCORES OF SHOULDER INTERNAL ROTATION ROM IN GROUP A & GROUP B

JLDER INTERNAL ROTATION		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	24.5	7.40755	0.54	Insignificant
	GROUP B	25.5	6.96143		

RESULT: The above table 7 indicate that the Pre -test mean group A (24.5) and group B (25.5) scores of the Shoulder Internal Rotation ROM between the two groups are found to be statistically Insignificant ($p>0.05$).

TABLE 8 ANALYSIS OF POST TEST SCORES OF SHOULDER INTERNAL ROTATION ROM IN GROUP A & GROUP B

JLDER INTERNAL ROTATION		MEAN	SD	P VALUE	INFERENCE
POST TEST	GROUP A	40.375	6.8301275	0.0001	Highly significant
	GROUP B	35	6.655439		

RESULT: The above table 8 indicate that the Post -test mean group A (40.375) and group B (35) scores of the Shoulder Internal Rotation ROM between the two groups are found to be statistically significant ($p<0.05$).

TABLE 9 ANALYSIS OF PRE TEST SCORES OF SHOULDER EXTERNAL ROTATION ROM IN GROUP A & GROUP B

JLDER EXTERNAL ROTATION		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	31.25	8.82523	0.77563	Insignificant
	GROUP B	31.75	6.65544		

RESULT: The above table 9 and indicate that the Pre -test mean group A (31.25) and group B (31.75) scores of the Shoulder External Rotation ROM between the two groups are found to be statistically Insignificant ($p>0.05$).

TABLE 10 ANALYSIS OF POST TEST SCORES OF SHOULDER EXTERNAL ROTATION ROM IN GROUP A & GROUP B

JLDER EXTERNAL ROTATION		MEAN	SD	P VALUE	INFERENCE
POST TEST	GROUP A	46.5	8.0224	0.0001	Highly significant
	GROUP B	41.25	6.67467		

RESULT: The above table 10 indicate that the Post - test mean group A (46.5) and group B (41.25) scores of the Shoulder External Rotation ROM between the two groups are found to be statistically highly significant ($p<0.05$).

TABLE 11 ANALYSIS OF PRE TEST SCORE OF SPADI IN GROUP A AND GROUP B

SPADI		MEAN	SD	P VALUE	INFERENCE
PRE TEST	GROUP A	65.525	7.90	0.55	Insignificant
	GROUP B	64.425	8.31		

RESULT: The above table 11 indicate that the Pre -test mean group A (62.525) and group B (62.425) scores of the SPADI between the two groups are found to be statistically Insignificant ($p>0.05$).

TABLE 12 ANALYSIS OF POST TEST SCORE OF SPADI IN GROUP A AND GROUP B

SPADI		MEAN	SD	P VALUE	INFERENCE
POST TEST	GROUP A	32.7	6.61	0.0001	Highly significant
	GROUP B	39.725	11.97		

RESULT: The above table 12 indicate that the Post -test mean group A (32.7) and group B (39.725) scores of the SPADI between the two groups are found to be statistically highly significant ($p<0.05$).

XIII. DISCUSSION:

The aim of the current study was to assess how well extracorporeal shock wave therapy (ESWT) and conventional physiotherapy work together to relieve pain ,improving range of motion and function in subjects with Periarthritis Shoulder. Eighty four participants were allocated into two groups at random: Group A received ESWT along with conventional physiotherapy , while Group B received conventional physiotherapy alone.

Subjects were assessed for pain, range of motion, and function at baseline and at the end of the intervention using these three outcome measures. The study experienced two dropouts in Group A and two dropouts in Group B due to their own reasons. Group A consisted of 40 subjects (Experimental group) and Group B consisted of 40 subjects (Control Group). Group A received ESWT in addition to conventional physiotherapy, while Group B underwent conventional physiotherapy alone.

Before and after the intervention, the Visual Analogue Scale (VAS), Universal Goniometer and The Shoulder Pain and Disability Index (SPADI) were used to measure pain intensity and functional disability, respectively. At the end of the intervention, both groups showed statistically significant improvements in VAS, Universal Goniometer and SPADI scores compared to baseline. However, Group A exhibited greater improvement in all outcome measures.

In Group A (Extracorporeal Shock Wave Therapy along with Conventional physiotherapy), there was a statistically significant improvement in VAS, Universal Goniometer, and SPADI ($p<0.0001$). According to Bassem et al., the use of Extracorporeal Shock Wave Therapy has a significant effect on pain intensity level, Range of Motion of flexion, abduction , internal rotation and SPADI for function. This study suggests that the use of Extracorporeal ShockWave Therapy has beneficial effects on pain, range of motion and function in periarthritis of shoulder[32].

A research study conducted by Murrell et al has indicated that the mechanism behind the reduction in pain intensity may be due to the delicate and repetitive stimulations of ESWT, a type of sound wave that travels through soft tissues without losing energy. This process creates an effect that suppresses nociceptors, leading to an overload of nerve endings with excessive stimuli, which in turn diminishes their activity and results in a temporary decrease in pain, thereby facilitating a reduction in pain[33]. Certain studies suggest that the pulsations produced influence the central nervous system, leading to alterations in the permeability of cell membranes, which inhibits the transmission of painful signals and results in a decline in pain intensity[34].

According to Huang et al, utilizing Extracorporeal Shock Wave Therapy results in a significant enhancement in shoulder range of motion (ROM) due to its ability to alleviate pain by modifying cellular metabolism and the permeability of endothelial tissues, which can subsequently improve shoulder ROM in all planes of movement[35]. For example, a study conducted by Vahdatpour et al has determined that extracorporeal shock wave therapy appears to have beneficial effects on treatment, facilitating a quicker

return to everyday activities and enhancing the quality of recovery for frozen shoulder[36]. Extracorporeal Shock Wave Therapy significantly boosts SPADI scores and shoulder mobility, and it also contributes to accelerating the healing process[37].

The research conducted by Zhang et al. has demonstrated that Extracorporeal Shock Wave Therapy (ESWT) for shoulder periarthritis operates on the principle of cavitation, which facilitates the diffusion of substance P in the shoulder joint, alleviates muscle spasms and pain, and raises the body's pain threshold[38]. Additionally, Duan et al. discovered that Extra corporeal shock wave therapy can diminish muscle tissue spasms in the shoulder joint and stimulate collagen production, along with a steady release of glycosaminoglycans, which aids in the healing of injured rotator cuff and tendon tissues; moreover, extracorporeal shock waves enhance the release of platelet endothelial cell adhesion molecules and vascular endothelial growth factor in muscle tissues, thereby improving the metabolic functions of the shoulder joint and restoring its range of motion[39].

Recent studies suggest that using ESWT as an adjuvant can help in producing shock waves which can reach the affected area through body fluids and tissues. This improves local blood flow, activates molecular and immune responses, stimulates angiogenesis, enhances microcirculation, increases oxygen delivery to cells, produces anti-inflammatory effects, and reduces pain[40]. Some studies have found that ESWT leads to increased tissue regeneration, decreased tissue apoptosis, and effective recruitment of fibroblasts[41].

In Group B (Conventional physiotherapy), there was a statistically significant improvement in VAS, Universal Goniometer, and SPADI ($p<0.0001$).According to Tahir et al Short Wave Diathermy has a significant effect in decreasing pain and improving range of motion[42]. G C Goats et al suggested that the short wave diathermy is the preferred method when a consistent rise in temperature is necessary in deeper tissues which is necessary for healing.He believed that the use of deeper heating modality helps in reducing muscle spasms , pain, improves range of motion, strengthens the relaxation of connective tissues, and decreases joint stiffness[43].

According to Yang et al., his study has shown a positive and significant reduction in pain. It showed improvements in range of motion and functional ability in patients with periarthritis shoulder. Using conventional physiotherapy has beneficial effects in decreasing pain and improving range of motion and function[44]. Mckinnis et al. concluded that using conventional physiotherapy alone significantly improves range of motion and functional ability in subjects with phase II adhesive capsulitis of the shoulder joint[45]. Previous studies, such as those by Thomas et al., have demonstrated that exercises combined with short wave diathermy can offer unique benefits for managing frozen shoulder. These methods not only improve physical outcomes but also increase patient satisfaction and help with improving abduction and external rotation range of motion and inturn reducing the disability[46].

Some studies found that combining Extracorporeal Shock Wave Therapy with physical exercises—such as the finger ladder exercise, circumduction exercise, pendulum exercise, and pulley exercise—benefited frozen shoulder in peri-menopausal women[47]. Additionally, the important role of ESWT is that it significantly helps heal tissues by promoting the release of substances that improve blood flow to the area[48].

After four weeks of intervention, the results showed significant improvements in all the three outcomes (VAS, universal goniometer, and SPADI) in both the ESWT combined with conventional physiotherapy (experimental Group [$p <0.0001$] and Conventional Physiotherapy alone(control group) [$p <0.0001$].However, it is crucial to emphasize that the improvements in the Extracorporeal Shock Wave Therapy combined with conventional physiotherapy group are consistently more pronounced. The study findings indicate that both interventions are effective in reducing pain, improving range of motion and enhancing function among subjects with periarthritis shoulder. But Extracorporeal Shock Wave Therapy combined with conventional physiotherapy have offered an advantage of decreasing pain, improving ROM and function in short duration and yielding better results in the outcome measures.

In this study both the Extracorporeal Shock Wave Therapy combined with conventional physiotherapy and Conventional physiotherapy alone are beneficial for managing periarthritis shoulder. The unique advantage of ESWT group make it the superior choice. The study findings indicating that after 4 weeks of intervention Extracorporeal Shock Wave Therapy combined with conventional physiotherapy was

more effective than conventional physiotherapy alone in reducing pain, improving range of motion and function. This study concludes that Extracorporeal Shock Wave Therapy combined with conventional physiotherapy was beneficial treatment for periarthritis shoulder.

XIX. LIMITATIONS:

- No follow up
- No blinding evaluators of outcomes was done
- The study duration is short
- Small Sample Size

XX. RECOMMENDATIONSFORFURTHER RESEARCH :

- Sample size can be increased with inclusion of a greater number of subjects to generalize the effects of these techniques in large population.
- Study duration can be increased in future research to assess the prolonged effectiveness.

XXI. CONCLUSION:

The current study concluded that 4 weeks intervention of Effects of Extracorporeal Shock Wave Therapy combined with conventional physiotherapy and Conventional Physiotherapy alone were shown significant improvement in reducing Pain, improving Range Of Motion and Function in subjects with Periarthritis Shoulder.

However Extracorporeal Shock Wave Therapy combined with conventional physiotherapy was more effective than Conventional Physiotherapy alone. Therefore it may be recommended from these findings that Extracorporeal Shock Wave Therapy along with Conventional Physiotherapy may be used as an adjunct to Conventional Physiotherapy alone for treatment of Periarthritis Shoulder.

Declaration by Authors

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XXII. REFERENCES:

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