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Immediate impact of matrix rhythm therapy on adhesive capsulitis-Quasi Experimental Study

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Abstract

Background: Adhesive capsulitis is a condition characterised with pain and stiffness leading restricted range of motion causing disturbance in daily activities, quality of life and disturbed sleep. having the condition with pain an instant relief during the everyday activities is the mainstay of the treatment option. Matrix rhythm therapy induces relaxation and reduction in pain by the action on the cellular metabolism.this study targeted to have immediate effect on pain and range of motion.

Method: 66 participants after a pilot study was included in the study, informed consent was taken from patients fulfilling the inclusion criteria with age group between 40-60 years. Patients with arthritis, rotator cuff injuries were excluded. Outcome measures for pain NPRS, ROM universal goniometer and was used.

Results: study showed significant reduction in pain at rest with mean difference of 1.1 after one sessionas well as on activity the difference was 1.5 with $p<0.05$. There was increase in range of motion with significant improvement in active motion with mean difference after one session was 3-4 degrees in all motion and passive range of motion mean difference ranges from 2-4 degrees in all motion with $p<0.05$.

Conclusion: This study concluded that there was improvement in pain and range of motion after a single session of matrix rhythm therapy.

Keywords: matrix rhythm therapy,adhesive capsulitis, pain , range of motion, NPRS, Universal goniometer

INTRODUCTION

Adhesive shoulder capsulitis, referred to as arthrofibrosis, causing the body to generate adhesions or scar tissue over the glenohumeral joint, results in contracture, discomfort and malfunction leading to trick movements. It is characteristically different from arthritis as the joint is conserved radiographically (1). There is a functional limitation seen in the active and passive range on motion, radiographic findings showed no abnormalities except osteopenia or calcific tendonitis (2). Thickened and contracted capsule adheres to the humeral head causing difficulty in functional movements. It is the self-limiting condition that progresses over the course of four phases, each lasting roughly 24 months(3).

Stage 1, The painful stage which is marked by a slow onset of symptoms lasting less than three months, including mild to severe pain, a mild reduction in range of motion, and an inability to lie on the affected shoulder.

Stage 2, The Freezing stage: Marked by intense nocturnal pain and a marked reduction of both active and passive range of motion, symptoms last for three to nine months.
Stage 3, The Frozen stage: Shoulder stiffness and pain at the end of motion or at night are the main symptoms that last for nine to fourteen months.
Stage 4, The The thawing period, which lasts for 15 to 24 months, is marked by little discomfort and a progressive improvement in range of motion because of capsular remodelling. (4).
Adhesive capsulitis, progressing in these stages leads to considerable change in quality of life as there is difficulty in movements and also disturbance in sleep quality (4). Excruciating limitation of 50% of the exterior rotation. Limitation of both active and passive elevation to less than 100°and radiologically normal appearance of shoulder joint (5).

The pathophysiology of adhesive capsulitis consists of first, the inflammatory response followed by fibroblast proliferation, collagen deposition and fibrosis and lastly neovascularization (6).In the inflammatory phase there is an inflammatory reaction seen in the shoulder joints synovial lining. Synovial fluid production rises as a result of thickening and inflammation of the synovium (7). The secretion is increased, of these two pro inflammatory cytokines and chemokines, tumor necrosis factor-alpha (TNF-α) and interleukin-1 (IL-1) in response to inflammation, adding to the general inflammatory milieu. Adhesive capsulitis diagnosed individuals have high levels of intercellular adhesion molecule-1 (ICAM-1) (8). In the phase of fibroblast proliferation of the joint capsule there is synthesis of collagen and other extracellular matrix constituents. This reaction occurs due to the inflammatory reaction. Increased collagen of type I and III collagen gets deposited in the joint capsule as a result of increased fibroblast activity. The capsular contraction appears to be caused by the fibroblasts changing into smooth muscle phenotype (myofibroblasts) (9). In the phase of collagen deposition and fibrosis the joint capsule thickens and contracts as a result of fibrosis, which is brought on by excessive collagen deposition. One of the main contributing factors to the development of the typical stiffness linked to frozen shoulder is this fibrotic process (10). In addition to affecting the joint capsule, fibrosis can also damage nearby tissues, such as the rotator cuff tendons and synovium. Increased vascularization is the pivotal step in the pathogenesis of adhesive capsulitis during the neovascularization phase. The shoulder capsular tissue had increased level of the nerve growth factor receptor and new nerve fibers. These findings imply that neo-angiogenesis and neoinnervation in the shoulder capsule and rotator interval are significant processes in the pathophysiology of frozen shoulder and could contribute to the understanding of why patients with frozen shoulder frequently experience excruciating pain (11).

The quality of life and daily functional activities also get affected. This causes this condition a challenge in diagnosing and treating cases, that makes it clinically significant. As per the pathophysiology of this condition there is significant pain and discomfort in individuals' daily activities (1). As global restricted range of motion is the hallmark of this condition it affects individual to rotate and elevate his arm affecting their independence and functionality. The pain and restricted range of motion has an daily activities like lifting reaching objects overhead, dressing, grooming etc. This pain and difficulties has impact on sleep disturbances leading to emotional distress, anxiety and depression (12).

Prevalence of adhesive capsulitis in general population is of 2-5% and as high as 20% in diabetes population (13). According to a study, the lifetime prevalence of shoulder pain might reach 70%, with an annual incidence of 14.7 cases per 1000 people. It is commonly affected in the age group of 40-70 years and prevalent in women than men (14). Idiopathic adhesive capsulitis involves non-dominant side and bilateral involvement is around 4-% (1).

A number of characteristics define adhesive capsulitis leading to anatomical abnormalities and inflammatory processes inside the shoulder joint capsule that cause discomfort, stiffness, and reduce motion (1). Capsule contracture is the hallmark of adhesive capsulitis. Thickened joint capsule due to fibrosis and inflammation are the main symptoms of the illness, albeit the actual etiology is not always known. Inflammatory healing leads to increased growth and production of fibroblasts releasing type I and III collagen. Fibroblasts gets differentiated into myofibroblasts and transforming newly formed type III into contracted state (1). Therefore, there is imbalance in increased fibrosis and remodeling of collagenous tissue resulting in contracted state of capsule and ligaments. there was a limited literature for observing the capsuloligamentous complex contracture but these findings were studied during histological examinations and arthroscopic release. Along with thickening of joint capsule, rotator internal and Coracohumeral (CHL) ligament also gets inflamed and thickened (15). Capsular ligamentous complex formed by joint capsule, coracohumeral ligament, and glenohumeral ligaments (superior, middle and inferior). Contracture in these supporting tissues leads to a clinical loss of flexion and external rotation in adduction (1).

As adhesive capsulitis is of unknown cause and has challenge in diagnosing the condition there remains a thought-provoking decision on the initial treatment. As corticosteroids and analgesics are the basic treatment for this condition. Injections of intra-articular corticosteroids are successful in relieving pain and discomfort in shorter periods, but the benefits did not last long (16). Many studies have proved that NSAIDS and corticosteroids are effective in treatment of adhesive capsulitis. The length of pain alleviation is generally limited, and potential side effects are a concern (1). Furthermore, the underlying pathology and restrictive alterations in the joint capsule may not be addressed by corticosteroids and also in conjunction with hydro dilation As a thorough explanation of the inflammatory reactions and anatomical alterations linked to adhesive capsulitis (17). Physical treatment techniques such as iontophoresis and phonophoresis are used to apply for anti-inflammatory effect across the skin. Patients with adhesive capsulitis may get a significant clinical improvement in their physical or pain states with theses therapies (18).

Administration of Matrix Rhythm Therapy has shown significant improvement in the muscle tone as well as muscle relaxation Application of vibration leads to muscle relaxation and this phenomenon is known as vibration induced muscle relaxation (19). Low frequency vibrations lead to muscle relaxation. Golgi tendon activation, Muscle spindle inhibition, Reflex muscle relaxation, Increased blood flow, micro massage and stretching, and neuromuscular adaptation is seen by the application of Matrix Rhythm Therapy which suggests significant improvement in the adhesive capsulitis. This study was done to study the immediate effects of Matrix Rhythm Therapy in adhesive capsulitis (20).

METHODS

This study aimed to observe the immediate effects of Matrix Rhythm Therapy (MRT) on adhesive capsulitis, focusing on various parameters such as pain, range of motion, coracohumeral ligament thickness, and functional disability. Conducted as a double-blinded randomized controlled trial. The study received ethical approval from the Ethical Committee (Ref. No. DYPV/EC/444/2020) and was registered under the Clinical Trial Registry (CTRI/2020/06/025936) prior to commencement.

The sample size was determined using SPSS version 27.0, with references from a pilot study, resulting in the inclusion of 66 participants. The study population comprised patients diagnosed

with adhesive capsulitis from the aforementioned centers. Inclusion criteria specified patients with stage 2 adhesive capsulitis, aged between 40 to 60 years, including both diabetic and non-diabetic individuals, who experienced shoulder pain for more than two months, exhibited limited active and passive range of motion, and had increased coracohumeral thickness. Patients with shoulder arthritis, rotator cuff tears, neurological conditions, upper limb fractures, or uncontrolled diabetes were excluded from the study. Patients diagnosed with adhesive capsulitis were screened and recruited based on the inclusion criteria, with baseline measurements taken accordingly. All participants provided informed consent after receiving an explanation of the study's general information and purpose. They read the information sheet and completed the consent form before enrollment. The study utilized computerized allocation and consecutive sampling for randomization. Outcome measures included the Numerical Pain Rating Scale (NPRS) for pain, a digital goniometer for shoulder range of motion for measuring pain and disability. Therapy procedure included, Matrix rhythm therapy was applied for shoulder region as shown in Image no.1 for 45 mins in supine, side-lying and prone position to cover whole of upper quadrant of affect shoulder followed by hot fermentation for 15 mins.

RESULTS

Table no. 1below indicates distribution of study subjects according to the age (years). Out of 66 study subjects, 5 (7.6%) were in the age group 35-40 years, 19 (28.8%) were in the age group 41-45 years, 9 (13.6%) were in the age group 46-50 years, 17 (25.8%) were in the age group 51-55 years, and 16 (24.2%) were in the age group 56-60 years.

Age (Years)		
	Frequency	**Percent**
35-40	5	7.6
41-45	19	28.8
46-50	9	13.6
51-55	17	25.8
56-60	16	24.2
Total	**66**	**100.0**

Table no 2: Below indicates the pre-post comparison of NPRS at rest, NPRS at activity, active range of motion parameters, and passive range of motion parameters. The comparison was done using Wilcoxon signed rank test.

Pre-post Comparison of study parameters using Wilcoxon Signed Rank Test								
		N	**Mean**	**SD**	**Min**	**Max**	**Z-value**	**p-value**
NPRS on rest	Pre	66	4.5152	1.93146	0	8	-6.329	<.001**
	Post	66	3.4091	1.94523	0	8		
NPRS on Activity	Pre	66	7.3692	0.99325	4	10	-7.094	<.001**
	Post	66	5.8769	1.05338	2	8		

The result indicates that the pre-post differences in NPRS at rest, NPRS at activity in graph no.1, Active range of motion parameters graph no.2, and passive range of motion graph no.3 parameters was significant (p<.001)

	Shoulder ROM		N	Mean	SD	Min	Max	Z-value	p-value
Active range of motion	Flexion	Pre	66	114.197	41.65729	20	170	-7.107	<.001**
		Post	66	118.4848	41.82022	22	180		
	Abduction	Pre	66	84.0455	31.98049	25	155	-7.072	<.001**
		Post	65	88.1385	32.00482	27	158		
	Internal rotation	Pre	66	33.8788	14.11438	10	70	-6.708	<.001**
		Post	66	36.8485	14.10536	13	75		
	External rotation	Pre	66	32.5909	15.58992	10	70	-6.812	<.001**
		Post	65	35.5692	15.58843	12	74		
Passive range of motion	Flexion	Pre	66	122.697	42.12873	25	180	-6.683	<.001**
		Post	66	124.5909	44.74336	13	183		
	Abduction	Pre	66	90.2879	32.80749	29	162	-7.128	<.001**
		Post	66	94.6667	33.68831	30	167		
	Internal rotation	Pre	66	36.6667	14.79536	15	76	-7.162	<.001**
		Post	66	39.3788	14.81762	17	80		
	External rotation	Pre	66	35.7576	15.1323	10	72	-7.147	<.001**

DISCUSSION

Understanding the pathophysiological mechanisms, clinical presentation, and effective management strategies is crucial for providing optimal care to patients. The pathophysiology involves an initial inflammatory response, followed by fibroblast proliferation, collagen deposition, fibrosis, and neovascularization (21). These processes lead to thickening and contraction of the joint capsule, causing stiffness and pain. Despite various treatment strategies, further research into molecular and cellular processes is necessary to develop targeted treatment strategies for better and earlier outcomes. Recovery from adhesive capsulitis typically ranges from 6 months to 2 years,(22) with outcomes varying from total recovery to residual stiffness that hampers the patient's functional ability. Early intervention and adherence to a comprehensive rehabilitation program are crucial for optimizing outcomes and minimizing long-term sequelae.

In this study, 66 participants diagnosed with adhesive capsulitis for more than three months, aged between 40 and 60 years, were included. Exclusions were made for post-operative cases, diabetes mellitus, and allergic skin reactions. Matrix Rhythm Therapy (MRT) was applied for 50 minutes using the scooping method by the probe of the modality. The application targeted the length of the muscle, including the shoulder joint, axilla, and scapula. A single application of MRT resulted in a 30% improvement in pain and range of motion. Matrix Rhythm Therapy facilitates cellular metabolism reactivation through depth-effective rhythmical micro-extensions, resulting in increased ATP and oxygen supply to the tissues.(23) This process leads to muscle relaxation, increased peripheral blood circulation, and tissue healing.(24)

Additionally, MRT induces micro-stretching on scar tissues, enhancing passive range of motion.(25) The physiological effects of MRT ie the low frequency vibrations have an enhanced effect on Golgi tendon organ activation, muscle spindle inhibition, reflex muscle relaxation, and neuromuscular adaptation contribute to its efficacy.(26) Therefore, Matrix Rhythm Therapy demonstrates significant and rapid improvements in range of motion and pain reduction in patients with adhesive capsulitis, offering a promising treatment modality for this condition. Further research with larger sample sizes and long-term follow-up is recommended to confirm these findings and establish MRT as a standard intervention for adhesive capsulitis.

The significant and immediate benefits of Matrix Rhythm Therapy (MRT) in managing adhesive capsulitis. The application of MRT results to a notable decrease in pain and progression in the range of motion among participants, demonstrating its potential as an effective therapeutic intervention. The physiological mechanisms underpinning MRT, such as enhanced cellular metabolism, increased ATP and oxygen supply, muscle relaxation, and improved peripheral blood circulation, contribute to its efficacy in addressing the symptoms of adhesive capsulitis.(27) Given these promising results, MRT offers a viable treatment option that can be integrated into rehabilitation programs for adhesive capsulitis. Larger sample sizes and long-term follow-up are required for future studies in order to confirm these results and make MRT the standard of care for adhesive capsulitis. MRT application in early stage could improve patient outcomes, shorten recovery periods, and enhance the general quality of life for those with this illness.

Conclusion:

This study demonstrates that Matrix Rhythm Therapy (MRT) significantly reduces pain and improves the range of motion in patients with adhesive capsulitis. The physiological benefits of MRT, such as enhanced cellular metabolism, increased ATP and oxygen supply, muscle relaxation, and improved blood circulation, contribute to its effectiveness. These findings suggest that MRT could be a valuable addition to rehabilitation programs for adhesive capsulitis, warranting further research to confirm its long-term benefits and establish it as a standard treatment option.

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