

# TO STUDY THE EFFECT OF VIRTUAL REALITY THERAPY AND SCAPULOTHORACIC EXERCISES ON SHOULDER PAIN, ROM AND DISABILITY IN PATIENT WITH GRADE-2 ADHESIVE CAPSULITIS- A COMPARATIVE STUDY

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**Abstract- Background :** Adhesive capsulitis, sometimes referred to as frozen shoulder.

Adhesive capsulitis is associated with pain, reduced range of motion and functional disability in shoulder. It is a condition with unknown etiology that causes discomfort and reduces both active and passive range of motion (ROM). Adhesive capsulitis is divided into three stages-1) Painful Phase (Freezing) 2) Stiffening Phase (Frozen) 3) Thawing Phase

**Scapulothoracic exercises-** Exercises for the scapulothoracic region that involve rotation, elevation, depression, protrusion, retraction, and circumduction are crucial for maintaining the shoulder's normal functioning. Scapulothoracic strengthening exercises restore external rotation and scapular protraction, while stretching activities restore the length of constricted muscles. **Virtual reality therapy-** Through the use of real input and adaptive capacity at changing intensities, virtual reality is a motivating technique for obtaining therapeutic outcomes. With the use of VR games, a variety of shoulder motions, including shoulder external rotation, abduction, and flexion, can be improved.

**Aim:** To study the effect of virtual reality therapy and scapulothoracic exercises on shoulder pain, ROM and disability in patient with GRADE-2 ADHESIVE CAPSULITIS- A COMPARATIVE STUDY

**Methodology:** - 48 subjects who fulfilled selection criteria were included. 48 subjects were divided into 2 groups 24 in each group. Group A consists of 24 patients which were treated with phonophoresis, maitland mobilization and Scapulothoracic exercise and Group B consisting 24 patients were treated with phonophoresis, maitland mobilization and Virtual reality therapy. Treatment duration was 6 days for 4 weeks.

**Outcome Measures:** NPRS for pain, universal goniometer measurements for Range Of Motion and DASH scale for functional disability were measured before and after the treatment,

**Result:** Stastical analysis was done by using Shapiro-Wilk test

**Statistical analysis** between groups was done by using independent t test. And the statistical analysis between pre and post interventions was done by paired t test. The statistical analysis of pre and post intervention data shows there is significant effect on adhesive capsulitis Grade-2 patients by both the group A and group B but group B shows more effect than group A

**Conclusion:** The present study concludes that both group, group A scapulothoracic exercises and group B virtual reality therapy shows significant improvement in adhesive capsulitis grade-2 patients, but group B (virtual reality therapy) shows more effect than group A (scapulothoracic exercises).

**Keywords:** Adhesive capsulitis grade-2, NPRS, DASH, scapulothoracic exercises, virtual reality.

## I. INTRODUCTION (HEADING 1)

Adhesive capsulitis, sometimes referred to as frozen shoulder, is a condition with unknown roots that causes pain and reduced active and passive range of motion (ROM)<sup>1</sup>. The fibroblastic proliferation in the rotator interval anterior capsule and coraco-humeral ligament is the source of the undetected condition.

Cyriax divided the three phases of adhesive capsulitis<sup>4</sup>.

1) Phase of Pain, often referred to as Freezing-Shoulder pain that develops gradually over 3 to 9 months, is acute at motion's extremes, and is felt at night as you sleep. 2) Phase of Stiffening, often referred to as Frozen- Discomfort begins to lessen, glenohumeral mobility gradually decreases in a capsular pattern, and discomfort is only felt at extremes of movement. It is possible for this phase to start at 4 months and last for about 12 months. 3) Phase of Thawing- A 1- to 3.5-year-long, spontaneously occurring improvement in functional range of motion.

The capsular pattern in adhesive capsulitis is external rotation, abduction and internal rotation. All glenohumeral joint movements in all planes will be proportionally limited in adhesive capsulitis of the shoulder.

## VIRTUAL REALITY THERAPY-

Due to recent technological advancements, many researchers have used virtual reality (VR) technology in rehabilitation therapies, demonstrating the viability and usability of the proposed VR system. Through the utilization of real input and adaptive capability

at changing intensities, virtual reality is a motivating technique for obtaining therapeutic outcomes. With the aid of virtual reality games, shoulder flexion and extension and external rotation activities may also be performed.

### **SCAPULOTHORACIC EXERCISES-**

To increase the possible range of motion accessible at the shoulder, the scapula is free to move around the thorax. Since the scapulothoracic articulation is involved, its range of motion may be limited. Due to long-term immobility brought on by adhesive capsulitis, scapulothoracic movement limits frequently result from adaptive shortening. As a result of capsular adhesions, the glenohumeral joint's mobility is decreased, which affects the shoulder's external rotation and inhibits the humerus from gliding inferiorly beneath the acromion when the shoulder is elevated. Therefore, mobilizations and scapulothoracic strengthening exercises restore external rotation and scapular protraction, while stretching activities allow muscles that have been tightened to restore the length. It's vital for the shoulder to function normally for the scapulothoracic motions of rotation, elevation, depression, protrusion, retraction, and circumduction<sup>2</sup>.

### **PHONOPHORESIS-**

Deep tissue heating modality like ultrasound (US) elevates tissue temperature. As a result of ultrasonic therapy, collagen tissue extensibility and pain threshold are both raised. Phonophoresis is the term used to describe the ultrasound-assisted delivery of drugs through intact skin<sup>7</sup>. Biologically active compounds are coupled with the coupling medium in phonophoresis, a variation of ultrasound, in the hopes that the force of ultrasound will drive the active substance into tissue<sup>7</sup>.

### **MAITLAND MOBILIZATION-**

The World Maitland Teachers Association (IMTA) defines the Maitland concept as a way of evaluating, diagnosing, and treating musculoskeletal diseases through manual physical therapy<sup>8</sup>.

People with adhesive capsulitis benefit from shoulder joint mobilization<sup>8</sup>.

Stretching of joint capsules with manual mobilizations is useful to improve ranges.

### **RANGE OF MOTION BY UNIVERSAL GONIOMETER**

Physical therapists can measure passive and active ranges of motion (ROM) with the help of a method called goniometry. Usually, measurements are used to evaluate ROM restrictions, choose appropriate interventions, and track therapy progress.

A goniometer's shoulder range-of-motion measurement has an ICC of 0.83-0.95 and a validity range of 0.79-0.99.

### **NUMERICAL PAIN RATING SCALE(NPRS)**

The ordinal 11-point Numerical Pain Rating Scale, which is the most often used version, has very high test-retest reliability ( $r=.79-.96$ )<sup>10</sup>. It is advised that each participant select the number that best reflects the intensity of the discomfort. From 0 (no pain) to 10 (worst agony attainable), the 11-point numeric scale<sup>11</sup>.

### **DISABILITIES OF THE ARM, SHOULDER AND HAND (DASH) QUESTIONNAIRE**

To evaluate impairment and symptoms in one or more upper limb diseases, the Disabilities of the Arm, Shoulder, and Hand (DASH) outcome measure was designed<sup>13</sup>. A patient's ability to perform out specific upper extremity tasks is evaluated using the 30 item Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire<sup>13</sup>. The DASH has established itself as a reliable and practical questionnaire for a variety of upper extremity issues, and it has been translated into several additional languages<sup>13</sup>.

## **MATERIALS AND METHODOLOGY**

### **MATERIALS-**

- Data collection form
- Pen
- Plinth
- Universal goniometer
- VR microsoft kinect device
- Rope
- Ultrasound modality
- Aqua sonic gel and diclofenac gel

### **METHODOLOGY**

- TYPE OF STUDY- Comparative study
- STUDY DESIGN-Experiment study
- TYPE OF SAMPLING-Purposive
- SAMPLE SIZE-48
- STUDY DURATION-6 months
- STUDY SETTING-Tertiary care hospital and communities of Sangli

## **OUTCOME MEASURES**

1)

### **RANGE OF MOTION (BY UNIVERSAL GONIOMETER)**

A goniometer's shoulder range of motion measurement has an ICC of 0.83-0.95 and a validity range of 0.79-0.99.

a) SHOULDER FLEXION-

• **POSITION:** supine with elbow extended with palm facing the body.,**AXIS LOCATION:** at the acromion process, laterally through the head of humerus ,**STATIONARY ARM:** placed along the mid-axillary line of the trunk  
**MOVING ARM:** along the lateral mid-line of the humerus in line with the lateral epicondyle ,**ROM:** 0-180°

b)SHOULDER ABDUCTION-

• **POSITION**-supine,**AXIS LOCATION**-At the anterior portion of acromion process /humeral head,**STATIONARY ARM**-at lateral aspect of anterior surface of chest parallel to midline of sternum,,**MOVING ARM**-arm on anterior aspect of arm parallel to midline of humerus and in line with medial epicondyle ,**ROM**-0-180°

c)SHOULDER EXTERNAL ROTATION-

• **POSITION**-supine abducted to 90.elbow flexed with forearm in neutral and perpendicular to table top such that the palm is facing the feet.humerus fully supported on plinth. Stabilize the distal humerus,thorax and scapula. ,**AXIS LOCATION**-Axis at olecranon process of the ulna.,**STATIONARY ARM**-placed parallel to the table top or perpendicular to the floor.,**MOVING ARM**-arm along the ulnar shaft aligned with the styloid process of the ulna.,**ROM**-0-90°

2)NUMERICAL PAIN RATING SCALE(NPRS)

• numerical scale for grading pain The NPRS is used to measure the perceived degree of pain severity and typically has 11 values. Each participant is instructed to select the number that best reflects the intensity of the discomfort. From 0 (no pain) to 10 (worst pain attainable), the 11-point numeric scale. A minute or less is needed to finish the NPRS.A popular subjective pain scale, the NPRS has high test-retest reliability (r=.79-.96).

3)DISABILITY OF THE ARM,SHOULDER AND HAND(DASH)

The DASH total score's reliability coefficients of ICC are equal to 0.96, and Validity is more than 0.70.

**METHOD:** The patient is asked to select the term from the list of options (no difficulty, mild difficulty, moderate difficulty, severe difficulty, inability) that best characterizes their degree of discomfort and the extent to which they are having trouble utilizing the affected shoulder. The overall DASH score is given as a percentage.

Scores range from 0 (best) to 100 (worst). A higher score indicates a greater level of impairment.

The shoulder girdle is made up of the sternoclavicular, acromioclavicular, and glenohumeral joints, as well as the scapulothoracic articulation. Shoulder girdle discomfort is pain that is in or near any of these structures. DASH was developed to evaluate how shoulder disease affects pain and disability both now and in the future.A self-administered self-assessment instrument with 30 items is called the DASH.

**RESULT**

**Normality test using Shapiro-Wilk**

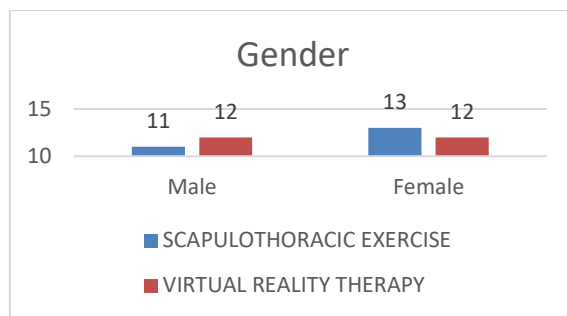
Variable	Time frame	SCAPULOTHORACIC EXERCISE		VIRTUAL REALITY THERAPY	
		z-value	p-value	z-value	p-value
NPRS	Pre	0.920	0.058	0.919	0.055
	Post	0.875	0.050	0.889	0.050
ROM: EXTERNAL ROTATION	Pre	0.923	0.067	0.949	0.254
	Post	0.889	0.051	0.959	0.421
ROM: ABDUCTION	Pre	0.925	0.074	0.928	0.090
	Post	0.951	0.287	0.906	0.052
ROM : FLEXION	Pre	0.921	0.062	0.959	0.422
	Post	0.888	0.052	0.893	0.051
DASH	Pre	0.879	0.050	0.912	0.053
	Post	0.882	0.050	0.880	0.050

Table.1.Mean table

Data set is normally distributed as all the variables have indicated p-value greater than 0.05 in the observation. The researcher shall use parametric test for data analysis purpose in the following sections.

Particular	Group	Group		Total
		SCAPULOTHORACIC EXERCISE	REALITY THERAPY	
Gender	Male	11	12	23
	Female	13	12	25
Total		24	24	48

Table.2.Gender Mean Table

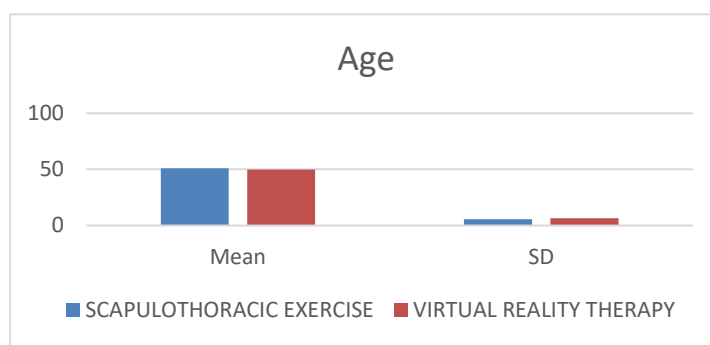


GRAPH.1.GENDER MEAN

**Independent sample test**

Comparison of Groups with independent samples ttest

Variable	Group	Mean	SD	t-value	p-value
AGE	SCAPULOTHORACIC EXERCISE	51.04	5.65	0.684	0.498
	VIRTUAL REALITY THERAPY	49.83	6.57		



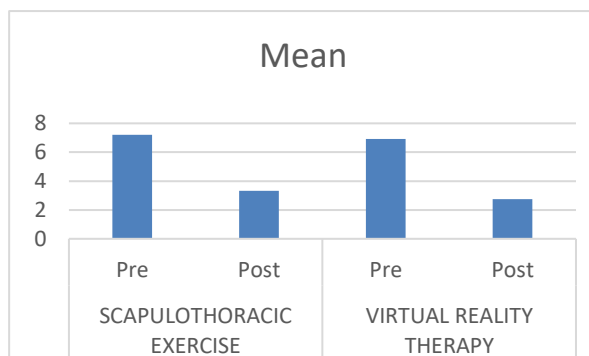
GRAPH.2.AGE MEAN

**Within group Pre and post test**

Comparison of pre-test and post-test scores of NPRS in two Groups by paired sample ttest

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
SCAPULOTHORACIC EXERCISE	Pre	7.21	1.06	3.88	1.08	3.60	17.644	0.001*
	Post	3.33	0.70					
VIRTUAL REALITY THERAPY	Pre	6.92	1.02	4.17	1.05	3.97	19.450	0.001*
	Post	2.75	0.68					

The mean value in group SCAPULOTHORACIC EXERCISE indicated changes post treatment and low values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.60 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention. The mean value in group VIRTUAL REALITY THERAPY indicated changes post treatment and low values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.97 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention.



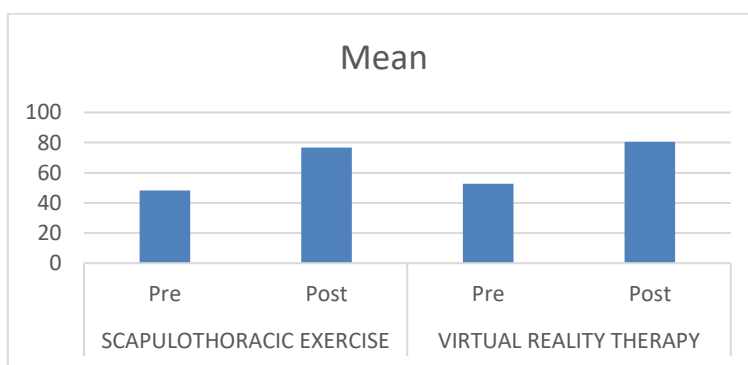
**GRAPH.3.NPRS MEAN**

**Within group Pre and post test**

Comparison of pre-test and post-test scores of ROM: EXTERNAL ROTATION in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
SCAPULOTHORACIC EXERCISE	Pre	48.21	5.45	28.42	5.74	4.95	24.252	0.001*
	Post	76.63	5.22					
VIRTUAL REALITY THERAPY	Pre	52.67	4.53	27.88	5.71	4.89	23.936	0.001*
	Post	80.54	2.96					

The mean value in group SCAPULOTHORACIC EXERCISE indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen’s D indicates 4.95 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention. The mean value in group VIRTUAL REALITY THERAPY indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen’s D indicates 4.89 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention.



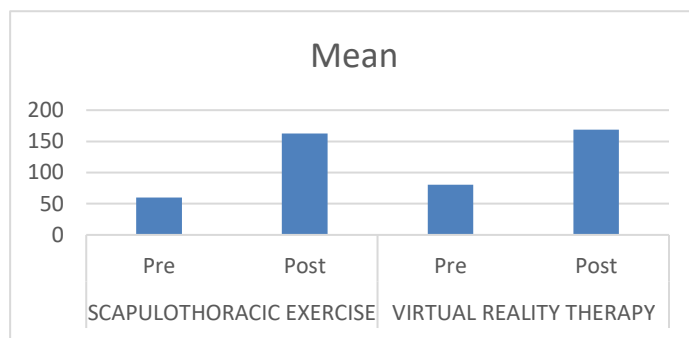
**GRAPH.4.ROM.EXTERNAL ROTATION MEAN**

**Within group Pre and post test**

Comparison of pre-test and post-test scores of ROM: ABDUCTION in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
SCAPULOTHORACIC EXERCISE	Pre	59.79	5.41	102.75	9.09	11.30	55.375	0.001*
	Post	162.54	5.52					
VIRTUAL REALITY THERAPY	Pre	80.54	3.53	88.29	6.03	14.64	71.703	0.001*
	Post	168.83	4.37					

The mean value in group SCAPULOTHORACIC EXERCISE indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 4.95 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention. The mean value in group VIRTUAL REALITY THERAPY indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 4.89 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention.



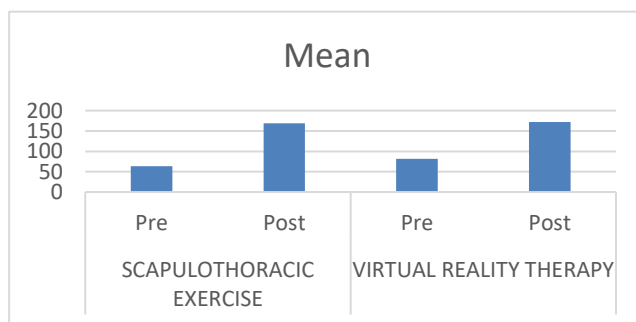
**GRAPH.5.ROM.ABDUCTION MEAN**

**Within group Pre and post test**

Comparison of pre-test and post-test scores of ROM FLEXION in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
SCAPULOTHORACIC EXERCISE	Pre	63.38	7.93	105.25	8.91	11.81	57.860	0.001*
	Post	168.63	4.34					
VIRTUAL REALITY THERAPY	Pre	81.92	4.77	89.96	6.19	14.54	71.209	0.001*
	Post	171.88	3.19					

The mean value in group SCAPULOTHORACIC EXERCISE indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 11.81 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention. The mean value in group VIRTUAL REALITY THERAPY indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 14.54 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e.  $0.001 < 0.05$ ) in the study and therefore it justifies the improvements in health outcome post intervention.



**GRAPH.6.ROM.FLEXION MEAN**

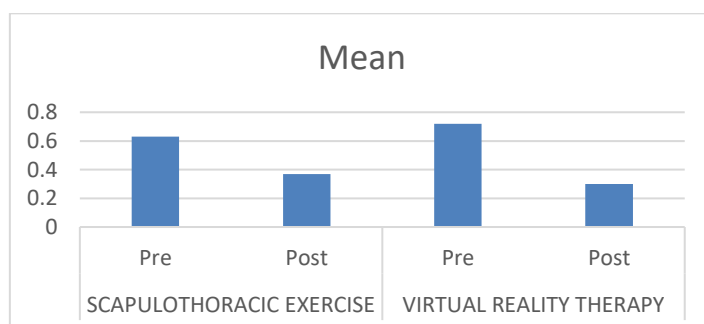
**Within group Pre and post test**

Comparison of pre-test and post-test scores of DASH in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
SCAPULOTHORACIC EXERCISE	Pre	0.63	0.06	0.26	0.05	5.21	25.548	0.001*
	Post	0.37	0.09					
VIRTUAL REALITY THERAPY	Pre	0.72	0.06	0.42	0.09	4.57	22.391	0.001*
	Post	0.30	0.07					

The mean value in group SCAPULOTHORACIC EXERCISE indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen’s D indicates 5.21 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is as significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level(i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group VIRTUAL REALITY THERAPY indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen’s D indicates 4.57 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is as significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level(i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

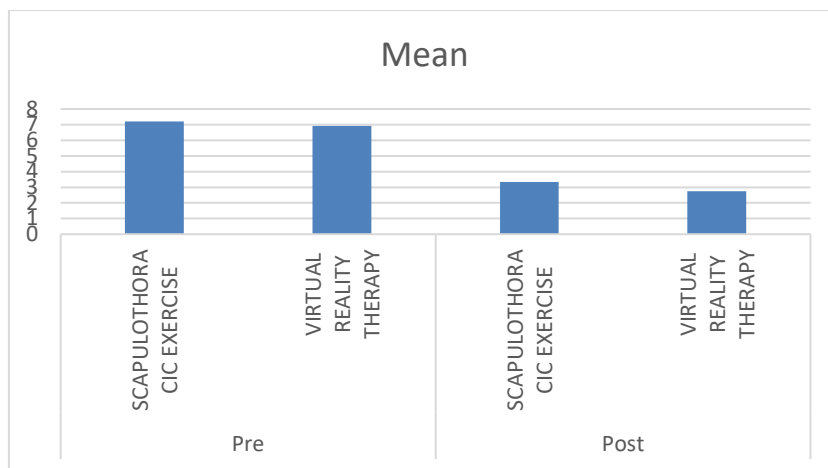


**GRAPH.7.DASH SCORE MEAN**

**Between groups independent test for Group Statistics using independent samples ttest**

Variable	Time	Group	Mean	SD	t-value	p-value
NPRS	Pre	SCAPULOTHORACIC EXERCISE	7.21	1.06	0.971	0.337
		VIRTUAL REALITY THERAPY	6.92	1.02		
	Post	SCAPULOTHORACIC EXERCISE	3.33	0.70	2.933	0.005*
		VIRTUAL REALITY THERAPY	2.75	0.68		

From the above table it is observed that between groups analysis is non-significant for NPRS pretime frame at 5% level significance as the p-value is morethan 5%. It shows non-significant differences between the groups. From the above table it is observed that between groups analysis is significant for post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups



**GRAPH.8.**

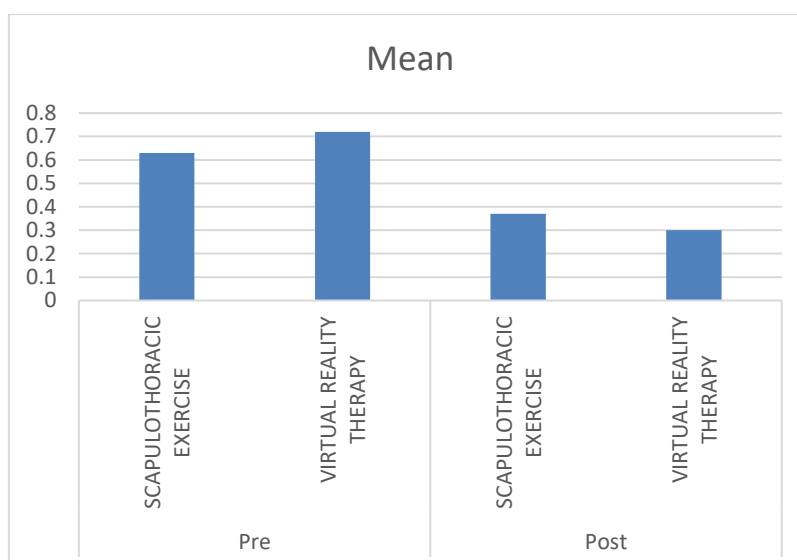
**PRE AND POST INTERVENTION OF NPRS OF SCAPULOTHORACIC EXERCISE AND VIRTUAL REALITY THERAPY**

Between groups independent test for Group Statistics using independent samples t test

Variable	Time	Group	Mean	SD	t-value	p-value
DASH	Pre	SCAPULOTHORACIC EXERCISE	0.63	0.06	4.935	0.001*
		VIRTUAL REALITY THERAPY	0.72	0.06		
	Post	SCAPULOTHORACIC EXERCISE	0.37	0.09	3.195	0.003*
		VIRTUAL REALITY THERAPY	0.30	0.07		

From the above table it is observed that between groups analysis is significant for DASH pre time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is significant for post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups



**GRAPH.9.PRE AND POST INTERVENTION OF DASH SCORE OF SCAPULOTHORACIC EXERCISE AND VIRTUAL REALITY THERAPY**

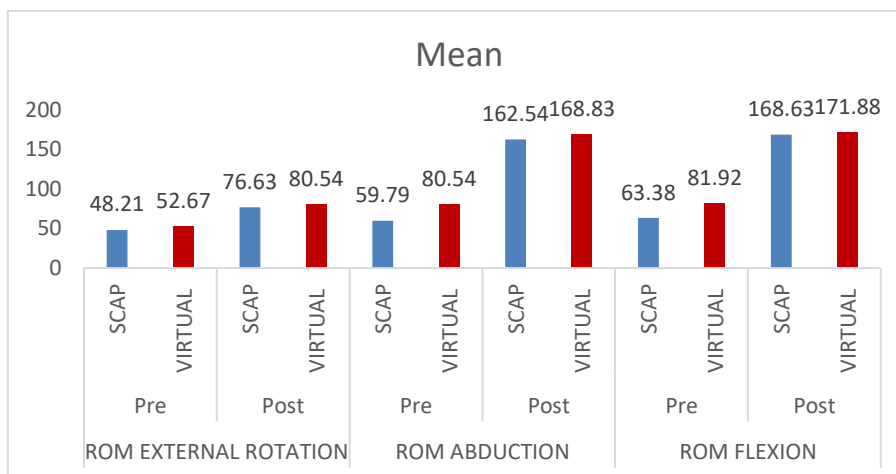
Between groups independent test for Group Statistics using independent samples t test

Variable	Time	Group	Mean	SD	t-value	p-value
ROM EXTERNAL	Pre	SCAPULOTHORACIC EXERCISE	48.21	5.45	3.084	0.003*



ROTATION		VIRTUAL REALITY THERAPY	52.67	4.53		
	Post	SCAPULOTHORACIC EXERCISE	76.63	5.22	3.199	0.002*
		VIRTUAL REALITY THERAPY	80.54	2.96		
ROM ABDUCTION	Pre	SCAPULOTHORACIC EXERCISE	59.79	5.41	15.735	0.001*
		VIRTUAL REALITY THERAPY	80.54	3.53		
	Post	SCAPULOTHORACIC EXERCISE	162.54	5.52	4.376	0.001*
		VIRTUAL REALITY THERAPY	168.83	4.37		
ROM FLEXION	Pre	SCAPULOTHORACIC EXERCISE	63.38	7.93	9.816	0.001*
		VIRTUAL REALITY THERAPY	81.92	4.77		
	Post	SCAPULOTHORACIC EXERCISE	168.63	4.34	2.954	0.005*
		VIRTUAL REALITY THERAPY	171.88	3.19		

From the above table it is observed that between groups analysis is significant for pre time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups .From the above table it is observed that between groups analysis is significant for post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups



**GRPAH.10.PRE AND POST INTERVENTION OF ROM EXTERNAL ROTATION,ABDUCTION&FLEXION**  
**ABBREVIATION-**

- SCAP-Scapulothoracic Exercise
- VIRTUAL-Virtual reality therapy

**DISCUSSION**

- The purpose of this study was to compare the effectiveness of Scapulothoracic exercise versus Virtual Reality Therapy on shoulder pain, ROM and disability in patient with grade-2 adhesive capsulitis. Adhesive capsulitis is characterized by Inflammation, stiffness, and limited range of motion around the shoulder joint where patient complains of pain, decreased mobility and reduced functional disability in shoulder joint. The three most frequent range of motion restrictions are external rotation, abduction and flexion.
- A severe loss of mobility is caused by the pathophysiology, which includes a diffuse inflammatory synovitis, adhesion of the capsule, loss of the typical axillary pouch, and joint volume. One possibility for the cause of capsular contracture is the adherence of the capsular surfaces or the proliferation of fibroblasts in response to cytokine secretion. The shoulder capsule thickens in adhesive capsulitis, and a modest chronic inflammatory infiltration and fibrosis may also be present.
- Patients with metabolic issues are more likely to develop the primary type of frozen shoulder, which has an unclear origin, than the secondary form, which is observed after bad injury or surgery.
- According to previous study the prevalence of adhesive capsulitis in 30-70 years is 22.9%.

- Phonophoresis is a technique where a particular kind of ultrasound is used to propel biologically active compounds into tissue, the coupling medium being coupled with the substances in this case.
- Maitland mobilization is a manual technique In a wide range of exercises, joint mobilization is a type of passive movement that helps alleviate sore and aching synovial joints. There are several types of mobilization, and different authorities use different nomenclature.
- The oscillatory motions will be directed in the direction of the accessory motions of the joint, which are small spinning, gliding, rolling, or distractive motions that take place between joint surfaces and are necessary for proper mobility.
- Virtual reality therapy helps well to restore the joints' full range of motion and dynamic flexibility..Physical treatment can be handled with virtual rehabilitation because it offers an interactive setting that stimulates patients and avoids stressful sessions.
- For the shoulder to operate normally, scapulothoracic motions such as rotation, elevation, depression, protrusion, retraction, and circumduction are essential.The scapulohumeral rhythm rate is typically 2:1. It is 4:1 in the glenohumeral flexion range of 30–60degree and 5:1 above 60degree. Therefore Scapulothoracic exercises are beneficial in adhesive capsulitis.
- In this study 48 subjects (24 in each group) were participated. Out of total participants an age group of 40-60 years were selected according to inclusion criteria and subjects were randomly divided into 2 groups. Group A consist of 13 female and 11 male. Group B consist of 12 female and 12 male. Mean age in Group A and Group B was 51.04 and 49.83 years respectively.Which was given for 6 days for 4 weeks.
- In this study Pre and Post intervention measurements were taken for both the groups by Universal Goniometer ,Numerical pain Rating Scale (NPRS) and Disabilities Of The Arm, Shoulder And Hand(DASH) for ROM ,pain and functional disability respectively. For both group the phonophoresis and maitland mobilization were given before the main treatment i.e. scapulothoracic exercises (Group A) and virtual reality therapy(Group B).
- Bhawna,et.al.(2016)did a study on prevalence of shoulder pain among adults in northern India. The investigation was conducted using a cross-sectional study design. Subjects between the ages of 30 and 70 were asked to complete a Hindi-language questionnaire. The respondents' employment, smoking habits, hand dominance, and present level of discomfort were all noted. Additionally, a diabetes history was gathered. The shoulder pain and disability index in Hindi was utilized. Shoulder discomfort affects 22.9% of individuals between the ages of 30 and 70.Obesity, left-handedness, and diabetes are all strongly linked to shoulder discomfort. There was no correlation between shoulder discomfort and gender, smoking, or rural or urban location.
- According, to Shrutika Wankhade, et al,(2022) they studied the effect of virtual reality aided physical therapy in adjunct to traditional therapy in frozen shoulder patients where 50 subjects were selected randomly . They were divided into two groups of 25 patients each, with one group receiving traditional Maitland mobilization treatment and the other receiving virtual reality-assisted physical therapy combined with Maitland mobilization.And concluded that apparently VR oculus-guided physical therapy treatments had more impressive results in terms of easing pain, enhancing shoulder mobility, and enhancing shoulder-related daily activities.
- Ashutosh Satapathy , Srinivasulu M(2021) did a comparison to study the Effectiveness of Capsular Stretching Versus Scapulothoracic Exercise in Patients with Adhesive Capsulitis of Shoulder. Thirty patients were divided into two groups, Group A (n=15) and Group B (n=15), and given exercises for the scapulothorax and capsular stretching, respectively. Common treatments for the participants in both groups were phonoporesis and glenohumeral exercises.And concluded that Scapulothoracic exercises for frozen shoulder were more effective than capsular stretching exercises.
- Samiksha Sathe,et al,(2018) did a study to contrast the effects of conventional physical therapy with maitland mobilization in adhesive capsulitis. Thirty participants were divided into two groups: group A received conventional therapy, while group B received Maitland therapy. Participants with even serial numbers were given to group A's conventional therapy. Traditional treatment methods included applying ultrasound to the shoulder joint for seven days and performing 20 repetitions of shoulder mobility exercises once a day for fifteen days. The Maitland therapy regimen comprised applying ultrasound to the shoulder joint for seven days, as well as Maitland mobilization method and exercises to improve shoulder mobility. Based on the results of this study, they concluded that Maitland mobilization treatment combined with conventional therapy has a greater impact on ROM, SPADI score, and NPRS pain scores than conventional physiotherapy alone.
- Dr. Abdullah Al Shehr,et .al.,studied on efficacy of maitland mobilization in frozen shoulder. According to predetermined inclusion and exclusion criteria, a total of 40 patients were enrolled. They were then randomly divided into two groups, each of which had 20 patients. Exercises (stretching, strengthening, and ROM exercises) were provided to Group A together with Maitland mobilization, whereas Group B received Ultrasound treatment along with Exercises (stretching, strengthening, and ROM exercises) three times per week for four weeks (12 sessions). The visual analog scale, the Shoulder Pain and Disability Index (SPADI), and goniometry for shoulder range of motion were used to evaluate the patient's outcomes. Pre- and post-treatment values were noted for results comparison.According to the study's findings, Maitland Mobilization and ultrasound both help with frozen shoulder problems. Maitland's group had greater progress than the Ultrasound group. These findings suggest that Maitland mobilization with exercises, as opposed to ultrasound with exercises, should be the preferred method of therapy for frozen shoulder.
- According, to the Post intervention results, this study states that, there is significant improvement in ROM and functional disability and decrease in pain in both the group. But the group B(Virtual Reality Therapy) shows more significant improvement in Range Of Motion, Functional Disability and decrease in Pain compared to Group A (scapulothoracic exercise).

**CONCLUSION**

The study was done on effectiveness of scapulothoracic exercises versus virtual reality therapy with common treatment phonophoresis and ultrasound on adhesive capsulitis grade-2. And according to results it is concluded that both the group, group A scapulothoracic exercises and group B virtual reality therapy shows significantly improvement in ROM, Functional disability and decrease in pain. But group B (virtual reality therapy) shows more improvement than group A (scapulothoracic exercises).

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