

Added effects of kinesiological taping along with conventional exercise and ultrasound therapy on amateur badminton players with bicipital tendinitis.

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Abstract-

Background: Badminton is one of the most widely played sports in the world and a very popular sport in India. The game is physically challenging and demands complex repetitive upper and lower extremity movements with constant postural variations and poses a high risk of overuse injuries to both the appendicular and axial musculoskeletal systems. Injuries are common in badminton due to the overuse of muscles. Bicipital tendinitis is an overuse injury. The inflammation of long head of biceps tendon is Bicipital tendonitis. Badminton is an active sport which involves different types of overhead and underhand shots of variable degrees of motion and strength. Ultrasound therapy has healing properties helps in reducing inflammation and pain thereby increasing range of motion and improving shoulder functioning. Kinesiological taping helps relieving pain and improving range of motion. Therefore, an optimum shoulder functioning plays an essential part in proper performance of the badminton players to prevent risk of injury.

Aim: To study the effect of k taping along with conventional exercise and UST on shoulder functioning, pain, ROM using SPADI, NPRS, GONIOMETRY in amateur badminton players with bicipital tendinitis.

Methodology: The materials used in this study are Kinesio tape, goniometer, ultrasound machine, Data sheet, SPADI questionnaire sheet. 30 subjects were selected according to inclusion criteria out of all the subjects has completed the study. Duration of treatment was 4 Weeks. Group 1 was treated under Conventional exercise intervention coupled with UST. Whereas, Group 2 treated under Kinesiological taping application intervention coupled with UST. Kinesiological tape (applied for once every week for 4 weeks. In total 4 applications of Kinesiological taping will be observed. With Conventional physiotherapeutic exercise (protocol of 1 session per day for 3 days a week for 4 weeks) AND UST (3 days in a week for 4 weeks) was observed. PRE and POST intervention pain was calculated with the NPRS scale and shoulder functioning by SPADI and shoulder ROM by GONIOMETRY. By comparing the values using the NPRS, SPADI & goniometer from the data obtained from both groups, the result was obtained. Study was conducted for a total of 4 weeks on amateur badminton players.

Outcome measures:

Prior and after the treatment both the outcome measures, Numeric pain rating scale (NPRS) for pain and Shoulder pain and disability index (SPADI) and GONIOMETRY for shoulder functioning and ROM were measured.

Results: The group B showed clinical and statistical significance in terms of SPADI and GONIOMETRY outcome with higher mean difference values resulting in [p=0.001], whereas both the groups Group A (p value =0.001 < 0.05) and Group B (p value=0.001 < 0.05) showed equal and effective clinical as well as statistical significance in terms of PAIN.

Conclusion: It is concluded that a treatment protocol that comprises the combination of Kinesiological taping and ultrasound therapy has a good reliability in terms of shoulder functioning and improving range of motion of shoulder joint. The exercise training protocol will eventually lead to a significant improvement in pain tolerance and overall improvement in sports performance of the player.

Key words: Kinesiological taping, Bicipital tendinitis, ultrasound therapy, conventional exercise, numerical pain rating scale (NPRS), Shoulder pain and disability scale (SPADI), goniometry.

INTRODUCTION

Badminton is one of the most widely played sports in the world and a very popular sport in India¹. Considered one of the fastest racquet sports, players require aerobic stamina, agility, strength, speed, and precision, besides requiring good sensorimotor coordination and complex racquet movements¹. Injuries in badminton are common despite it not being a contact sport, and include overuse injuries, and acute traumatic events¹. The game is physically challenging and demands complex repetitive upper and lower extremity movements with constant postural variations and poses a high risk of overuse injuries to both the appendicular and axial musculoskeletal systems¹. Badminton also necessitates short bursts of movement with sudden sharp changes in direction, which places players at risk of non-contact traumatic injuries to joints and muscle-tendon units². Preventing injuries and decreasing time away from training and competition are critical in an elite badminton player's sporting career². It is considered a relatively safe sport, despite many players report shoulder pain¹. The game is physically challenging and demands complex movements with constant postural variations in the form of lunges, reaches, retrievals and jumps². Moreover, repetitive overhead forehand and backhand strokes executed with a very short hitting action, and incorporating deception, apply excessive stress on the upper

extremity. Badminton is a sport that requires a lot of overhead shoulder motion, with shoulder in abduction and external rotation³. Overhead shots are estimated to constitute 30% of shots played by badminton players³. In Badminton, players they can develop biceps tendonitis just from repetitive nature of overhead strokes. Shoulder pain affects or had affected 50% of recreational and elite badminton players with 20% reporting on going shoulder pain³.

Bicipital Tendinitis is the inflammation of long head of biceps tendon and is more commonly observed in younger population especially in sports⁴. This is usually caused by repetitive overhead shoulder joint motion. Studies specific to the definition of biceps tendinitis were first performed by Codman in 1934.

Anatomy: The long head of biceps tendon begins at the supraglenoid tubercle of the scapula and the short head at the tip of the coracoid process the long head of biceps tendon is extra synovial and intra articular and is roughly about 9 cm long⁴. Primary bicipital tendonitis occurs in the age range of 18-35 years old. Individual who play sports involving overhead motions such as badminton, basketball, soft ball, swimming. Bicipital tendonitis occurs in both males and females. The prevalence of shoulder pain in the young population is between 7-26% and the lifetime prevalence reaches 67% .Primary bicipital tendonitis (inflammation without any pathological changes occur in about 5 % of patients).Of all the patients with bicipital tendonitis 95% usually have another injury such as rotator cuff .Studies have determined that the long head of the biceps depresses the humerus head, providing stabilization in the glenohumeral joint, contractions in which the biceps long head was stimulated significantly decreased anterior, superior, and inferior translation at the shoulder. Rodosky MW, Harner CD, Fu FH-when stimulating the biceps long head, the biceps muscle creates resistance against shoulder abduction and external rotational torsional force. For these reasons there is slight limitation in shoulder functions due to bicipital tendonitis.

Kinesiological taping method was discovered in 1979 by a Japanese doctor-Kenzo Kase. Kinesiological taping application is a treatment method has been used since 2007 and has one of the current physiotherapy approaches in recent years⁵. Kinesio-tape is a cotton elastic fibre, waterproof, breathable, anti-allergic, without medications with hypoallergic glue completely different from previously existing sport- medication tape⁵.

Kinesio-taping is used mainly for non-sports (85%) and about 15% for athletes. It is being used regardless of age.

KT applications are recommended in rehabilitation protocols because they reduce pain and provide motor control. It reduces pain by activating endogenous painkillers (pain-suppressing system) and releasing the compression on nociceptors. Kinesio tape leads to carefully lifting the skin, increasing space between epidermis and fascia, which reduces the stagnation of lymph and improves lymph circulation and blood flow⁵. It also stimulates proprioceptors in the skin and fascia. Correction of positional errors and functional limitations between articulating surfaces caused of shortening of muscles KT increases the range of motion in joints, improving muscle contractures of the damaged muscle, increasing strength and ROM reducing the muscle tonus⁵. Kinesiological Tape is placed at the maximum tension of the relevant muscle. The glue on the Kinesiological tape is activated by the heat released from the body⁵.

Different way of application of Kinesiological taping are –

- I-type: Strong tape with biggest effort the tension is focused directly on the target issue.
- Y-type: with less effort compared to I-type; the tension here is under the bar between the 2 ends on the target tissue. This particular tape is used for the ligament, tendons, myofascial correction, for wrapping the muscle, mechanical correction for supporting the superficial fascia.
- X-type: tension is focused on target tissue.

Ultrasound Therapy is widely available and frequently used in electrophysical agent in sports medicine. An ultrasound machine uses ceramic and quartz piezoelectric crystals to convert electrical signals into ultrasonic sound waves which are transmitted through the tissue absorbed by it and converted into heat⁹. Ultrasound waves are transmitted from a transducer to the patient through a homogenous coupling medium- Aquasonic gel. Ultrasound therapy with an intensity ranging from 0.5 to 2.0 W/cm² of body surface area is widely used for the treatment of painful musculoskeletal disorders⁹.

To understand the mechanisms of ultrasound in tendon healing, one needs to understand the cellular events of tendon healing¹⁰. Tendon cells which are the basic components of tendons, are the site of collagen formation, protein mediators of repair and matrix proteoglycans. The physiologic response of tendon to trauma is inducing production of both type I and type III collagen¹⁰. For an injured tendon healing can be divided into: Inflammation, Remodelling, Maturation¹⁰.

Effects of ultrasound can be thermal and non-thermal⁹.

As the ultrasonic waves are absorbed, they are converted to thermal energy. The amount of heat produced depends on the factors such as the no. of times per second the transducer passes over a part on the average intensity (watts/cm²) used. Pulsed ultrasound produces little thermal effect as heat can be produced by 2ms of US is carried away by the circulation in the 8ms rest. Pulsed ultrasound may thus be indicated in the treatment of bicipital tendonitis in an acute condition.

NEED FOR STUDY

Badminton is an active sport which involves different types of overhead and underhand shots of variable degrees of motion and strength. Therefore, an optimum shoulder functioning plays an essential part in proper performance of the badminton players to prevent risk of injury.

Studies show that 74% of shoulder injuries are due to overuse and improper use of the shoulder muscles. The few of the most common injuries of them are Rotator Cuff pathology, subacromial impingement and bicipital tendinitis

There are Studies done proving the treatment of bicipital tendinitis using therapeutic ultrasound to be significant.

Previous Studies were conducted on patients with shoulder pain and bicipital tendinitis effectively treated with Kinesiological Tape adjunct to therapeutic exercises as well.

But there was no study found where combination of Ultrasound and Kinesiological Tape was used to treat the shoulder injuries in badminton players.

Therefore, this study will help analyze the combined effects of therapeutic Ultrasound and Kinesiological tape on shoulder functioning, pain and ROM on bicipital tendinitis using the SPADI, NPRS and Goniometry in badminton players.

AIM AND OBJECTIVES

AIM:

To study the effects of Kinesiological taping along with conventional exercises and Therapeutic Ultrasound on shoulder functioning, pain and ROM using SPADI, NPRS and Goniometry in amateur badminton players with bicipital tendinitis.

OBJECTIVES:

1. To see the effects of Therapeutic Ultrasound with conventional exercises on shoulder functioning, pain and ROM using SPADI and Goniometry in amateur badminton players with bicipital tendinitis.
2. To see the effects of Therapeutic Ultrasound with Kinesiological Taping on shoulder functioning, pain and ROM using SPADI and Goniometry in amateur badminton players with bicipital tendinitis.
3. To compare the effects of Therapeutic Ultrasound with conventional exercises vs Therapeutic Ultrasound with Kinesiological Taping on shoulder functioning, pain and ROM using SPADI, NPRS and Goniometry in amateur badminton players with bicipital tendinitis.

HYPOTHESIS

Null hypothesis:

There will be no significant effects of Therapeutic Ultrasound with Kinesiological Taping versus therapeutic ultrasound with conventional exercises on Shoulder functioning, Pain and ROM in amateur badminton players with Bicipital tendinitis

Alternate hypothesis:

There will be significant effects of Therapeutic Ultrasound with Kinesiological Taping versus therapeutic ultrasound with conventional exercises on Shoulder functioning, Pain and ROM in amateur badminton players with Bicipital tendinitis.

REVIEW OF LITERATURE

1. Erdinç Genç, Tomris Duymaz (2020)

The purpose of this study was to investigate the effects of Kinesio-taping in patients with biceps tendinitis in terms of pain, pain threshold, upper extremity functionality level and quality of life and assessment was done using Digital Algometer, VAS, Q-DASH and Nottingham Health profile, respectively. The intervention duration is of 6 weeks. A total 80 patients were taken and randomly divided into two groups of 40 each. The control group received only exercises for 5 days per week. The experimental group received exercises along with Kinesio-Taping for 2 times per week for 6 weeks. Pre and post interventional assessment was done. The results showed significance improvement in Pain intensity reduction ($p < 0.001$), pain thresholds increased ($p < 0.001$) and functionality using Q-DASH ($p < 0.001$) and comparable improvement in Quality of life in Experimental group whereas Control group showed no significant improvement.

2. Koji Shomoto et al (2001)

The aim of this study was to evaluate ultrasound therapy effects on calcification, pain during active movement and to find factors of improvement in randomized controlled fashion. A total 40 diagnosed patients were taken and the calcification was classified. They were divided into two groups consisting of 20 each using the stratified random allocation method. The controlled group was treated with therapeutic exercises only whereas the experimental group was treated with ultrasound therapy along with therapeutic exercises. The patients underwent the interventions for 3 times per week till the end of the study. After classifying the calcification, Radiography at the end of each month was done and the outcome measure was change in the Base-line of calcifications evaluated by 3-point scale of Gartner and Heyer. The results showed significant difference and improvement in calcifications ($p < 0.0001$) and pain reduction during active movement ($p < 0.002$) proving that Ultrasound along with therapeutic exercises is effective.

3. Tarık Özmen et al (2020)

The purpose of this study was to compare the clinical and sonographic effects of Ultrasound therapy, Extracorporeal shockwave therapy (ESWT) and Kinesio-Taping (KT) in lateral epicondylitis (LE). A total of 40 patients were taken diagnosed with lateral Epicondylitis and divided into three groups randomly. Group 1 (US) had 13 participants, Group 2 (ESWT) had 14 participants and Group 3 (KT) had 13 participants. Pre and post-intervention assessment was done using VAS (pain), Jamar Dynamometer (Hand grip strength) and PRTEE for forearm pain and disability. The intervention duration was of 2 weeks. Hot pack and TENS was common for all the three groups for 20 mins per session Group 1 received US (1 MHz at 1 W/cm³ for 3 mins) 5 days per week for 2 weeks. Group 2 received ESWT for 3 sessions in 2 weeks time. In group 3, Kinesiological Tape was applied for once every 2 days for 2 weeks.

The results show significant decrease in pain and disability in each group. Each intervention was proven significant but none of them are superior to each other.

4. M. Fahlstrom and K. Soderman (2006)

The aim of this study was to describe the prevalence and consequences of painful conditions in the shoulder region in recreational badminton players.

A questionnaire study was given to 122 players out of which 99 players responded. The questionnaire included questions about the habits and training of the players and was common to everyone. Pain assessment was done using the VAS. Out of 99 players, 51 players reported previous injuries on dominant hand. 39 players reported previous shoulder injury. 16 players reported ongoing shoulder pain and 4 players reported of both previous episodes and ongoing shoulder pain. Decreased internal rotation was a common finding (84%). 9 out of 57 players had shown signs of shoulder instability.

5. Wen-chung Tsai, SF-T Tang and Fang-Chen Liang (2011)

This study was done to investigate and evaluate the physiological effects of therapeutic Ultrasound on the musculoskeletal conditions including tendinopathy or or tendon injuries. The results prove that Therapeutic Ultrasound can stimulate cell migration, proliferation, collagen synthesis of tendon cells and help in healing in Tendinopathies like tendinitis.

MATERIALS

MATERIALS:

1. Kinesiological tape
2. Therapeutic ultrasound machine
3. Aqua sonic gel
4. Goniometer
5. Chair/Stool



Goniometer

METHODOLOGY:

1. Type of study: Comparative study
2. Study design: Randomized control trial
3. Study duration: 6 months
4. Duration of intervention: 4 weeks
5. Type of sampling: Simple random sampling
6. Sample size: 30
7. Study setting: Dhiraj badminton academy

INCLUSION AND EXCLUSION CRITERIA:**INCLUSION CRITERIA:**

1. Age – 18 to 24 years
2. Badminton players playing regularly.
3. Gender: Male and Female
4. Clinically diagnosed Primary (Acute) Bicipital Tendinitis (Less than 4 weeks)
5. Speeds test – Positive.
6. Yergason s Test – Positive

EXCLUSION CRITERIA:

1. Shoulder dislocation/subluxation on affected side
2. recent history of surgery involving upper limb
3. Recent history of glenohumeral joint fracture
4. Recent trauma
5. Musculoskeletal disorders like OA, RA
6. Neurological impairments like CTS or any nerve entrapments.
7. Denial of consent

OUTCOME MEASURES:

1. Shoulder Pain and Disability Index_(SPADI) (Reliability of 0.86-096): THE SHOULDER PAIN AND DISABILITY INDEX is a self-administered questionnaire consisting of items grouped into pain and disability subscales. Rating is on Visual analogue scales, and the means of 2 subscales will provide a total score of 100. SPADI was designed to measure shoulder pathology in terms of pain and disability for both current status and change overtime.

Interpretation of scores

Total pain score: / 50 x 100 = %

Total disability score: / 80 x 100 = %

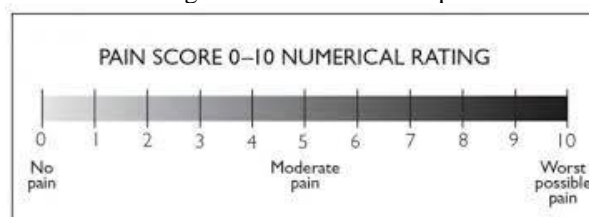
Total Spadi score: / 130 x 100 = %

The means of the two subscales are averaged to produce a total score ranging from 0 (best) to 100 (worst). Minimum Detectable Change (90% confidence) = 13 points

2. NPRS

A unidimensional measure of pain intensity

NPRS is a segmented numeric version of visual analogue scale in which a respondent selects a whole number 0-10



3. Goniometry of shoulder (reliability of 0.91) Goniometric measurements are used by physical therapists to quantify baseline limitations of motion, decide on appropriate therapeutic interventions, and document the effectiveness of these interventions.

PROCEDURE

Ethical clearance will be obtained from the Institutional Ethical Committee. Screening of the subjects will be done and selected according to the inclusion criteria. Prior to the study, procedure will be explained to the subjects and written informed consent will be taken from them. Pre-intervention and post-intervention assessment will be done using Shoulder Pain and Disability Index (SPADI), NPRS and Goniometry. The selected subjects then will be randomly divided into 2 groups comprising of "N" in each group. Group A will be the Control group undergoing Therapeutic Ultrasound and conventional physiotherapy exercises. Group B is the experimental group undergoing a combination of Therapeutic ultrasound along with Kinesiological Tape. Both groups will perform the respective protocol for 1 session per day, 3 days per week for 4 weeks.

INTERVENTION:

Group A (Control)

This group consist of players who'll undergo the combination of Ultrasound and Conventional physiotherapeutic exercise protocol of 1 session per day for 3 days a week for 4 weeks.

1. Ultrasound dosage –

- Mode: Pulsed low intensity
- Intensity: 1 W/cm²
- Frequency: 3 MHz
- Duration: 3 to 5 mins
- Application: Patient will be in a seated position on a chair. Position of patient's hand in a neutral position between 55-70 degrees of shoulder abduction with respect to the trunk in the plane of the scapula. The area is cleaned using sterilizer and then apply sufficient gel to the treatment area without bubbles and move the transducer in circles over the treatment area while keeping it perpendicular to the treatment area.

2. Conventional exercises –

The following set of exercises need to performed 1 session per day 3 days per week for 4 weeks:

1. Scapular Isometrics (Protraction, Retraction, Elevation and Depression)
 - 30 seconds hold each.
2. Shoulder Joint Isometrics – self (flexion, Abduction and extension)
 - 30 seconds hold each.
3. Closed chain exercises (hands on wall)
 - 30 seconds hold each.
4. Self-stretching (sleeper's stretch)
 - 30 seconds hold each.

Figure 01



Figure 02



Figure 03



Figure 04



Figure 05**GROUP B (Experimental group)****Therapeutic Ultrasound+ Kinesiological Taping.**

This group will undergo the same protocol as of control group for ultrasound therapy along with the application of Kinesiological taping for the Biceps muscle.

Ultrasound therapy 3 days in a week for 4 weeks along with exercises

Ultrasound dosage –

- Mode: Pulsed low intensity
- Intensity: 1 W/cm²
- Frequency: 3 MHz
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The Kinesiological tape will be applied for once every week for 4 weeks. In total 4 applications of Kinesiological taping will be observed.

Kinesiological tape will be replaced after every 7 days.

- **Application of Kinesiological tape:**

KT tape was applied once a week, 4 times for a total of 4 weeks.

In practice, 2 pieces of Y tape are used.

Patient is in a seated in a resting position on a chair.

The beginning of the 1st tape is applied below the inside of elbow, the 2 tails of the band surround the biceps brachii muscle then run parallel to the anterior edge of the deltoid muscle and end in the coracoid process. For the 2nd tape is for fascia correction arm is in extension the fascia is pulled in the transverse direction.

Figure 06

Figure 07



Figure 08



STATISTICAL ANALYSIS

Statistical analysis was done using the Statistical Package for Social Sciences [SPSS] software.

GROUP A Pre and Post intervention – done by paired Wilcoxon test

GROUP B Pre and Post intervention – done by paired Wilcoxon test

Between Group A and Group B done by independent Mann Whitney test

RESULTS

Data analysis was performed using Graph Pad prism software [GPSS]. Statistical analysis was done using Paired and Unpaired Wilcoxon test.

TABLE 1: Correlation between demographic data between Group A and Group B

Demographic data: AGE GENDER and DOMINANCE of HAND

Comparison of Groups with mean age by independent Mann Whitney test

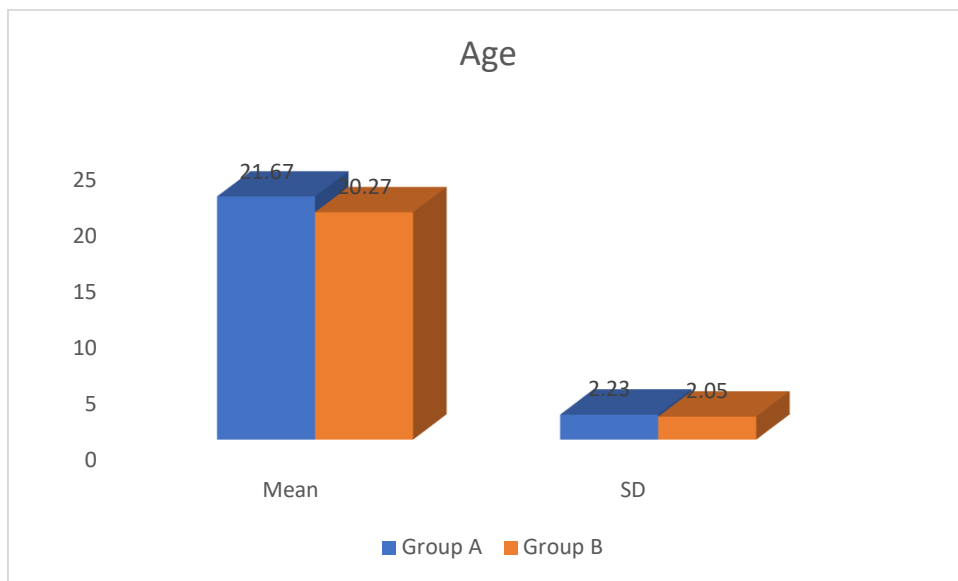
Variable	Groups	Mean	SD	z-value	p-value
Age	Group A	21.67	2.23	71.500	0.089
	Group B	20.27	2.05		

Distribution of GENDER between Group A and Group B

Particular		Group		Total
		A	B	
Gender	Male	11	10	21
	Female	4	5	9
Total		15	15	30

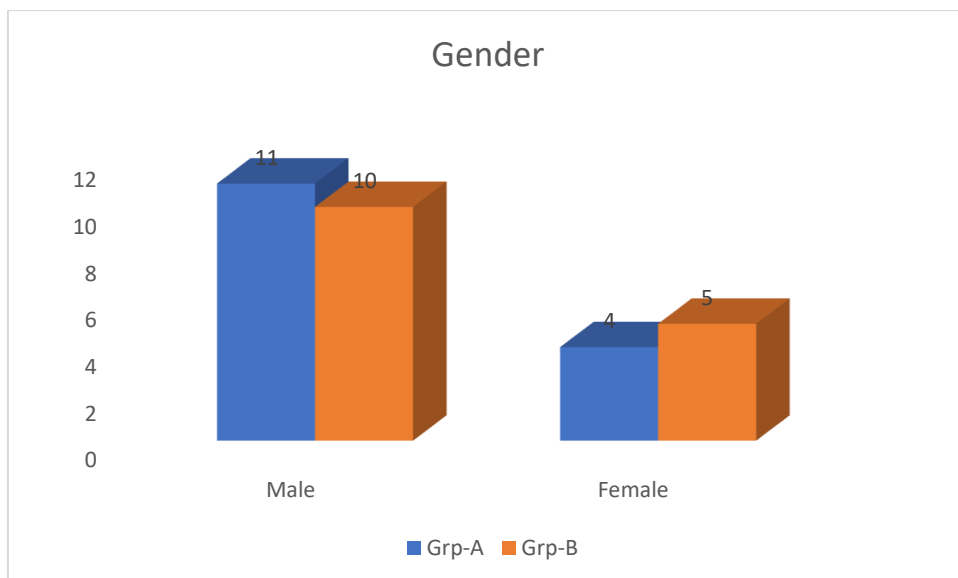
Distribution of Hand Dominance between Group A and Group B

Particular		Group		Total
		Grp-A	Grp-B	
DH	Left	3	3	6
	Right	12	12	24
Total		15	15	30



GRAPH 1: Distribution and Comparison as per Age

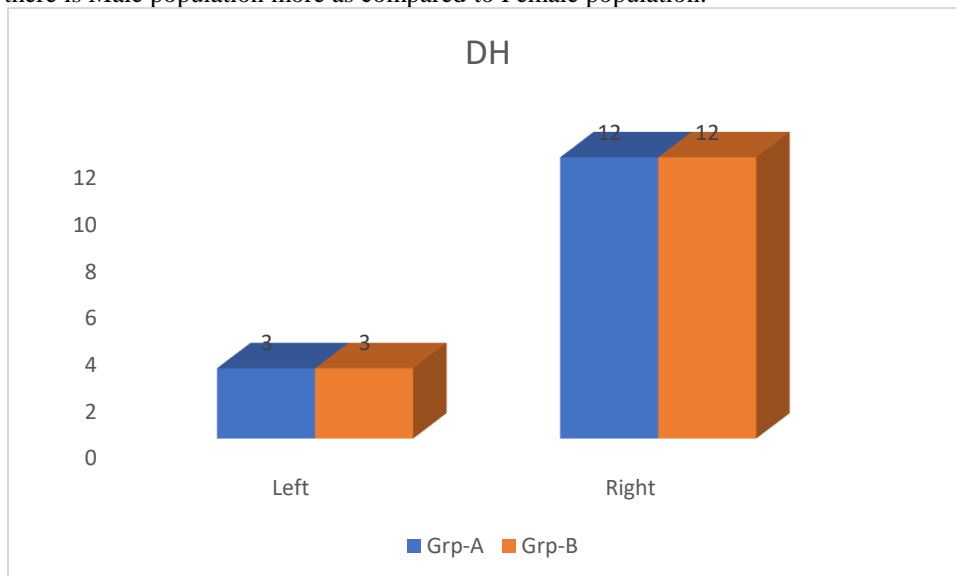
Interpretation: From the above graph analysis of distribution of Age between Group A and Group B , it is observed that there is no significant values at 5% level significance. Hence Mean AGE when compared between 2 groups is 21 years.



GRAPH 2: Distribution and Comparison as per Gender

Interpretation: From the above graph analysis of distribution of Gender between Group A and Group B, it is observed that there is significant values at 5% level significance.

Hence justifies that there is Male population more as compared to Female population.



Graph 3: Distribution and Comparison as per Hand dominance

Interpretation: : From the above graph analysis of distribution of Hand Dominance between Group A and Group B , it is observed that there is significant values at 5% level significance

Hence RIGHT HAND is Dominant when compared between 2 groups.

TABLE 2: Intragroup Analysis of NPRS GONIOMETRY and SPADI

Variable	Time frame	Group A	
		z-value	p-value
Pain	Pre	0.926	0.235
	Post	0.722	0.001
	Diff	0.714	0.001
SF	Pre	0.870	0.034
	Post	0.769	0.001
	Diff	0.772	0.002
SE	Pre	0.893	0.075
	Post	0.561	0.000
	Diff	0.915	0.164
AB	Pre	0.851	0.018
	Post	0.898	0.089
	Diff	0.862	0.026
AD	Pre	0.663	0.000
	Post	0.663	0.000
	Diff	0.663	0.000
SPADI	Pre	0.944	0.433
	Post	0.845	0.015
	Diff	0.973	0.902

TABLE 3: Intragroup analysis of NPRS, GONIOMETRY and SPADI

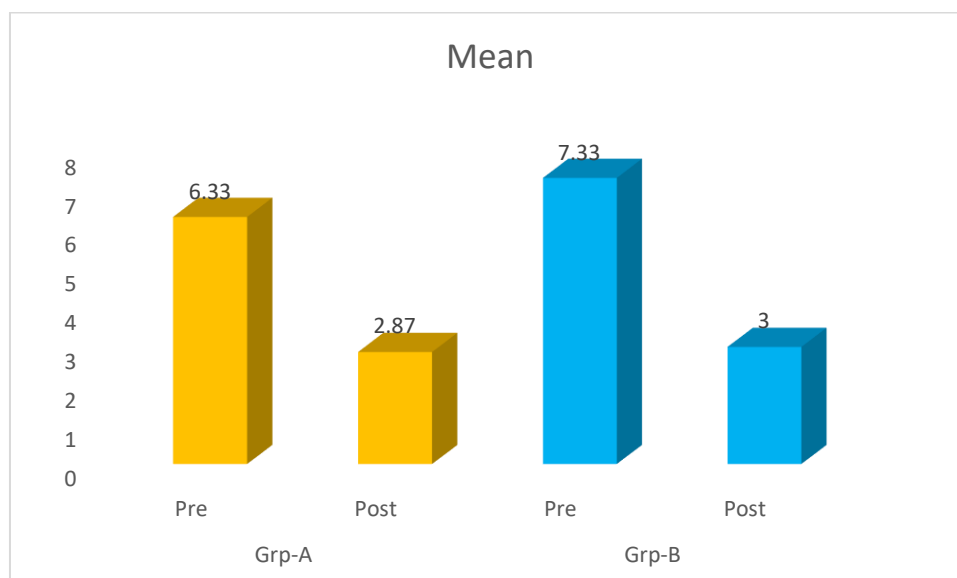
Variable	Time frame	Group B	
		z-value	p-value

Pain	Pre	0.766	0.001
	Post	0.799	0.004
	Diff	0.766	0.001
SF	Pre	0.741	0.001
	Post	0.713	0.000
	Diff	0.881	0.050
SE	Pre	0.710	0.000
	Post	0.800	0.004
	Diff	0.824	0.008
AB	Pre	0.715	0.000
	Post	0.805	0.004
	Diff	0.889	0.066
AD	Pre	0.828	0.008
	Post	0.768	0.001
	Diff	0.805	0.004
SPADI	Pre	0.897	0.085
	Post	0.806	0.004
	Diff	0.924	0.221

Within group Pre and post test Inter group

Comparison of pre-test & post-test scores of PAIN in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	6.33	1.11	3.47	2.03	1.71	3.447	0.001*
	Post	2.87	1.85					
Grp-B	Pre	7.33	0.62	4.33	0.62	7.02	3.493	0.001*
	Post	3.00	0.65					



INTERPRETATION:

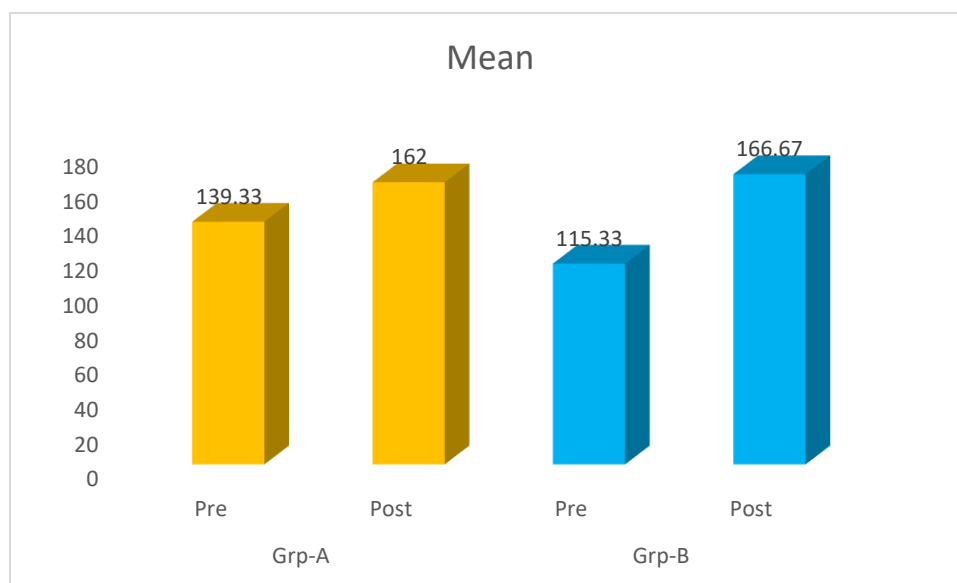
The mean value of pain in group A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 1.71 value which is 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 of pain in group B 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 7.02 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

Within group Pre and post test OF GONIOMETRY

Comparison of pre-test & post-test scores of SHOULDER FLEXION in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	139.33	17.51	22.67	14.38	1.58	3.354	0.001*
	Post	162.00	10.82					
Grp-B	Pre	115.33	17.67	51.33	15.06	3.41	3.436	0.001*
	Post	166.67	16.33					

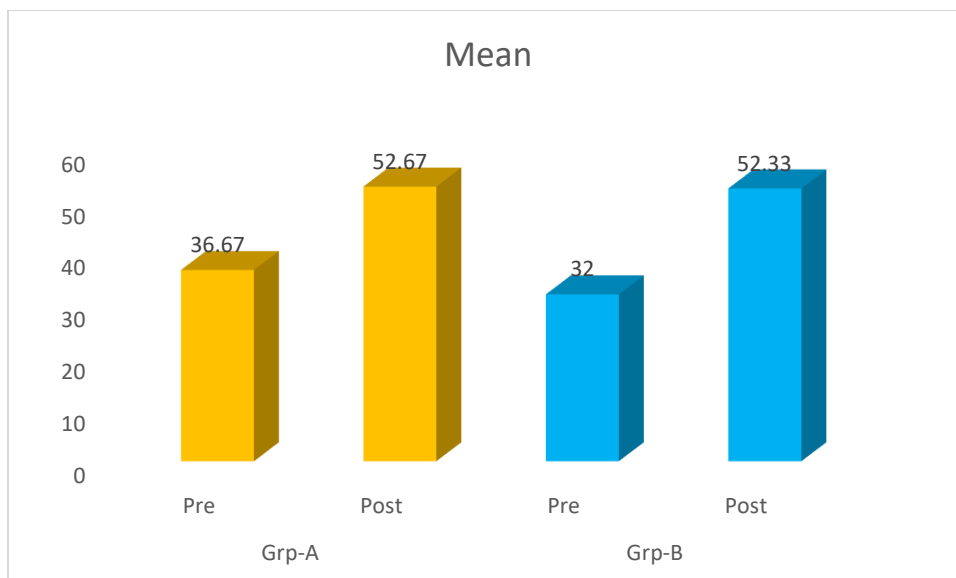


INTERPRETATION:

From the above table it is observed that between groups analysis is significant for SF pre time frame and difference score at 5% level significance as the p-value (i.e. $0.001 < 0.05$) is less than 5%. It shows significant differences between the groups

Comparison of pre-test & post-test scores of SHOULDER EXTENSION in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	36.67	9.39	16.00	11.53	1.39	3.322	0.001*
	Post	52.67	4.58					
Grp-B	Pre	32.00	9.41	20.33	10.93	1.86	3.450	0.001*
	Post	52.33	5.30					

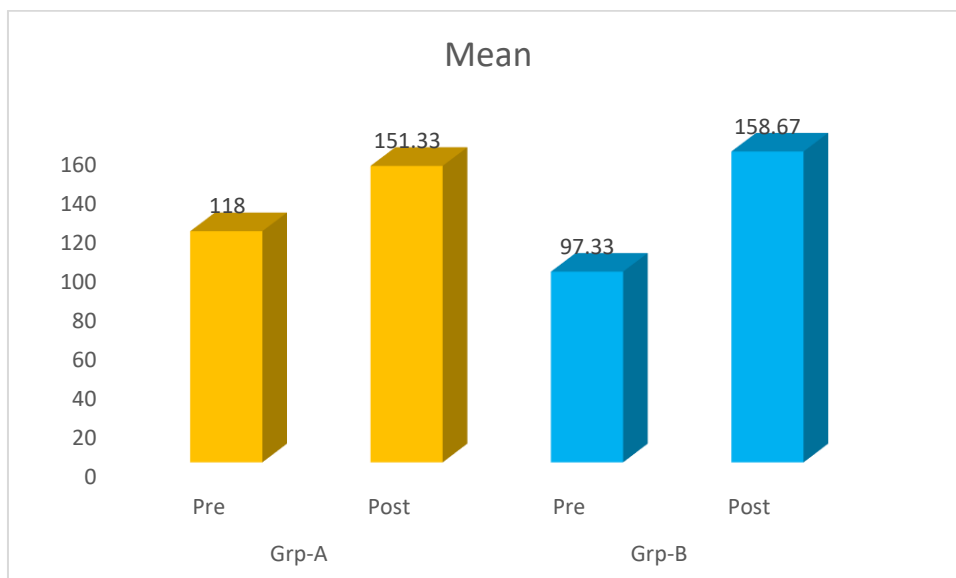


INTERPRETATION:

From the above table it is observed that between groups analysis is significant for SE pre time frame and difference score at 5% level significance as the p-value (i.e. $0.001 < 0.05$) is less than 5%. It shows significant differences between the groups

Comparison of pre-test & post-test scores of SHOULDER ABDUCTION in two Groups by paired Wilcoxon test

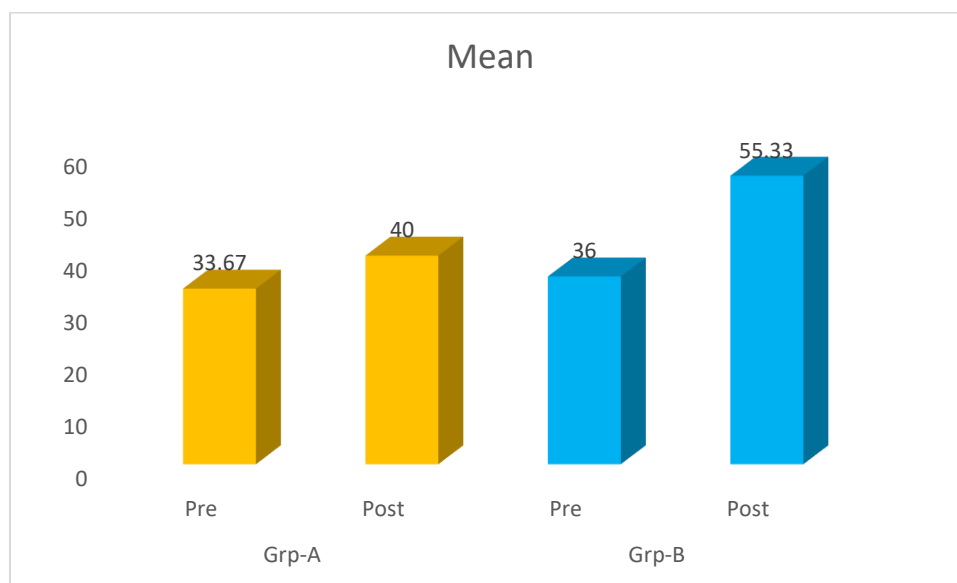
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	118.00	16.99	33.33	13.97	2.39	3.436	0.001*
	Post	151.33	16.42					
Grp-B	Pre	97.33	31.27	61.33	23.86	2.57	3.421	0.001*
	Post	158.67	22.32					



INTERPRETATION: From the above table it is observed that between groups analysis is significant for shoulder abduction pre time frame and difference score at 5% level significance as the p-value (i.e. $0.001 < 0.05$) is less than 5%. It shows significant differences between the groups

Comparison of pre-test & post-test scores of SHOULDER ADDUCTION in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	33.67	5.50	6.33	5.50	1.15	3.110	0.001*
	Post	40.00	0.00					
Grp-B	Pre	36.00	5.73	19.33	7.53	2.57	3.455	0.001*
	Post	55.33	5.81					



INTERPRETATION: From the above table it is observed that between groups analysis is significant for AD pre time frame and difference score at 5% level significance as the p-value (i.e. $0.001 < 0.05$) is less than 5%. It shows significant differences between the groups

Comparison of pre-test & post-test scores of SHOULDER external rotation in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	36.67	9.39	16.00	11.53	1.39	3.322	0.001*
	Post	52.67	4.58					
Grp-B	Pre	32.00	9.41	20.33	10.93	1.86	3.450	0.001*
	Post	52.33	5.30					

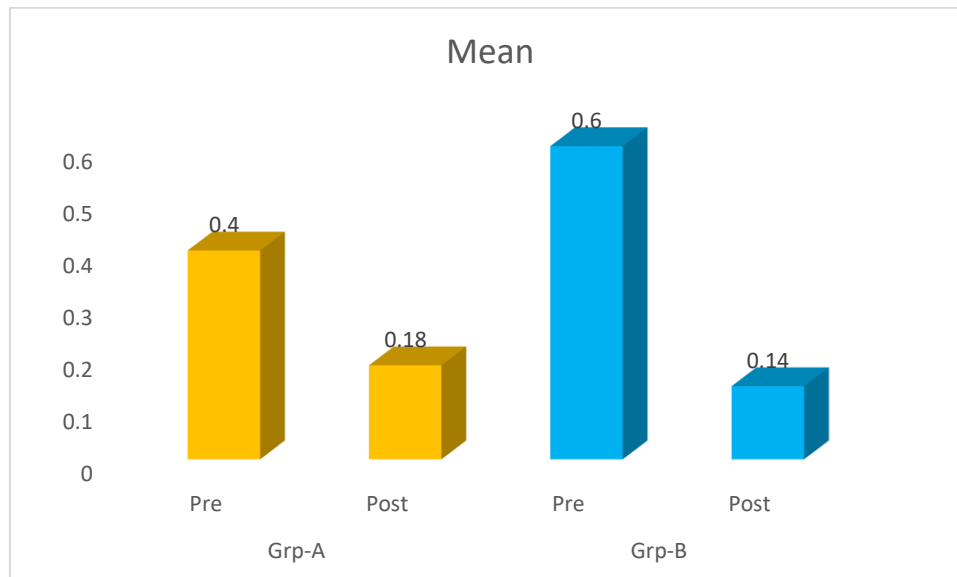
Comparison of pre-test & post-test scores of SHOULDER internal rotation in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	33.67	5.50	6.33	5.50	1.15	3.110	0.001*
	Post	40.00	0.00					
Grp-B	Pre	36.00	5.73	19.33	7.53	2.57	3.455	0.001*
	Post	55.33	5.81					

INTER group Pre and post test SPADI

Comparison of pre-test & post-test scores of SPADI in two Groups by paired Wilcoxon test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	0.40	0.07	0.22	0.08	2.72	3.410	0.001*
	Post	0.18	0.05					
Grp-B	Pre	0.60	0.11	0.46	0.12	3.87	3.415	0.001*
	Post	0.14	0.04					

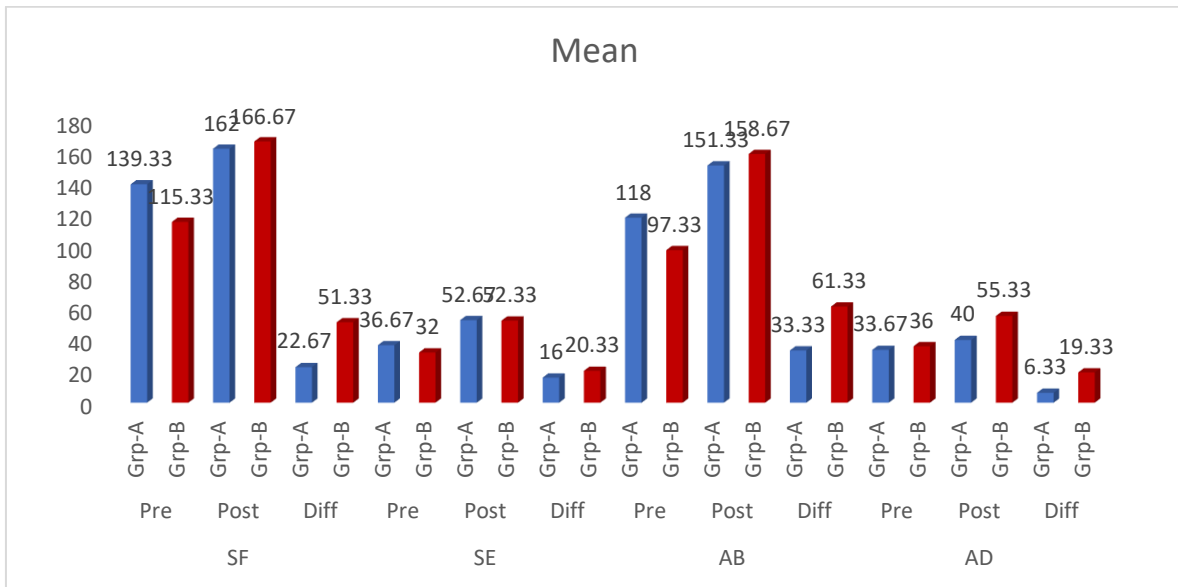
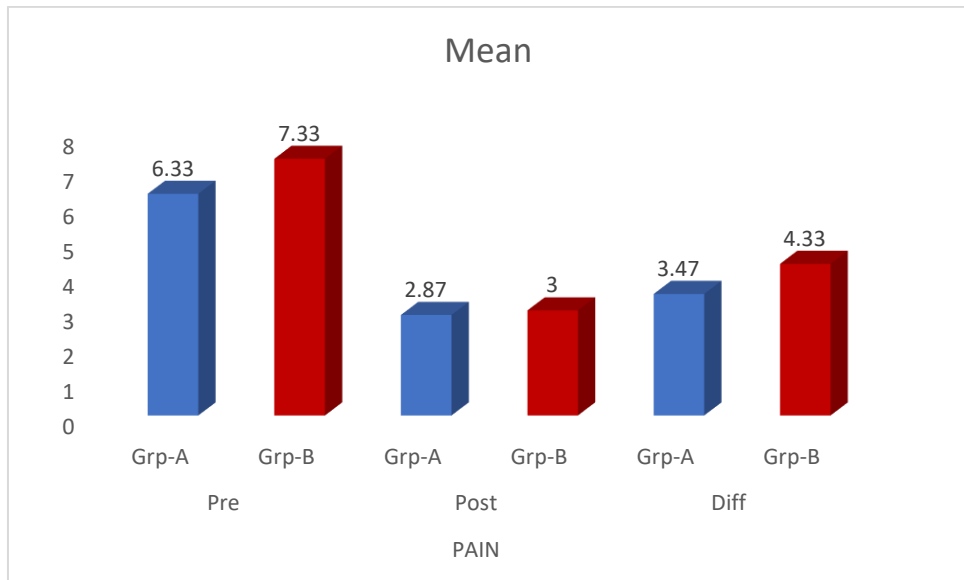
**INTERPRETATION:**

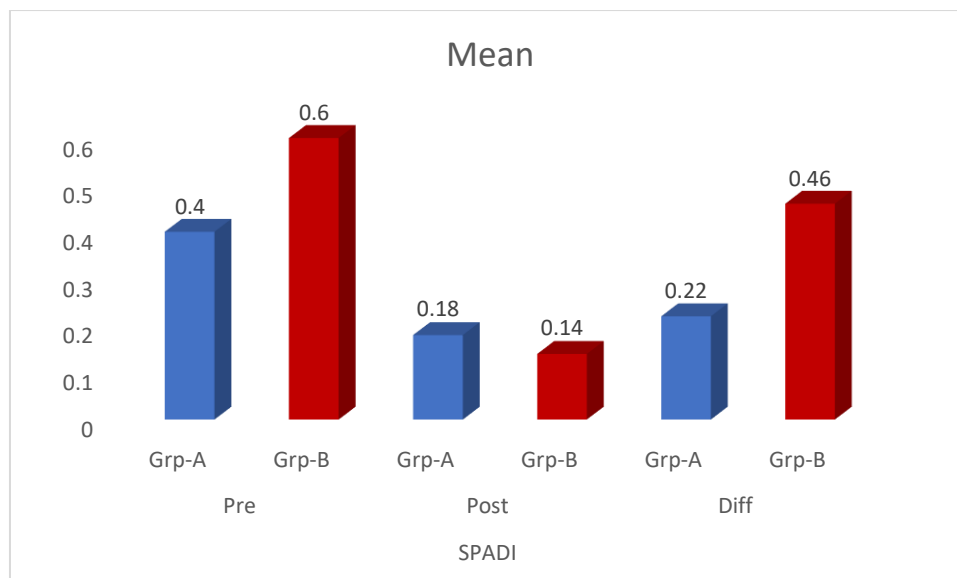
From the above table it is observed that between groups analysis is significant for SPADI pre, post time frame and difference score at 5% level significance as the p-value (i.e. $0.001 < 0.05$) is less than 5%. It shows significant differences between the groups

Between groups independent test for Group Statistics using Mann Whitney test

Variable	Time	Group	Mean	SD	z-value	p-value
PAIN	Pre	Grp-A	6.33	1.11	51.500	0.007*
		Grp-B	7.33	0.62		
	Post	Grp-A	2.87	1.85	87.000	0.265
		Grp-B	3.00	0.65		
	Diff	Grp-A	3.47	2.03	49.500	0.007*
		Grp-B	4.33	0.62		
SF	Pre	Grp-A	139.33	17.51	38.000	0.002*
		Grp-B	115.33	17.67		
	Post	Grp-A	162.00	10.82	81.500	0.146
		Grp-B	166.67	16.33		
	Diff	Grp-A	22.67	14.38	19.500	0.001*
		Grp-B	51.33	15.06		
SE	Pre	Grp-A	36.67	9.39	77.000	0.123
		Grp-B	32.00	9.41		
	Post	Grp-A	52.67	4.58	107.000	0.789
		Grp-B	52.33	5.30		
	Diff	Grp-A	16.00	11.53	82.000	0.196
		Grp-B	20.33	10.93		
AB	Pre	Grp-A	118.00	16.99	83.000	0.203
		Grp-B	97.33	31.27		
	Post	Grp-A	151.33	16.42	80.500	0.171
		Grp-B	158.67	22.32		
	Diff	Grp-A	33.33	13.97	32.500	0.001*
		Grp-B	61.33	23.86		
AD	Pre	Grp-A	33.67	5.50	86.000	0.225
		Grp-B	36.00	5.73		

SPADI	Post	Grp-A	40.00	0.00	0.000	0.001*
		Grp-B	55.33	5.81		
	Diff	Grp-A	6.33	5.50	10.000	0.001*
		Grp-B	19.33	7.53		
	Pre	Grp-A	0.40	0.07	13.000	0.001*
		Grp-B	0.60	0.11		
Post	Grp-A	0.18	0.05	57.000	0.016*	
	Grp-B	0.14	0.04			
Diff	Grp-A	0.22	0.08	7.000	0.001*	
	Grp-B	0.46	0.12			





RESULTS FROM ANALYSIS:

The final analysis proves that the Group B is clinically as well as statistically highly significant than the Group A.

The Comparison of post intervention statistical data (mean difference values) of both the Groups proved that Group B (experimental) was better than the Group A (control) in terms of shoulder functioning and range of motion but in terms of pain threshold individually both the groups showed equal and effective improvement statistically but when compared between 2 groups none were superior than one another.

When the components of the NPRS, SPADI, Goniometry were compared to the Group A, Group B recorded significantly higher mean values for post intervention and mean value difference shows significant improvement in terms of shoulder functioning post intervention. The standard deviation showed consistency with post intervention value which is lesser than pre value. Thus, reference to the results of the paired t test analysis at 5% significance level, there is significant statistical reliable difference between pre and post intervention values with pvalue less than the 5% significance level ($0.001 < 0.05$) and therefore it justifies the improvement in health outcomes post intervention.

This states that Kinesiological taping along with the ultrasound therapy has good reliability in terms of rehabilitation and exercise training and it will eventually lead to a significant overall improvement in sports performance of the player

DISCUSSION

Badminton is one of the most widely played sports in the world and a very popular sport in India and is introduced at very young age. In order to compete in one of the fastest and most technical racquet sports, players need to have aerobic stamina, agility, strength, speed, and precision, in addition to having good sensorimotor coordination and complex movements with their racquets. Injuries in badminton are common and includes overuse injuries, and acute traumatic events. The game is physically challenging and demands complex repetitive upper and lower extremity movements with constant postural variations and poses a high risk of overuse injuries to both the appendicular and axial musculoskeletal systems. Players must also have the mental strength to handle the pressures of competition. With the right training, players can reach their full potential in the sport. Badminton is considered a low-risk sport compared with many other sports but there is also a high risk of traumatic injuries to the joints and muscles-tendon units on the court when players play badminton because they perform short bursts of movement accompanied by sudden, sharp changes in direction. Majority (74%) of injuries in badminton are described as overuse injuries. Badminton is a sport that requires a lot overhead Shoulder motion with Shoulder in Abduction and external rotation. Overhead shots are estimated to constitute about 30% shots played by badminton players. Bicipital Tendinitis is an overuse injury. Hence Badminton players can develop Bicipital Tendinitis just by the repetitive nature of the condition as well as repetitive nature of overhead shots.

Bicipital Tendinitis is the inflammation of long head of biceps tendon and is more commonly observed in younger population especially in sports. This is usually caused by repetitive overhead shoulder joint motion. Bicipital tendonitis occurs in both males and females. In this study the distribution of Gender in group A and group B that is Male: Female ratio is 21:9.

Kinesiological taping method was discovered in 1979 by a Japanese doctor-Kenzo Kase. Kinesiological taping application is a treatment method that has been used since 2007 and has one of the current physiotherapy approaches in recent years. KT applications are recommended in rehabilitation protocols because they reduce pain and provide motor control. KT increases the range of motion in joints by improving muscle contractures of the damaged muscle, increasing strength and ROM reducing the muscle tonus. For this study a five block rock tape was used. Kinesiological Tape (Y type) is placed at the maximum tension of the relevant biceps muscle that is from insertion to origin in order to inhibit the already present inflammation. The tape was removed using the paper off technique after every 7 days.

Ultrasound Therapy is widely available and frequently used in electrophysical agent in sports medicine. Pulsed low intensity ultrasound with an intensity of 1 W/cm² and frequency of 3 MHz was used in this study for 5 minutes duration. In bicipital tendinitis there is disordered healing with the absence of inflammatory cells, poor healing response, noninflammatory intratendinous collagen degeneration, fiber disorientation and thinning, hypercellularity, scattered vascular ingrowth, and an increase in interfibrillar

glycosaminoglycans. Hence therapeutic ultrasound promotes the restoration of mechanical strength and collagen alignment in healing tendon. It enhances the healing rate of the tendon graft/bone interface through the up-regulation of bi glycan and type I collagen also helps in the regulation of vascular endothelial growth factor expression has been found to be a mechanism for enhancing bone/tendon junction healing.

Conventional exercise for improving pain threshold and improving shoulder functioning in primary bicipital tendinitis are Shoulder and Scapular Isometrics, Closed chain (hands on wall) Self stretching (Sleeper's stretch). The following set of exercises need to be performed 1 session per day 3 days per week for 4 weeks.

Scapular Isometrics (Protraction, Retraction, Elevation and Depression) 30 s hold

Shoulder Isometrics self (Flexion, Abduction, Extension) 30 s hold

Closed chain exercises (hands on wall) 30 s hold

Self-stretching (sleeper's stretch) 30 s hold

The purpose of this study is to evaluate added effects of Kinesiological Taping along with Conventional exercise and Ultrasound therapy on amateur badminton players with bicipital tendinitis. The aim of the study is to evaluate the effects of Kinesiological taping along with conventional exercises and Therapeutic Ultrasound on shoulder functioning, pain and ROM using SPADI, NPRS and Goniometry in amateur badminton players with bicipital tendinitis.

The objectives of this study were to improve the pain threshold, to improve shoulder overall functioning and to improve optimal range of motion such that it should result into full ROM of shoulder joint using NPRS, SPADI and GONIOMETRY as outcome measures.

The subjects in Group A (Control group) underwent Conventional exercise and Ultrasound Therapy which aimed to improve pain threshold and improve shoulder functioning and shoulder Range of Motion. The subjects in Group B (Experimental) underwent Kinesiological taping application and Ultrasound therapy with ultrasound thrice a week for 4 weeks. Kinesiological taping was applied once every week

Within the intragroup comparison, the NPRS or the pain threshold of both the groups were same (pre and post intervention) that is There was no comparative difference in statistical data analysis in terms of pain threshold when compared between 2 groups but individually both groups showed improvement post intervention that is Intragroup analysis is significant for pain pre time frame and difference score at 5% level significance as the p-value (0.001) is less than 5%. It shows significant differences between the pre intervention and post intervention within same group.

Within the intra group comparison, the shoulder range of motion using a goniometer (reliability=0.91) for shoulder flexion, abduction, adduction, external rotation and internal rotation Group B showed more significant improvement post intervention as compared to group A but for Shoulder Extension individually both the groups showed improvement post intervention but when compared both the groups were equally effective and statistically significant with a p-value ($p < 0.001$) less than 5 and none were superior than one another.

The final result of the study demonstrated that compared to the control group, the subjects in the experimental group showed marked improvements in terms of shoulder functioning and shoulder range of motion. The Comparison of post intervention statistical data (mean difference values) of both the Groups proved that Group B (experimental) was better than the Group A (control) in terms of shoulder functioning and range of motion but in terms of pain threshold individually both the groups showed equal and effective improvement statistically but when compared between 2 groups none were superior than one another.

Clinical presentation showed significant improvement in terms shoulder functioning and shoulder ROM in Group A, while more significant improvement in Group B. We conclude by saying that while comparing the effects of KT with UST and Conventional Ex w UST on shoulder functioning and shoulder range of motion in amateur badminton players; KT with UST showed better results for shoulder functioning and shoulder range of motion than Conventional Ex with UST.

Erdinç Genç, Tomris Duymaz (2020)

The purpose of this study was to investigate the effects of Kinesio-taping in patients with biceps tendinitis in terms of pain, pain threshold, upper extremity functionality level and quality of life and assessment was done using Digital Algometer, VAS, Q-DASH and Nottingham Health profile, respectively. The intervention duration is of 6 weeks. A total 80 patients were taken and randomly divided into two groups of 40 each. The control group received only exercises for 5 days per week. The experimental group received exercises along with Kinesio-Taping for 2 times per week for 6 weeks. Pre and post interventional assessment was done. The results showed significance improvement in Pain intensity reduction ($p < 0.001$), pain thresholds increased ($p < 0.001$) and functionality using Q-DASH ($p < 0.001$) and comparable improvement in Quality of life in Experimental group whereas Control group showed no significant improvement.

Tarik Özmen et al (2020)

The purpose of this study was to compare the clinical and sonographic effects of Ultrasound therapy, Extracorporeal shockwave therapy (ESWT) and Kinesio-Taping (KT) in lateral epicondylitis (LE). A total of 40 patients were taken diagnosed with lateral Epicondylitis and divided into three groups randomly. Group 1 (US) had 13 participants, Group 2 (ESWT) had 14 participants and Group 3 (KT) had 13 participants. Pre and post-intervention assessment was done using VAS (pain), Jamar Dynamometer (Hand grip strength) and PRTEE for forearm pain and disability. The intervention duration was of 2 weeks. Hot pack and TENS was common for all the three groups for 20 mins per session Group 1 received US (1 MHz at 1 W/cm³ for 3 mins) 5 days per week for 2 weeks. Group 2 received ESWT for 3 sessions in 2 weeks time. In group 3, Kinesiological Tape was applied for once every 2 days for 2 weeks.

The results show significant decrease in pain and disability in each group. Each intervention was proven significant but none of them are superior to each other.

M. Fahlstrom and K. Soderman (2006)

The aim of this study was to describe the prevalence and consequences of painful conditions in the shoulder region in recreational badminton players.

A questionnaire study was given to 122 players out of which 99 players responded. The questionnaire included questions about the habits and training of the players and was common to everyone. Pain assessment was done using the VAS. Out of 99 players, 51 players reported previous injuries on dominant hand. 39 players reported previous shoulder injury. 16 players reported ongoing shoulder pain and 4 players reported of both previous episodes and ongoing shoulder pain. Decreased internal rotation was a common finding (84%). 9 out of 57 players had shown signs of shoulder instability.

CONCLUSION:

Previous Studies were conducted on patients with shoulder pain and bicipital tendinitis effectively treated with Kinesiological Tape adjunct to therapeutic exercises as well. Studies were also done proving the treatment of bicipital tendinitis using therapeutic ultrasound were significant.

Hence the study was done on amateur badminton players to compare the effects of KT with UST Vs Conventional Ex with UST on Pain, Shoulder functioning and Goniometry using SPADI, NPRS, GONIOMETER.

Results of the study indicated that there was significant difference in Pain threshold, Shoulder functioning and Goniometry within each group.

This study emphasizes that Conventional exercise with UST group; are responsible for improving the pain threshold, shoulder functioning and goniometry of the individual as well. The evaluation of the result proves that individuals undergoing Kinesiological taping application along with UST showed more significant improvements in increasing pain threshold, shoulder functioning and range of motion.

Hence, it is concluded that a treatment protocol comprising the combination of Kinesiological taping with Ultrasound therapy has a good reliability in terms of rehabilitation and will eventually lead to a significant overall improvement in sports performance of the player.

LIMITATIONS AND SUGGESTIONS:**LIMITATIONS**

- Younger population was selected
- There was an unequal gender distribution.

SUGGESTIONS


- Study can be done in equal distribution of male and female population so that Comparative study between male and female can be done
- Study can be done in elite badminton players
- Study can be on larger population

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ETHICAL CLEARANCE



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E-mail : copwanlesshospital@gmail.com

Date:-04/06/2022 WH/MMC/COP/INTR./1521/2022

To,
Miss. Diksha Chinta / Dr. Aakanksha Joshi
College of Physiotherapy, Wanless Hospital, Miraj

Ref : Your Project no.118 entitled, Added effects of kinesio taping along with ultrasound and conventional exercise in badminton players with bicipital tendinitis. received by IEC on 04 June 2022.

Sub – Regarding submission of Project to IEC

Dear, Miss. Diksha Chinta / Dr. Aakanksha Joshi

The meeting of the Institutional Ethics Committee (IEC) was held on 01/06/2022 at 2.00 pm in the incubation center with Dr .V.B Borade as a Chairperson.

12 members attended the meeting held on 07 December 2021. The list of members who attended the meeting is as follows,

SR.NO.	NAME	DESIGNATION
1	Dr .V.B Borade	Chairperson, Ex-Dean, Bharti Vidyapeeth & Medical College Wanlesswadi, dist, Sangli
2	Dr. Prabha S Quaraishi	Director & Program Co-ordinator
3	Dr. Sanjeev Waidande	Medical Superintendent
4	Dr.Ronald N. Prabhakar (PT)	Principal, College of Physiotherapy
5.	Mrs. Sangeeta Satwekar	Principal, College Of Nursing
6.	Dr. T B More	HOD Surgery
7.	Dr.Anand Sakte	HOD Medicine
8.	Dr. M.C. Rajput	HOD Obs/Gyn
9.	Dr. V.K Patki	HOD Pediatric
10	Dr. S.V Khade	HOD Orthopedic
11	Adv. K.H Kulkarni	Legal expert
12.	Prof. Sharad Patil	Person of social standing

The Institutional Ethics Committee reviewed the above – mentioned clinical study & approved the following documents submitted for this clinical study at the meeting –

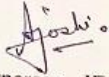
1. Suggested change in title
2. Correction in the sample size
3. Study setting

The IEC hereby approves the proposal entitled Added effects of kinesio taping along with ultrasound and conventional exercise in badminton players with bicipital tendinitis. received by IEC on 04 June 2022.

It is understood that the study will be conducted under your direction, in a total of 30 research participant at Dheeraj Badminton Academy Sangli as per the submitted protocol. This approval is valid for the entire duration of the study.

No deviations from, or changes of the protocol and informed consent document should be initiated without prior written approval by the IEC any deviations from, or changes of the protocol to eliminate immediate hazards to the trial subjects and about any new information's that may affect adversely the safety of the subjects or the conduct of the trial.

A copy of the final report should be submitted to the IEC for review.



Chairperson , IEC

Date of Approval of Study - 04/06/2022

INFORMED CONSENT FORM

Participant's Name:

Age:

Gender:

Address:

Title of the project: ADDED EFFECTS OF KINESIOTAPING ALONGWITH CONVENTIONAL EXERCISE AND ULTRASOUND THERAPY IN AMATEUR BADMINTON PLAYERS WITH BICIPITAL TENDINITIS.

The details of the study have been provided to me in writing and explained to me in my own language. I confirmed that I have understood the above study and have the opportunity to ask question. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving any reasons. By doing so I am aware that my medical care or legal rights will not be affected. I agree that the data or results obtained from this study can be used only for scientific purpose(s). I fully agree to participate in the above study.

Signature of the participant: _____

Signature of the investigator: _____

Date:

Place

DATA COLLECTION SHEET

Name of participants:

Age:

Gender:

Address:

	Pre intervention	Post Intervention
SPADI		
NPRS		
GONIOMETRY		

Signature of participants -

Signature of investigator -

Date:

Place:

माहिती कन्सेंट फॉर्म

नाव :
वय:
लिंग:
पत्ता:

प्रकल्पाचे शीर्षक : गती आजारपणासाठी वेस्टिब्यूलर अनुकूलन विरूद्ध नियंत्रित श्वास व्यायामाची प्रभावीता - तुलनात्मक अभ्यास वरील अभ्यासाचे तपशील मला लेखी दिले गेले आहेत आणि मला माझ्या स्वतःच्या भाषेत समजावून सांगितले आहे मी पुष्टी केली की मला वरील अभ्यास समजला आहे आणि मला प्रश्न विचारण्याची संधी आहे मला हे समजले आहे की माझा माझ्या अभ्यासा मधील सहभाग ठीक आहे आणि मी कोणत्याही कारणाशिवाय काहीही मागे घेण्यास मोकळे आहे असे केल्याने मला माहित आहे की माझी वैद्यकीय सेवा किंवा कायदेशीर हक्क प्रभावित होणार नाहीत मी सहमत आहे की या अभ्यासामधून प्राप्त केलेला डेटा किंवा परिणाम परिणाम केवळ वैज्ञानिक हेतूसाठी वापरल्या जाऊ शकतात वरील अभ्यासात भाग घेण्यास मी पूर्णपणे सहमत आहे.

सहभागीची स्वाक्षरी :

चौकशी करत्याची सही :

MASTERCHART

GROUP A :Conventional exercise w UST															
SR NO.	AGE	GENDER	DH	PRE						POST					
				PAIN	GONIO				SPADI	PAIN	GONIO				SPADI
					SF	SE	AB	AD			SF	SE	AB	AD	
1	23	M	R	6	160	45	140	30	39%	4	180	50%	180	40	20%
2	18	M	R	6	160	40	110	30	36%	4	180	50%	120	40	30%
3	19	M	R	7	140	30	110	45	43%	4	160	50%	140	40	20%
4	22	M	R	7	140	30	120	30	40%	4	160	50%	140	40	16%
5	23	M	R	6	160	45	160	30	49%	4	160	50%	180	40	20%
6	24	M	L	8	120	20	120	30	47%	0	160	50%	140	40	20%
7	18	F	L	8	110	20	100	40	50%	0	160	60%	150	40	15%
8	21	F	R	5	160	45	140	40	40%	3	180	50%	160	40	20%
9	22	F	R	5	140	40	110	40	30%	0	160	60%	160	40	15%
10	19	M	L	6	140	50	110	40	36%	3	160	50%	160	40	20%
11	24	M	R	6	140	40	110	30	36%	4	160	60%	160	40	20%
12	24	F	R	7	110	45	100	30	45%	4	160	50%	140	40	20%
13	21	M	R	7	120	40	100	30	40%	4	140	50%	140	40	15%
14	23	M	R	4	150	30	120	30	23%	0	150	60%	140	40	10%
15	24	M	R	7	140	30	120	30	45%	5	160	50%	160	40	10%

GROUP B : KT with UST																
SRNO.	AGE	GENDER	DH	PAIN	PRE						POST					
					GONIO				SPADI	PAIN	GONIO				SPADI	
					SF	SE	AB	AD			SF	SE	AB	AD		
1	19	M	R	7	120	20	60	30	70%	0	160	45	180	60	10%	
2	20	M	R	8	110	20	60	30	75%	2	180	45	180	60	10%	
3	21	F	R	7	120	40	60	30	50%	2	180	50	180	60	15%	
4	22	F	R	8	60	40	20	30	75%	2	120	50	120	60	10%	
5	20	F	R	8	120	40	110	40	60%	2	180	50	160	55	10%	
6	18	M	R	7	110	40	120	40	45%	3	160	50	160	50	10%	
7	18	M	L	8	130	40	110	40	59%	3	160	50	180	60	5%	
8	19	M	L	8	120	40	110	45	60%	3	180	50	180	60	10%	
9	21	F	L	6	110	40	120	45	45%	2	160	60	150	60	15%	
10	19	M	R	7	120	30	120	30	60%	2	180	60	170	45	15%	
11	18	M	R	7	110	20	120	35	45%	2	160	60	160	60	15%	
12	22	M	R	7	120	30	110	35	50%	3	180	60	160	50	10%	
13	25	M	R	7	110	20	110	40	60%	3	180	55	180	55	10%	
14	23	M	R	7	140	20	120	40	70%	3	180	50	160	50	10%	
15	19	F	R	8	130	40	110	30	70%	3	180	50	180	45	10%	