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Effectiveness of muscle energy technique on shoulder range of motion in individuals with bicipital tendinitis, randomised clinical trial

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Abstract
Background: Biceps tendinitis is inflammation of the tendon around the long head of the biceps muscle. Pathology of the biceps tendon is most often found in patients 18 to 35 years of age who are involved in sports. Muscle energy technique is a manual therapy procedure which involves the voluntary contraction of a muscle in a precisely controlled direction. MET may be used to decrease pain, stretch tight muscles and fascia, reduce muscle tonus, improve local circulation, strengthen musculature and mobilize joint restrictions.
Objectives: To assess persons for bicipital tendinitis, to determine the effect of muscle energy technique in acute and chronic symptoms of bicipital tendinitis and to find out the risk factors for development of bicipital tendinitis.
Methodology: Informed consent was taken from each of the subject prior to Participation. All Instruction was given to the subjects about techniques performed. The study was conducted in and around Karad. Subjects were selected according to inclusion and exclusion criteria.
Results: The study used outcome measures, visual analogue scale (VAS), Range of motion (ROM) and shoulder pain and disability index (SPADI). All three scores revealed statistically significant results ($p < 0.05$) reduction in pain after post interventional.
Conclusion: This study concluded that there was an improvement in the bicipital tendinitis patients after undergoing 3 weeks of core muscle energy technique protocol. This indirectly improved their shoulder performance by reducing pain to shoulder and improving their dynamic balance.

Keywords: Bicep, inflammation, muscle energy technique, tendinitis

Introduction
Biceps tendinitis is inflammation of the tendon around the long head of the biceps muscle. Biceps tendinitis and tendinosis are commonly accompanied by rotator cuff tears or SLAP (superior labarum anterior to posterior) lesions. Patients with biceps tendinitis or tendinosis usually complain of a deep, throbbing ache in the anterior shoulder. Repetitive overhead motion of the arm initiates or exacerbates the symptoms. The most common isolated clinical finding in biceps tendinitis is bicipital groove point tenderness with the arm in 10 degrees of internal rotation [1]. Pathology of the biceps tendon is most often found in patients 18 to 35 years of age who are involved in sports, including throwing and contact sports, swimming, gymnastics, and martial arts. These patients often have secondary impingement of the biceps tendon, which may be caused by scapular instability, shoulder ligamentous instability, anterior capsule laxity, or posterior capsule tightness [2]. Secondary impingement may also be caused by soft tissue labral tears or rotator cuff tears that expose the biceps tendon to the coracoacromial arch. Biceps tendinitis may also refer to tendinosis, which is a syndrome of overuse and degeneration. Older patients (i.e., athletes older than 35 years or non-athletes older than 65 years) may have acute biceps tendinitis caused by sudden overuse, or biceps tendinosis caused by use over time. Primary impingement syndrome is considered the most common cause of biceps tendinosis or tenosynovitis (i.e., inflammation of the tendon sheath).
Muscle energy technique is a manual therapy procedure which involves the voluntary contraction of a muscle in a precisely controlled direction at varying levels of intensity against

a distinct counterforce applied by the operator. Muscle energy techniques are a class of soft tissue osteopathic (originally) manipulation methods that incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contractions, designed to improve musculoskeletal function and reduce pain [5]. MET may be used to decrease pain, stretch tight muscles and fascia, reduce muscle tonus, improve local circulation, strengthen weak musculature and mobilize joint restrictions [4]. This leads to improved postural alignment and the restoration of proper joint biomechanics and functional movement. The purpose of the study is to see the effect of MET in increasing the ROM and strength of the shoulder joint.

Methodology

An approval for the study was obtained from the Protocol committee and the Institutional Ethical Committee of KIMSDU. An Experimental study was conducted for a duration of 6 months at Physiotherapy department of Krishna college of Physiotherapy. Individuals were approached and those fulfilling the inclusive criteria were selected.

Study type: Experimental stud.

Study design: Pre and post.

Sample size: 15 Sample size = 4pq/l2.

Mode of selection: Simple random sampling technique.

Study duration: Supposed to be 3 weeks.

Place of study: Krishna institute of medical sciences.

Procedure Informed consent was taken from each of the subject prior to Participation. All subjects are diagnosed with bicipital tendinitis by a certified physiotherapist or orthopedician. Instruction was given to the subjects about techniques performed. The study was conducted in and around Karad. Subjects were selected according to inclusion and exclusion criteria. The data will be collected and statistically analysis will be done.

Table 1: Exercise protocol the group will receive respective training for 3 weeks

Weeks	MET flexion	MET extension	MET abduction	MET internal rotation	MET external rotation
Week 1	25×2	20×2	20×2	15×2	20×2
Week 2	30×2	25×2	20×2	20×2	25×2
Week 3	30×2	25×2	30×2	25×2	30×2

Outcome measures

I) Pain assessment by visual analogue scale (VAS)

Pain was measured using the visual analogue scale (VAS) each subject will asked to mark to 10cm vertical line or horizontal line to indicate the perceived level of pain intensity when achieve. No pain is indicated with value of 0 cm and extreme pain indicated with a value of 10cm.

II) Range of motion (ROM)

Range of motion is the measurement of movement around a joint. Passive range of motion requires full assistance for an individual to move their joint. Active – assistance, and active range of motion is when the client is able to move their joint independently.

III) Shoulder pain and disability index (SPADI)

The shoulder pain and disability index (SPADI) is a self – administered questionnaire that consists of two dimensions, one for pain and the other for functional activities. The shoulder pain disability index takes 5 to 10 minutes for a patient to complete and is the only reliable and valid region-specific measure for the shoulder.

Results

1. Visual Analogue Scale (VAS)

Table 2: Comparison of pre and post VAS score within groups

VAS	Mean	SD	95% CI		Wilcoxon Matched Paired Test Value (W)	*p*-value
Pre-Test	7.2	1.22	6.75	7.65	465	<0.0001*
Post-Test	2.63	0.72	2.37	2.9		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 2, in the present study pre interventional mean VAS score was 7.2 ± 1.22 in Group A and 2.63 ± 0.72 in the study group analysis of VAS score revealed statistically reduction in pain post interventional for both the groups, of VAS score revealed statistically significant with p <0.05 reduction in pain after post interventional and this was done using Wilcoxon matched Paired Test.

2. Shoulder pain and disability index (SPADI)

Table 3: Comparison of pre and post SPADI score within groups

SPADI	Mean	SD	95% CI		Wilcoxon Matched Paired Test Value (W)	*p*-value
Pre-Test	36.97	6.93	34.38	39.56	465	<0.0001
Post-Test	17.19	4.16	15.65	18.75		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 3 and Figure 4, In the present study pre interventional mean SPADI score was 36.97 ± 6.93 in Group A and 17.19 ± 4.16 in the study group analysis of SPADI score revealed statistically reduction in pain post interventional for both the groups, of SPADI score revealed statistically significant with p <0.05 reduction in pain after post interventional and this was done using Wilcoxon matched Paired Test.

3. Shoulder flexion

Table 4: Comparison of pre and post shoulder flexion within groups

Shoulder flexion		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Pre-Test	Active	97.93	23.33	89.22	106.64	248.00	0.0029
	Passive	113	19.52	105.71	120.29		
Post-Test	Active	132.33	14	127.11	143.96	191.00	0.0001
	Passive	148.6	12.44	137.56	153.24		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 4 and Figure 5 in the present study pre interventional mean shoulder flexion range was 97.93 ± 23.33 in Active Group A and 113 ± 19.52 in Passive Group B whereas post-interventional mean of shoulder flexion range was 132.33 ± 14 in Active Group A and 148.6 ± 12.44 in Passive Group B respectively. Intra group statistical analysis revealed statistically extremely significant increase in shoulder flexion range post interventional for both the active and passive

groups. This was done by using Mann Whitney U-Statistics Group A (U=248.00, p <0.05), Group B (U=191.00, p <0.05).

Table 5: Comparison of pre and post shoulder flexion between groups

Shoulder flexion		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Active	Pre-Test	97.93	23.33	89.23	106.64	110	<0.0001
	Post-Test	132.33	14	127.11	137.56		
Passive	Pre-Test	113	19.52	105.71	120.29	66	<0.0001
	Post-Test	148.6	12.44	143.96	153.24		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 5 and Figure 5, in the present study pre interventional mean shoulder flexion range was 97.33 ± 132.33 in Active Group A and post intervention mean 132.33 ± 14 in Active Group B whereas pre-interventional mean of shoulder flexion range was 113 ± 19.52 in Passive Group A and post-intervention mean 148.6 ± 12.44 in Passive Group B respectively. Inter group analysis of shoulder flexion range was done by using Mann Whitney U-Statistics. Pre & Post interventional analysis showed statistical significant difference for Active group A and group B (U=110, p <0.05). Whereas Pre & Post intervention analysis showed statistical significant difference between Passive Group A and Group B (U=66, p <0.05).

4. Shoulder extension

Table 6: Comparison of pre and post shoulder extension within groups

Shoulder extension		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Pre-Test	Active	44.17	17.3	37.77	50.56	338	0.099
	Passive	49.87	15.15	44.21	50.52		
Post-Test	Active	53.47	11.64	49.12	57.81	243	0.0023
	Passive	62.1	8.72	58.85	65.35		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 6 and Figure 6, in the present study pre interventional shoulder extension mean was 44.17 ± 17.3 in Active Group A and 49.87 ± 15.15 in Passive Group B whereas post-interventional shoulder extension mean was 53.47 ± 11.64 in Active Group A and 62.1 ± 8.72 in Passive Group B respectively. Intra group statistical analysis revealed statistically extremely significant increase in shoulder flexion range post interventional for passive group, the active group found not significant. This was done by using Mann Whitney U-Statistics Group A (U=348, p >0.05), Group B (U=243.00, p <0.05).

Table 7: Comparison of pre and post shoulder extension between groups

Shoulder extension		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Active	Pre-Test	44.17	17.13	37.77	50.56	306	0.0338
	Post-Test	53.47	11.64	49.11	57.81		
Passive	Pre-Test	49.87	15.15	44.21	52.53	228	0.0011
	Post-Test	62.1	8.72	58.85	65.36		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

Table 7 and Figure 6, in the present study pre interventional mean shoulder extension range was 44.17 ± 17.13 in Active Group A and post intervention mean 53.47 ± 11.64 in Active Group B whereas pre-interventional mean of shoulder extension range was 49.87 ± 15.15 in Passive Group A and post-intervention mean 62.1 ± 8.72 in Passive Group B respectively. Inter group analysis of shoulder extension range was done by using Mann Whitney U-Statistics. Pre & Post interventional analysis showed statistical significant difference for Active group A and group B (U=110, p <0.0001). Whereas Pre & Post intervention analysis showed statistical significant difference between Passive Group A and Group B (U=66, p <0.0001).

5. Shoulder abduction

Table 8: Comparison of pre and post shoulder abduction within groups

Shoulder abduction		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Pre-Test	Active	89.97	23.51	81.19	98.75	222.00	0.0008
	Passive	100.97	24.02	92	109.93		
Post-Test	Active	111.67	24.26	102.61	120.97	230.5	0.0012
	Passive	129.43	27.66	119.11	139.76		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder abduction range was 89.97 ± 23.51 in Active Group A and 100.97 ± 24.02 in Passive Group B whereas post-interventional mean of shoulder abduction range was 111.67 ± 24.26 in Active Group A and 129.43 ± 27.66 in Passive Group B respectively. Intra group statistical analysis revealed statistically extremely significant increase in shoulder abduction range post interventional for both the active and passive groups. This was done by using Mann Whitney U-Statistics Group A (U=222.00, p <0.05), Group B (U=230.5, p <0.05).

Table 9: Comparison of pre and post shoulder abduction between groups

Shoulder abduction		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Active	Pre-Test	89.97	23.51	81.19	98.75	164	<0.0001
	Post-Test	111.67	24.26	102.61	120.73		
Passive	Pre-Test	100.97	24.02	92	109.93	150	<0.0001
	Post-Test	129.43	27.66	119.11	139.76		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder abduction range was 89.97 ± 23.51 in Active Group A and post intervention mean 111.67 ± 14 in Active Group B whereas pre-interventional mean of shoulder abduction range was 100.97 ± 24.02 in Passive Group A and post-intervention mean 129.43 ± 27.66 in Passive Group B respectively. Inter group analysis of shoulder abduction range was done by using Mann Whitney U-Statistics. Pre & Post interventional analysis showed statistical significant difference for Active group A and group B (U=164, p <0.05). Whereas Pre & Post intervention analysis showed statistical significant difference between Passive Group A and Group B (U=150, p <0.05).

6. Shoulder internal rotation

Table 8: Comparison of pre and post shoulder internal rotation within groups

Shoulder internal rotation		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Pre-Test	Active	44.17	14.7	38.68	49.65	350.5	0.14
	Passive	50.13	16.11	44.12	56.15		
Post-Test	Active	54.13	12.29	49.54	58.72	231	0.0012
	Passive	66.5	13.39	61.5	71.5		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder internal rotation range was 44.17 ± 14.7 in Active Group A and 50.13 ± 16.11 in Passive Group B whereas post-interventional mean of shoulder internal rotation range was 54.13 ± 12.29 in Active Group A and 66.5 ± 13.39 in Passive Group B respectively. Intra group statistical analysis revealed statistically extremely significant increase in shoulder internal rotation range post interventional for post-test groups. Whereas, in the pre-test was not observed to be significant. This was done by using Mann Whitney U-Statistics Group A (U=350.5, p >0.05), Group B (U=231, p <0.05).

Table 8: Comparison of pre and post shoulder internal rotation between groups

Shoulder internal rotation		Mean	SD	95% CI		Mann Whitney U-Statistics	*p*-value
Active	Pre-Test	44.17	14.7	38.68	49.65	274.5	0.0097
	Post-Test	54.13	12.29	49.54	58.72		
Passive	Pre-Test	50.13	16.11	44.12	56.15	192	0.0001
	Post-Test	66.5	13.39	61.5	71.5		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder internal rotation range was 44.17 ± 14.7 in Active Group A and post intervention mean 54.13 ± 12.29 in Active Group B whereas pre-interventional mean of shoulder internal rotation range was 50.13 ± 16.11 in Passive Group A and post-intervention mean 66.5 ± 13.39 in Passive Group B respectively. Inter group analysis of shoulder internal rotation range was done by using Mann Whitney U-Statistics. Pre & Post interventional analysis showed statistical significant difference for Active group A and group B (U=274.5, p <0.05). Whereas Pre & Post intervention analysis showed statistical significant difference between Passive Group A and Group B (U=192, p <0.05).

7. Shoulder external rotation

Table 8: Comparison of pre and post shoulder external rotation within groups

Shoulder external rotation		Mean	SD	95% CI		Unpaired T-Value	*p*-value
Pre-Test	Active	42.6	17.6	36.03	49.17	1.69	0.095
	Passive	50.33	17.66	43.74	56.93		
Post-Test	Active	56.6	17.42	50.095	63.105	2.4	0.019
	Passive	66.97	15.96	61	72.93		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder external rotation range was 42.6 ± 17.6 in Active Group A and 50.33 ± 17.66 in Passive Group B whereas post-interventional mean of shoulder external rotation range was 56.6 ± 17.42 in Active Group A and 66.97 ± 15.96 in Passive Group B respectively. Intra group statistical analysis revealed statistically extremely significant increase in shoulder external rotation range post interventional for post-test groups. Whereas, in the pre-test was not observed to be significant. This was done by using Unpaired t-test Group A (t = 1.69, p >0.05), Group B (U=2.4, p <0.05).

Table 9: Comparison of pre and post shoulder external rotation within groups

Shoulder external rotation		Mean	SD	95% CI		Unpaired T-Value	*p*-value
Active	Pre-Test	42.6	17.6	36.03	49.17	3.097	0.003
	Post-Test	56.6	17.42	50.095	63.105		
Passive	Pre-Test	50.33	17.66	43.74	56.93	3.83	0.0007
	Post-Test	66.97	15.96	61	72.93		

*significant when p <0.05, CI-Confidence Interval, SD-Standard Deviation

In the present study pre interventional mean shoulder external rotation range was 42.6 ± 17.6 in Active Group A and post intervention mean 56.6 ± 17.42 in Active Group B whereas pre-interventional mean of shoulder external rotation range was 50.33 ± 17.66 in Passive Group A and post-intervention mean 66.97 ± 15.96 in Passive Group B respectively. Inter group analysis of shoulder external rotation range was done by using unpaired t-test. Pre & Post interventional analysis showed statistical significant difference for Active group A and group B (t=3.097, p <0.05). Whereas Pre & Post intervention analysis showed statistical significant difference between Passive Group A and Group B (t=3.83, p <0.05).

Discussion

The present clinical study was conducted to see the effectiveness of muscle energy technique in bicipital tendinitis patient. Biceps tendinitis is inflammation of the tendon around the long head of the biceps muscle. For patients present with this condition received the muscle energy technique for three weeks. Muscle energy technique is a manual therapy procedure which involves the voluntary contraction of a muscle in a precisely controlled direction at varying levels of intensity against a distinct counterforce applied by the operator. Results of this study were focused on improvement of range of motion and strength of shoulder.

A combination of range of motion assessment of shoulder with goniometer, visual analog scale for pain and shoulder pain and disability index were used as outcome measures were used to assess the effectiveness of muscle energy technique in bicipital tendinitis patients.

In this study, the age group of the participants was in between 19 to 50 years. Subjects between this age group were mostly exposed to more physical activities compared to old age group and children's. The players of this age group could take up more advance training and more hours of play.

Sample size of present study consisted of 15females and 20 males that are 43% females and 57% males.

In this study, all patients are diagnosed with bicipital tendinitis. Exercise protocol given for every patient was muscle energy technique flexion, extension, abduction,

internal rotation, external rotation.

The assessment had been taken before and after the study and statistical analysis was done and it shows significant result.

Table 2 and Figure 3, in the present study pre interventional mean VAS score was 7.2 ± 1.22 in Group A and 2.63 ±0.72 in the study group analysis of VAS score revealed statistically reduction in pain post interventional for both the groups, of VAS score revealed statistically significant with p <0.05 reduction in pain after post interventional and this was done using Wilcoxon matched Paired Test.

Table 3 and Figure 4, In the present study pre interventional mean SPADI score was 36.97 ± 6.93 in Group A and 17.19 ±4.16 in the study group analysis of SPADI score revealed statistically reduction in pain post interventional for both the groups, of SPADI score revealed statistically significant with p <0.05 reduction in pain after post interventional and this was done using Wilcoxon matched Paired Test.

In Table No. 4 – Table No. 8 statistical analysis revealed statistically extremely significant increase in shoulder range (flexion, extension, abduction, internal rotation, external rotation) post interventional for both the active and passive groups. This was done by using Mann Whitney U-Statistics.

The shoulder after three weeks of strengthening will respond like there is no any injury prior, to training, thereby improving the ability of the neuromuscular system to perform dynamic, eccentric, isometric stabilization contractions in response to gravity and momentum. Higher stability performance might lead to improved synchronization of motor units and lowering of neural inhibitory reflexes.

An Article concludes that there is effect of muscle energy technique in bicipital tendinitis patients.

The finding of this study showed significant improvement in the overall performance of shoulder.

Limitations

1. Small sample size
2. Subjects could not be followed up after the study.
3. Duration of the study was short.

Recommendations

1. Studies with longer duration are recommended with longer follow-up period to assess long term benefits.
2. Conduct the study with larger sample size.
3. This was a heterogeneous group with both male and female population, future studies could be done taking up a homogenous sample with either male or female subjects separately.

Conclusion

This study concluded that there was an improvement in the bicipital tendinitis patients after undergoing 3 weeks of core muscle energy technique protocol. This indirectly improved their shoulder performance by reducing pain to shoulder and improving their dynamic balance.

Conflict of interest

There were no conflicts of interest in this study.

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Ethical clearance

The study was approved by the institutional ethics committee of KIMSDU.

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