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Immediate effect of mulligan technique to correct the kyphotic deformity in cervical spondylosis patients

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Abstract
Objective: To investigate the immediate effect of mulligan mobilization to correct kyphotic deformity in cervical spondylosis patients.
Design: A Simple Randomized Control Study.
Setting: MGM Fitness and Rehabilitation Centre, Aurangabad, Maharashtra.
Subjects: Sixty patients with Cervical spondylosis Patients and ROM(range of motion),Crani-vertebral angle(CVA) measured less than or equal to 50 degree,CBVA angle measured to -1.7 degree and Neck Disability Index(NDI), were Randomly assigned to an Experimental group and a Control group.
Intervention: The Experimental Group (n=30) received kyphotic deformity corrective mulligan mobilization where-as the Control Group (n=30) received Moist Pack and Neck Isometric strengthening exercise program.
Main outcome Measures: Cervical ROM, Cranio-vertebral angle, Chin Brow vertical angle, Neck Disability Index were measured for all patients (Before treatment and after treatment).
Results: There was a significant difference between groups subjected to baseline value of outcome measures. (p= < 0.0001).
Conclusion: Kyphotic deformity Correction using a Mulligan Mobilization to decrease pain, CVA, CBVA, NDI Score was effective in cases of cervical spondylosis patients.

Keywords: Cervical spondylosis, Cranio-vertebral angle, Chin brow vertical angle, Neck disability index

1. Introduction

Cervical spondylosis is common progressive degenerative disorder caused by natural aging process.It is defined as vertebral osteophytosis secondary to degenerative disc disease due to osteophyte formation that occurs with spinal segment degeneration [1].

Primary risk factor of cervical spondylosis is age related degeneration of the intervertebral disc, cervical spinal elements and also surrounding structures include the uncovertebral joints,facets joints,posterior longitudinal ligament (PLL) and ligamentum flavum, these all combinely cause the narrowing of spinal canal and intervertebral foramina then the spinal cord, spinal vasculature and nerve roots can also be compressed. Some factors contribute for the disease progression and early onset of cervical spondylosis like- spinal trauma, congenitally narrow vertebral canal, dystonic cerebral palsy(affects the cervical musculature) and specific athletic activities such as rugby,soccer and horse riding [2-3]. Most common form of cervical deformity is cervical kyphosis [4].

Prevalence of cervical spondylosis was 13.76 %, although it differed significantly among the urban, suburban, and rural population (13.07%, 15.97% and 12.25%, respectively). Moreover, it was higher in female than males (1.51%vs 10.49%) [5].

Clinically normal cervical lordosis is 31 degree to 40 degree but in cervical spondylosis patients, degenerative changes occurs in cervical spine, and lordosis angle alters [6].

So in early changes of biomechanics are:-

Disc desiccation-loss of H_2O, protein,muco-polysaccharide and increased keratin sulphate, chondroitin sulfate

↓

Fibrous nucleus pulposus —loss of elasticity and decrease in size

↓

Loss of annular fiber integrity —loss of load bearing integrity and bulging of disc, laxity of ligament, loss of height of disc

↓

Disc height loss = loss of normal cervical lordosis — ventral compression and angular changes of spinal segment

↓

Loss of fiber attachment to bone —overload on vertebral and facet joints and osteophyte formation

↓

Progressive kyphosis — vascular and neural compression.[7-8]

As per discussions above, normal cervical lordosis is 31 degree to 40 degree but it alters due to natural aging process so to maintain the cervical lordosis we used Mulligan concept of manual therapy. Mulligan concept of manual therapy is based on sustained accessory joint mobilization in weight bearing position which utilizes active effort or functional task of patien'ts throughout specific range of motion [9].

In Mulligan concept, we used SNAG (Sustained Natural Apophyseal Glide). SNAG is useful in large number of musculoskeletal disorders. In SNAG the patients attempts to actively move cervical spine throughout the range of motion and therapist apply sustained parallel glide to treatment plane [10].

For measurement of cervical angle we used Kenovea softwere. It is the 2D motion analysis software under GPLv2 license, created in 2009 via the non-profit collaboration of several researchers, athletes, coaches and programmers from all over worlds.It enables the distance, angles,coordinates and spatial – temporal parameters [11]. This software mainly used in the field –sports [12-13], clinical analysis [14]. and tool with which to compare the realiability of other technologies.

With the help of Kenovea software, we measured CVA (Craniovertebral angle), CBVA (Chin Brow vertical Angle) to evaluate cervical lordotic angle. CVA is defined as the angle between an imaginary line extending from 7th cervical vertebra through the tagus and the horizontal line. The normal angle is 55;02±2:86[15].CBVA is defined as the angle between patients chin to eyebrow and the vertical line drawn from the eyebrow.The mean value of CBVA is -1.7. [16].

After that, we took goniometric measurement of cervical motion before and after treatment [17]. For pain measurement, we took NDI (Neck Disability Index) - is self-report qouestioner used to determine how neck pain affect the patients daily life and to assess the self-related disability of patients with neck pain.it is specific to neurological tissue,as well as pathological origin of pain like result of trauma, degeneration etc. [18-19].

2. Method

Study design: MGM Physical Fitness and Rehabilitation Centre.

Study population: 60

Participants: Office worker and cervical spondylosis and cervical radiculopathy patients diagnosed from orthopedician

a. **Material Used**: Laptop, Data collection sheet, Informed Consent Form, Disability Scales–neck disability scale, Kenovea Software, Chair.
b. **Inclusion criteria**
   Age: 35-60 years
   Gender: Male and Female Office worker and cervical spondylosis and radiculopathy patients Diagnosed from orthopedician.
c. **Exclusion criteria:** Cervical fracture Psychological condition Thoracic outlet syndrome Any Congenital abnormality Any other musculo-skeletal condition

Experimental Group Procedure
Mulligan SNAG for Cervical
Procedure

- We took two groups Group A (controlled group) and Group B (Experimental group). Before starting the treatment, an explanation regarding the study was given and informed consent was taken from each individual. After the screening of objects as per the exclusion and inclusion criteria, cervical lordosis was measured by CVA and CBVA with the help of Kenovea software and cervical motion measured by Goniometer and NDI scores for pain severity (pre-treatment measurements).
- After the screening of baseline measurement, the subjects got allotted by simple random sampling into two groups –controlled groups (A) and experimental group (B).
- For the correction of kyphotic deformity, the protocol included for group A-Hot pack (10 min)and neck isometrics(10 rep /3 sets) and for group B –Mulligan SNAG extension technique for cervical spine (10 rep/3 sets)
- After treatment, we again measured the cervical lordosis angle with the help of CVA and CBVA angle, cervical motion and NDI was taken (post-test measurement)

Mulligan SNAG for Cervical

Patient position: Sitting on chair with arms resting on the thigh.

Therapist position: Back of patient in walk standing position.

Procedure: Patient comfortably and well supported sits in chair. Cervical spine and head are set in neutral position. Then apply a PA glide parallel to plane of facet on spinous process. While sustained glide ask the patient to actively moves neck in extension.

Fig 1: Snag For Cervical

3. Result

Table 1: Differentiation of Patient According to Age

Differentiation of patient according to age	Experimental	%	Control	%
	No. of patients		No. of patients	
35	1	3.33	3	10
36	0	0	0	0
37	0	0	1	3.33
38	2	6.67	3	10
39	0	0	0	0
40	1	3.33	0	0
41	1	3.33	0	0
42	1	3.33	2	6.67
43	0	0	0	0
44	0	0	0	0
45	2	6.67	0	0
46	2	6.67	4	13.33
47	2	6.67	1	3.33
48	1	3.33	4	13.33
49	2	6.67	2	6.67
50	5	16.67	4	13.33
51	1	3.33	0	0
52	1	3.33	1	3.33
53	1	3.33	0	0
54	1	3.33	1	3.33
55	1	3.33	0	0
56	0	0	1	3.33
57	0	0	1	3.33
58	1	3.33	0	0
59	1	3.33	2	6.67
60	2	6.67	0	0

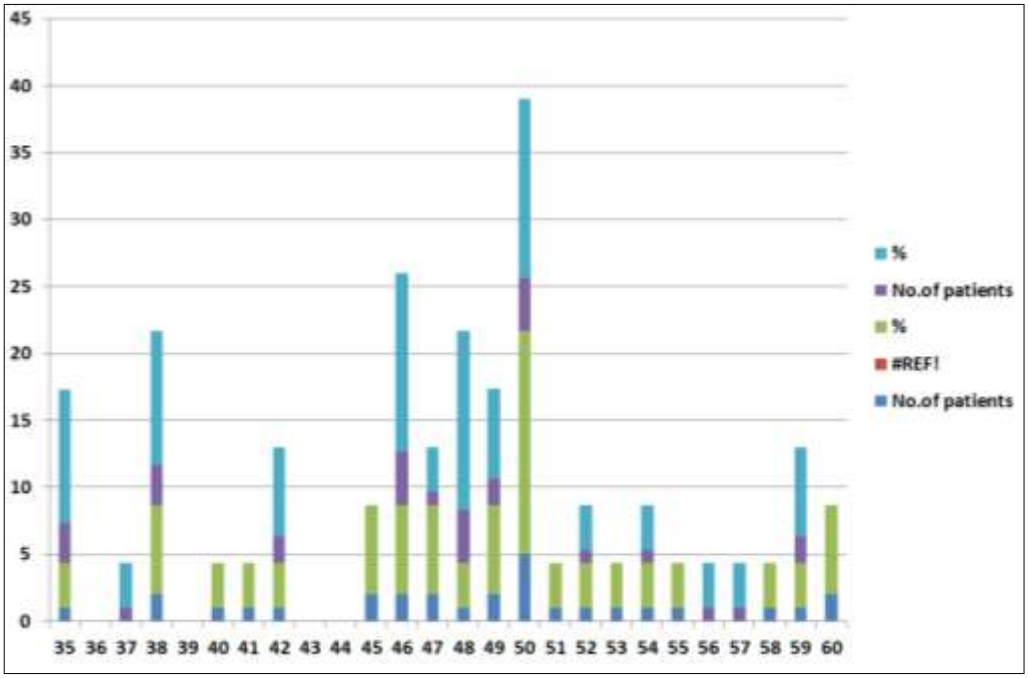

Fig 1: Differentiation of Patient According to Age

Table 2: Differentiation of Patients According to Gender

Differentiation of patients according to gender				
Gender	Experimental		Control	
	No. of patients	%	No. of patients	%
M	5	16.67	5	16.67
F	25	83.33	25	83.33

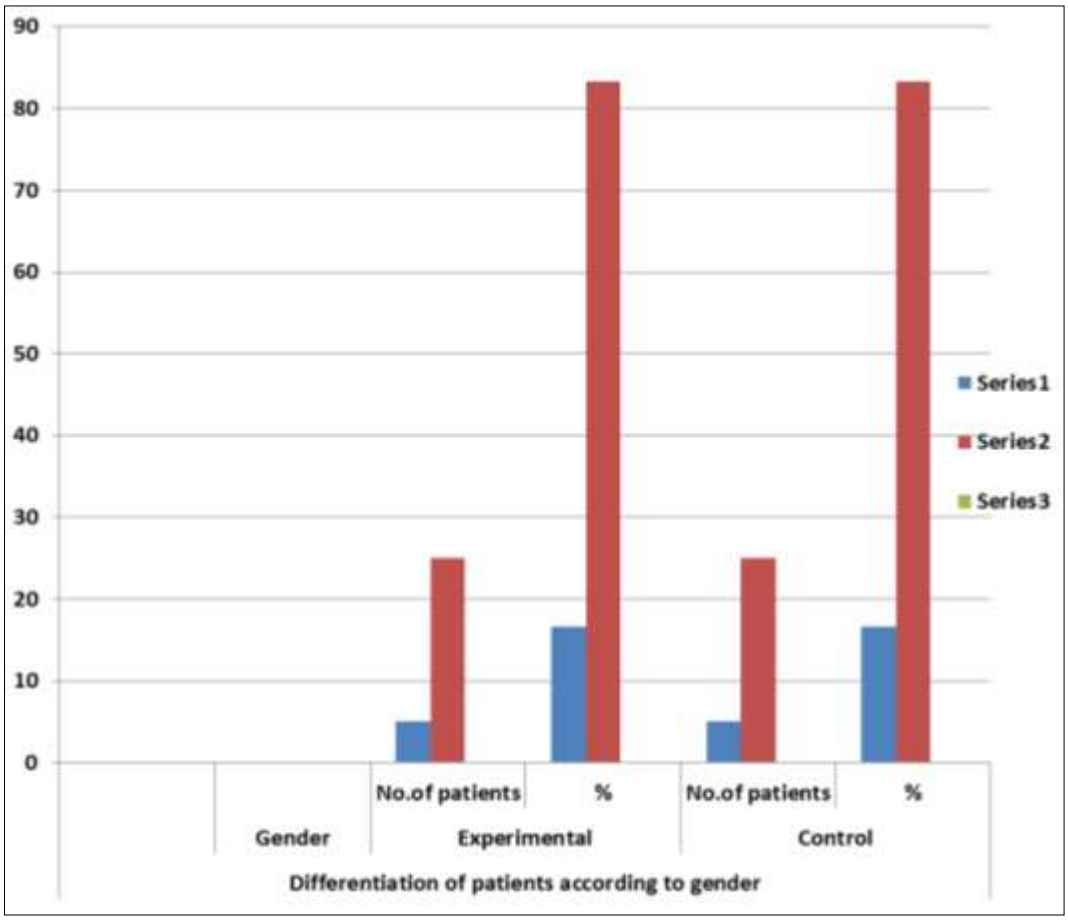

Fig 2: Differentiation of Patients According to Gender

The following table and graph of patients according to gender, Number of male in experimental group is 5 and percentage Is 16.67, and female is 25 and percentage is 83.33.Number of male in control group is 5 and percentage is 16.67, and female is 25 and percentage is 83.33.

Table 3: Comparison of Mean Rom at Pre and Post

Rom	Comparison of mean ROM at pre and post		t-value	p-value
	Experimental	Control		
	Mean ± Sd	Mean ± Sd		
pre active flexion	77.4 ±84.49272	76.06±5.092267	0.8177	0.4169
post active flexion	84.1±90.18468	82.37±4.748401	1.202	0.2343
pre active extension	60.33±4.65821	58.03±5.467988	1.712	0.0922
post active extension	66.23±3.841063	64.37±3.69379	1.856	0.0686
pre active LF	35.7±3.74295	37.33±4.066649	1.566	0.1229
post active LF	41.87±3.097693	42.53±1.9631	0.963	0.3395
pre active LR	72.3±7.419025	72.57±10.67008	0.1087	0.9138
post active LR	80.33±6.103058	78.27±8.965645	1.009	0.3169
pre passive flexion	81.25±6.605249	79.54±4.70265	1.235	0.2217
post passive flexion	86.77±5.252854	85.5±4.217858	0.9961	0.3233
pre passive extension	60.75±12.19039	61.97±4.351369	2.089	0.0411
post passive extension	68.53±2.392641	64.37±3.69379	1.902	0.0621
pre passive LF	38.41.±3.963865	40.37±3.157003	0.8447	0.4017
post passive LF	43.93±1.830447	44.53±1.9631	0.7057	0.4832
pre passive LR	77.37±6.448222	75.73±10.10249	0.722	0.4732
post passive LR	84.23±4.797065	80.1±9.070868	2.134	0.0371

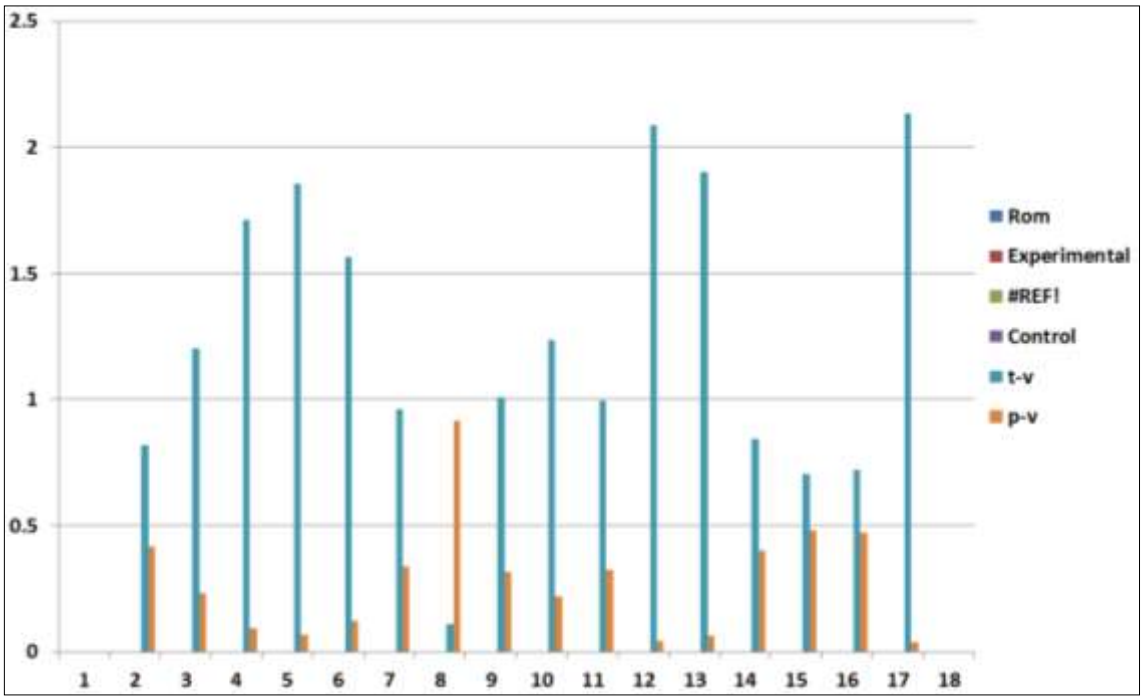

Fig 3: Comparison of Mean Rom at Pre and Post

In the following table of Pre and Post ROM in experimental and control group, t value of pre active flexion 0.8177,pre active extension 1.712, pre active LF1.566, pre active LR 0.1087,Pre passive flexion 1.235, pre passive extension 2.089,pre passive LF 0.8447, pre passive LR 0.722 and post active flexion 1.202, post active extension 1.856,post active LF 0.963, post active LR1.009, post passive flexion 0.9961,post passive extension1.902, post passive LF 0.7057,post passive LR 2.134, and p value of pre active flexion 0.4169, pre active extension0.0922, pre active LF0.1229, pre active LR 0.1087, pre passive flexion 1.235, pre passive extension 2.089, pre passive LF 0.8447, pre passive LR0.722,post active flexion1.202, post active extension 1.856,post active LF 0.963, post active LR 1.009, post passive flexion 0.9961,post passive extension 1.902, post passive LF 0.7057, post passive LR 2.134.

Table 4: Comparison of Mean of Cva at Pre and Post

Angle	Experimental	Comparison of mean of CVA at pre and post control	t-value	p-value
	mean±Sd	mean±Sd		
pre CVA	59.2±2.752125	57.93±1.318194	2.20E+00	0.319
postCVA	56.13±2.310332	55.87±1.099364	0.5521	0.583

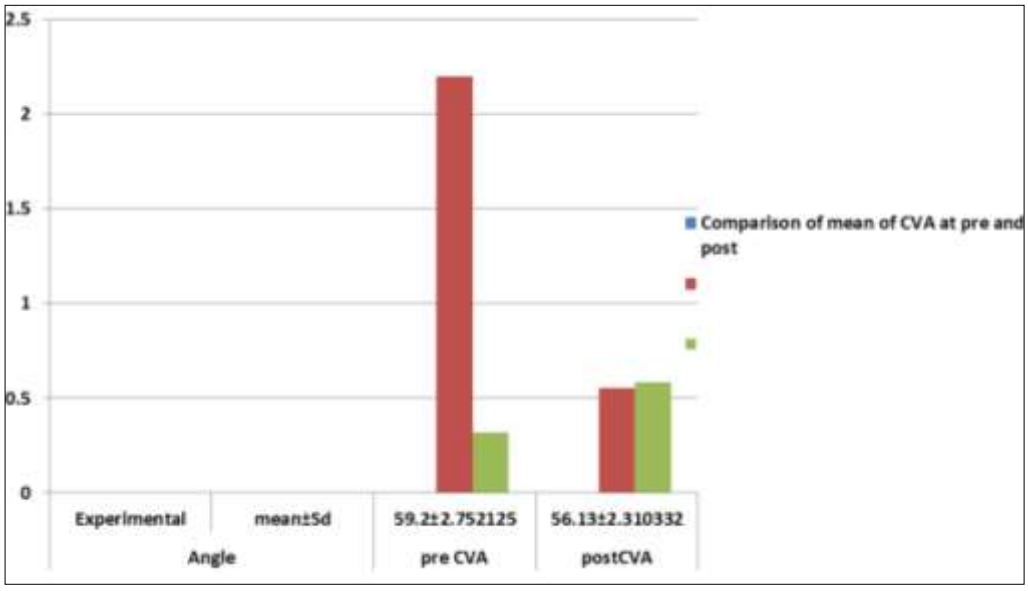

Fig 4: Comparison of Mean of Cva at Pre and Post

In the following table and graph of pre and post CVA, t value in experimental group is 2.20 and in control group is 0.5521 and p value in experimental group is 0.319 and in control group is 0.583.

Table 5: Comparison of Mean of Cbva at Pre and Post

Angle	Exp.	Comparison of mean of CBVA at pre and post Control	t-value	p-value
	Mean ±Sd	mean ±Sd		
pre CBVA	2.17±0.122694	2.21±0.177951	1.225	0.2254
post CBVA	1.84±0.182456	2.03±0.146243	4.896	<0.0001

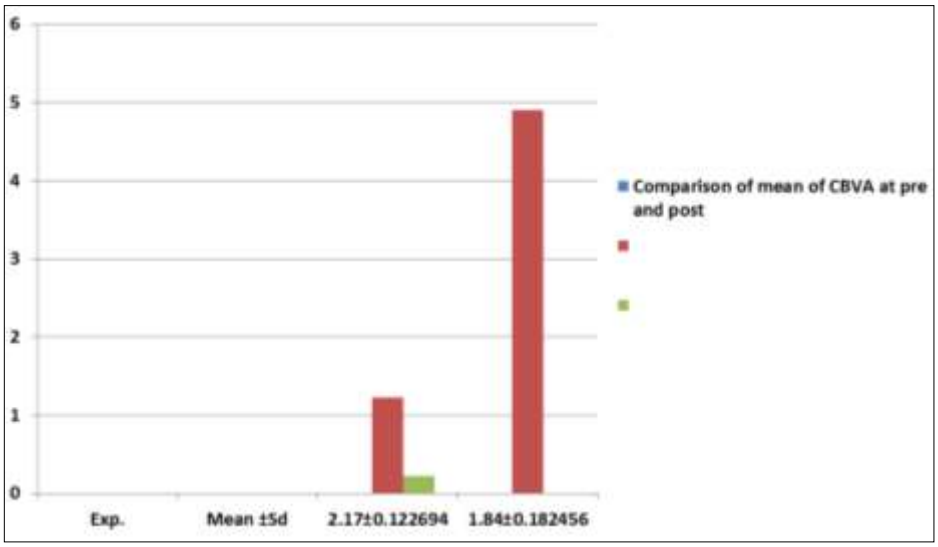

Fig 5: Comparison of Mean Cbva at Pre abd Post

Table 6: Comparison of Mean Ndi Pre and Post

Scale	Exp.	Comparison of mean NDI pre and post Control	t-value	p-value
	Mean±Sd	Mean ± Sd		
pre	18.73±3.909734	17.43±4.093136	1.217	0.2287
post	14.2±3.821839	14.53±3.932768	0.322	0.7486

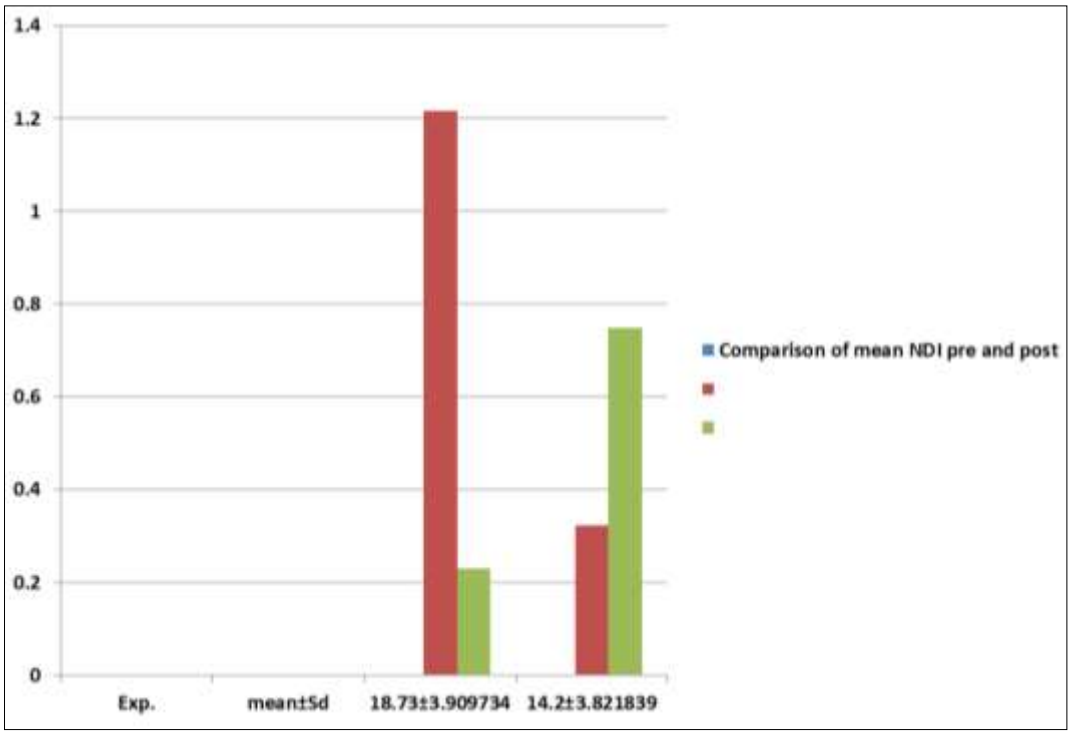

Fig 6: Comparison of Mean Ndi Pre and Post

In the following table and graph of pre and post NDI, t value in experimental group is 1.217and in control group is 0.322 and p value in experimental group is 0.2287 and in control group is 0.7486.

4. Discussion

The present study was conducted to see if there was any change in kyphotic deformity by Mulligan mobilization as an immediate effect. Statistical analysis was done by using graph pad trial version. Patient's age ranging from 35-60 years diagnosed with cervical spondylosis, showed more tendency towards kyphotic deformity, were included in the study.After the result analysis, it was found that there was an immediate effect in the change in angulation of CVA and CBVA, thereby correcting the kyphotic deformity to some extent.

As per the reliability and validity of kenovea software, it measures accurately at distances up to 5m from object and at an angle range of 90 degree to 45 degree [20]. We took cervical angle measurement CVA, CBVA, Goniometric cervical measurements, NDI for pain severity.

Then in controlled group we used moist pack and neck isometric excercises. Moist pack is the most common superficial thermotherapy, benefits are increased blood flow [21-22], muscle relaxation [23], Antispasmodic effect, [23, 24] decreased fatigue and excitability [22] increased muscle Flexibility [22, 23, 25], decreased joint surfaces [26, 28], and increased elastic properties [25-27]. In recent year, uses of most pack is helpful for relieving pain and decreased muscle contracture. [29, 30]. Neck isometric excercises also helpful in increased muscle strength and endurance of cervical region.

After the treatment, data analysis showed significant changes in AROM with P value < 0.0001, PROM with P value <0.0001, CVA with P value <0.0001, CBVA with P value <0.0001, NDI with P value < 0.0001 but significant changes is very less than group B.

In Experimental group, we used Mulligan concept of manual therapy 10 rep/ 3 sets for each vertebra, before starting treatment we measured all parameter, after treatment also in both group, we measured all parameters then after giving manual therapy there was also seen significant changes in AROM with P value < 0.0001, PROM with P value <0.0001, CVA with P value <0.0001, CBVA with P value <0.0001, NDI with P value < 0.0001.

So, there is more significant changes in experimental group as compared to controlled-group.

The experimental group showed more effect than the control group because the Mulligan therapy uses the technique of spinal glide along-with the mobilization, that is, movement with mobilization that not only helps in decreasing the pain, using the pain gate mechanism and also improves the joint range of motion by decreasing the joint stiffness which is common in cervical spondylosis cases, due to which the apophyseal glides helps in restoring the range of motion and improving the cervical range and also helps in relieving the pain.[9-10]

5. Conclusion

This study provides positive effects in correction of kyphotic deformity by mobilization treatment given to cervical vertebrae. So, it also emphasizes that the physiotherapy management for cervical spondylosis patients, can also be imparted at a single sitting, for those patients who are not able to or find it difficult to have a regular visit to the physiotherapy set-up. This treatment management highlights and shows us the insight of using the techniques that has been grabbed till now,to use more deliberately and wisely for more effective outcomes in a stipulated time-frame.

6. Future Scope of Study

The study can be done on more sample size to prove its validity and use more easy sampling techniques such that in a limited time-frames more better results can be provided to the fellow patients.

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