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To Compare the Effect of Isometric and Dynamic Neck Exercises on Pain, Cervical Muscle Endurance and Range of Motion in Patient with Non-Specific Chronic Neck Pain

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ABSTRACT

Background: Neck pain is among the most encountered problem. Several previous studies have reported the effectiveness of various therapeutic exercises on neck pain. However, the comparison of the effectiveness of isometric and dynamic neck exercises on neck muscle endurance (NME) and Range of motion (ROM) in this population is not well documented.
Objective: To compare the effectiveness of isometric and dynamic neck exercises on pain, NME and ROM in patients with Chronic Non-specific neck pain (CNNP). Study Design: Experimental design Source of Data Collection: DAV institute of physiotherapy, Yamunanagar.
Methodology: 30 Subjects with non-specific chronic neck pain were included in study on the basis of inclusion criteria were randomly allocated into 2 groups: Group A performed isometric neck exercises and Group B performed dynamic neck exercises. Treatment was given for 3 weeks. Pain, cervical muscle endurance and ROM was measured as Outcome measure on 1st, 10th and 21st day using Visual Analogue Scale (VAS), Ventral and Dorsal Neck Muscle Endurance (NME) Test and universal goniometer respectively.
Result: Statistically significant improvement ($p<0.05$) noticed in both groups for all the outcomes. However, Dynamic exercise group has shown highly significant improvement in all three parameters as compared to isometric exercise group.
Conclusion: This study provides evidence that the dynamic neck exercises (DNE) are more effective than isometric neck exercises (INE) and resulting in speedy and early recovery in patient with CNNP.

KEY WORDS: Chronic Non- Specific Neck Pain, dynamic neck exercises, isometric neck exercises, VAS, Ventral and Dorsal Neck Muscle Endurance Test, Cervical ROM.

INTRODUCTION

In modern industrialized countries Neck disorders remain a common problem. Neck pain may come from any of the structures in the neck which include muscles and nerves as well as the spine and the cushioning discs in between. It may also come from regions near the neck, like the shoulder, jaw, head, and upper arms.[1]

Disorder of neck affect 13% of adult population at any one time and around up to 30% men and 50% of women during the course of their life. Once the red flags are excluded, patients are classified into groups of having simple neck pain or non-specific neck pain.[2]

Neck pain associated with muscle tightness and the other with muscle strain in the posterior neck. Symptoms and treatment

differ according to the underlying cause. Both types are quite prevalent; the pain associated with muscle tightness usually has a gradual onset of symptoms, while the pain associated with muscle strain usually has an acute onset.[1,3] Non-specific Neck Pain refers to neck pain (with or without radiation) whose underlying cause cannot be traced to any specific systemic disease. Neck pain found to be a common condition all over the world.[4]

Usually, everyday activities are to blame. Such activities include bending over a desk for hours, having poor posture while watching TV or reading, placing your computer monitor too high or too low, sleeping in an uncomfortable position, or twisting and turning the neck in a jarring manner while exercising. Traumatic accidents or falls can cause severe neck injuries like vertebral fractures, whiplash injury, blood vessel injury, and even paralysis. Other causes include herniated disc, fibromyalgia (pain syndrome throughout the body), and arthritis. Meningitis, although much less common, can cause significant neck stiffness.[5]

Physiotherapy interventions commonly used in the treatment of neck pain are: Exercise therapy (neuromuscular training, strength training, and endurance training). Manual therapy (massage, manipulation, mobilization). Electrotherapy (TENS, Low level LASER). According to The Cochrane Collaboration the above-mentioned interventions have low evidence as well as no definite statements on the efficiency and clinical usefulness of these statements can be made.[6]

Stabilization exercises are exercises that are meant to maximize function, and prevent injury progression or re-injury. They require coordination and training of the anterior and posterior cervical and shoulder girdle musculature.[7]

METHODS

Participants

Study design was Experimental and sampling technique was non-randomized convenient sampling technique. Total 30 subjects with CNNP were included in the study on the basis of inclusion criteria and were randomly allocated into 2 groups as Group A and B using computer software program that generates random sequence.

Sampling criteria

INCLUSION CRITERIA

- Age 25-35 years.
- Both Males and Females.
- Primary complaint of neck pain with no radiculopathy.
- Chronic stage neck pain (above 7weeks).
- Patients with Neck Disability Index (NDI) score above 15/50.

EXCLUSION CRITERIA

- Acute pain & inflammation.
- Acute inflammatory arthritis.
- Congenital malformation of spine e.g., Torticollis.
- History of trauma and fracture of cervical spine.
- History of vertigo.
- Prior surgery to cervical and upper thoracic spine.
- Physiotherapy interventions taken before for neck pain.

Outcome Measures

VAS, Ventral and Dorsal Neck Muscle Endurance Neck and universal goniometer were used to evaluate pain, NME and cervical ROM on 1st, 10th and on 21st day.

Study Protocol

Subjects in Group A performed Isometric neck exercises and Group B performed Dynamic neck exercises.

Exercises were performed 3 times a week for 3 weeks.[8] 10 repetition was performed for each exercise with 10 second hold. 3 sec pause between repetitions was given.[9]

Group A: Isometric exercises Group[10]

INE include Isometric neck flexion, extension, lateral flexion and rotation.

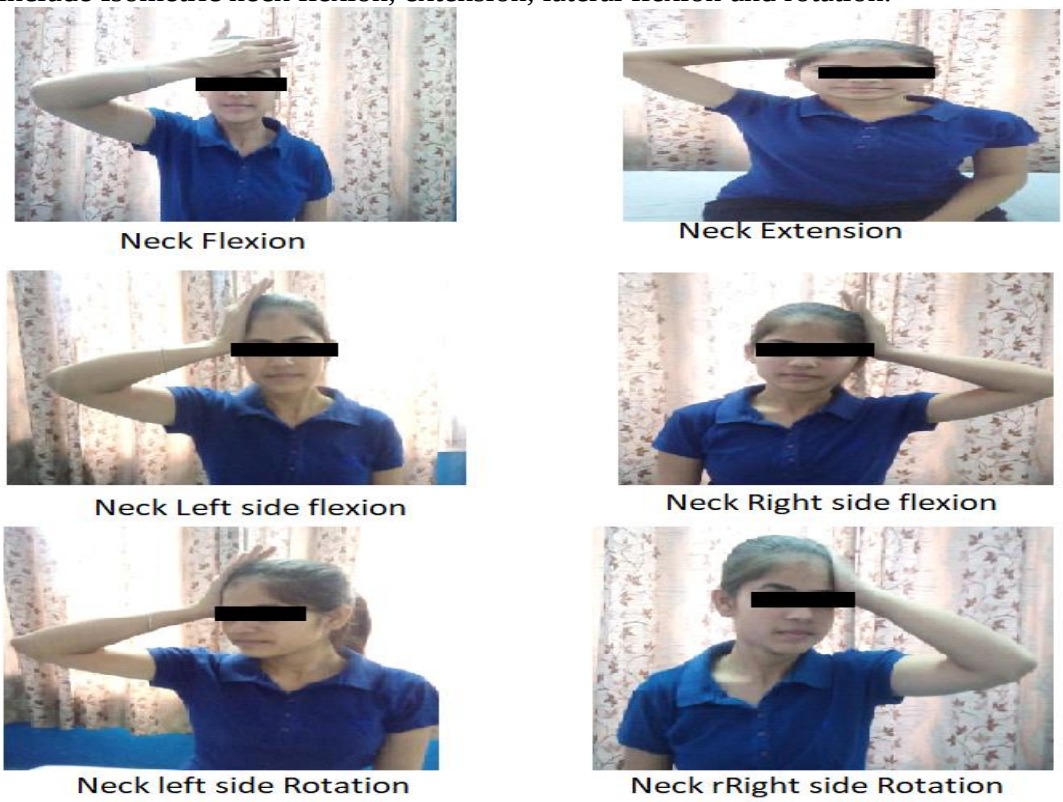

Figure No. 1 cervical isometric exercises

Group B: Dynamic Exercises Group[11]

DNE include Dynamic neck flexion, extension, lateral flexion and rotation.

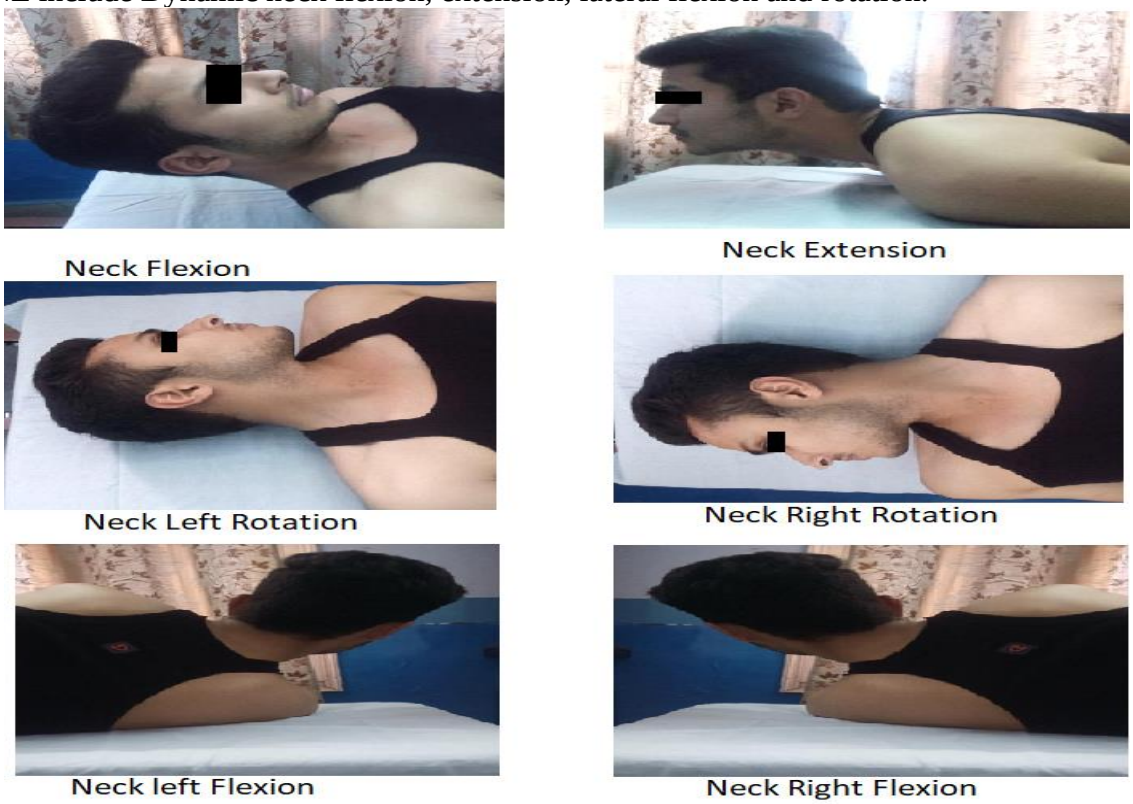

Figure No. 2 Dynamic cervical exercises

Statistical Analysis

The data analysis was done with the help of SPSS v-16. Statistical analyses for above two groups were performed to find out the mean, standard deviation and the statistical significance between pain, neck muscle endurance (NME) and cervical ROM in both groups.

The statistical analysis carried out as follows t- test used for between group comparisons.

Repeated ANOVA and Tukey's method for pairwise comparison was used for within group comparison.

The results were found to be significant at $p<0.05$

RESULT

Unpaired T Test	VAS					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	7.67	7.53	5.60	4.93	3.13	1.67
S.D.	1.799	1.84	1.80	1.44	1.726	1.5
Number	15	15	15	15	15	15
Maximum	10	10	9	8	6	5
Minimum	5	5	2	3	0	0
Range	5	5	7	5	6	5
Mean Difference	0.14		0.67		1.64	
Unpaired T Test	0.211		1.254		2.899	
P value	0.836		0.230		0.012	
Result	Not-Significant		Not-Significant		Significant	

Table No.1: Comparison of VAS between the Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired T Test	Ventral NME					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	23.30	22.59	25.82	31.14	29.21	40.72
S.D.	3.502	4.828	3.633	7.471	4.374	1.068
Number	15	15	15	15	15	15
Maximum	29.00	34.08	31.50	50.30	36.00	60.10
Minimum	18.80	17.00	20.20	22.90	23.30	26.10
Range	10.2	17.08	11.3	27.4	12.7	34
Mean Difference	0.71		-5.32		-11.51	
Unpaired T Test	-0.488		2.55		4.133	
P value	0.633		0.023		0.001	
Result	Not-Significant		Significant		Significant	

Table No. 2: Comparison of Ventral NME between Group A and Group B on pre 1st day, post 10th day and post 21st day intervention

Unpaired T Test	DORSAL NME					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	26.62	38.40	29.23	53.62	31.69	68.46
S.D.	4.333	8.894	5.005	1.026	5.265	1.221
Number	15	15	15	15	15	15
Maximum	33.30	52.80	38.10	70.50	42.10	95.10
Minimum	19.90	20.20	22.10	36.50	23.50	50.10
Range	13.4	32.6	16	34	18.6	45
Mean Difference	-11.78		-24.39		-36.77	
Unpaired T Test	4.156		7.487		9.808	
P value	0.001		0.000		0.000	
Result	Significant		Significant		Significant	

Table No.3: Comparison of Dorsal NME between the Group A and Group B on pre 1st day, post 10th day and post 21st day intervention

Unpaired T Test	FLEXION					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	26.14	21.67	30.20	30.06	35.00	37.87
S.D.	6.468	5.123	6.167	4.234	6.425	3.603
Number	15	15	15	15	15	15
Maximum	35	33	40	40	45	45
Minimum	15	15	18	23	22	32
Range	20	18	22	17	23	13
Mean Difference	4.47		0.14		-2.87	

Table 4 To Be Continued…			
Unpaired T Test	2.396	0.084	-1.833
P value	0.031	0.934	0.088
Result	Significant	Non- Significant	Non- Significant

Table No.4: Comparison of Flexion ROM between the Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired T Test	EXTENSION					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	25.33	22.27	29.86	29.60	34.14	37.27
S.D.	6.229	3.654	5.655	3.906	5.276	3.751
Number	15	15	15	15	15	15
Maximum	33	30	37	37	40	45
Minimum	16	17	20	24	24	32
Range	17	13	17	13	16	13
Mean Difference	3.06		0.26		-3.13	
Unpaired T Test	2.141		0.217		-2.580	
P value	0.05		0.831		0.022	
Result	Significant		Non- Significant		Significant	

Table No.5: Comparison of Extension ROM between the Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired T Test	LATERAL FLEXION (Rt.)					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	26.87	21.94	30.74	30.34	35.27	38.94
S.D.	5.409	6.296	5.561	5.301	5.799	4.217
Number	15	15	15	15	15	15
Maximum	33	31	37	39	42	45
Minimum	17	10	20	22	23	31
Range	16	21	17	17	19	14
Mean Difference	4.93		0.4		-3.67	
Unpaired T Test	2.338		0.204		-1.784	
P value	0.035		0.841		0.096	
Result	Significant		Non- Significant		Non- Significant	

Table No.6: Comparison of Lateral Flexion (Rt.) ROM between Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired T Test	LATERAL FLEXION (Lt.)					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	25.67	20.74	29.4	29.94	33	39
S.D.	4.701	5.021	5.248	4.589	5.632	4.141
Number	15	15	15	15	15	15
Maximum	31	29	35	37	39	45
Minimum	18	13	21	24	24	32
Range	13	16	14	13	15	13
Mean Difference	4.96		-0.54		-6	
Unpaired T Test	2.700		0.294		-3.125	
P value	0.017		0.773		0.007	
Result	Significant		Non- Significant		Significant	

Table No.7: Comparison of Lateral Flexion (Lt.) ROM between Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired T Test	Rotation (Rt.)					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	43.20	25.87	45.87	36.27	49.74	52.14
S.D.	7.282	8.088	7.039	8.388	7.055	6.446
Number	15	15	15	15	15	15
Maximum	51	40	53	52	58	60
Minimum	29	14	31	23	34	41
Range	22	26	22	29	24	19
Mean Difference	17.33		9.6		-2.4	
Unpaired T Test	7.164		4.017		-1.091	
P value	0.000		0.001		0.294	
Result	Significant		Significant		Non- Significant	

Table No.8: Comparison of Rotation (Rt.) ROM between the Group A and Group B on pre 1st, post 10th and post 21st day intervention

Unpaired t Test	Rotation (Lt.)					
	PRE		POST10		POST21	
	Group A	Group B	Group A	Group B	Group A	Group B
Mean	42.74	25.8	46.14	38.6	49.40	52.6
S.D.	7.185	7.993	7.161	7.717	7.614	6.599
Number	15	15	15	15	15	15
Maximum	52	40	55	53	58	60
Minimum	31	15	35	28	37	40
Range	21	25	20	25	21	20
Mean Difference	16.94		7.54		-3.2	
Unpaired T Test	6.505		3.061		-1.262	
P value	0.000		0.008		0.228	
Result	Significant		Significant		Non- Significant	

Table No. 9: Comparison of Rotation (Lt.) ROM between the Group A and Group B on pre 1st, post 10th and post 21st day intervention

DISCUSSION

Neck pain is a common musculoskeletal problem, and has episodic and periodic types which cause ADL and work difficulties, disability and economic and social costs for both patients and society. Therefore, introducing the most effective treatment protocol would seem to be essential in order to decrease not only the pain but also the complications which are not spontaneously reversible.

This study was intended to compare the effect of isometric and dynamic neck exercises on pain, NME and ROM in patient with CNNP. Present study found that there is significant improvement noticed in both groups for all the outcomes. However, Dynamic exercise group has shown highly significant improvement in all three parameters as compared to isometric exercise group. Result of Rashmika Vishnu is consistent with present study who also found dynamic neck exercises more effective as compared to isometric neck exercises.[11] This study is also supported by the study of Berg HE et al (1994) that found the effectiveness of dynamic neck resistance training on improving strength and pain in workers with a high prevalence of neck disorders.[12] Although the result of present study is not in accordance with findings of the study performed by Viljanen M et.al (2003) who found the that the dynamic muscle training and relaxation training do not lead to better improvements in neck pain compared with ordinary activity.[13]

Effect of neck exercise on pain: The mechanism through which stabilization exercises reduce CNNP may be based on the belief that intense exercise increases activity in the motor pathways, thereby exerting an inhibitory effect on pain centres in the central nervous system. Furthermore, muscle contraction and strain on different connective tissues will stimulate the mechanoreceptors and increase sensory nerve activity, which in turn may inhibit the pathways mediating pain.[14] This intervention probably works because exercise has both physical and mental benefits through its effects on numerous systems, such as the cardiovascular system, immune system, brain function, sleep, mood, and the musculoskeletal system. Exercise also increases flexibility and mobility of structures, improves muscle strength and endurance, increases the tensile strength of ligaments and capsule, amplifies strength and prevents injury of tendons and cartilage, and is also important for repair of these tissues, thereby relieves pain.

Effect of DNE on Cervical ROM: The cause of improved cervical ROM in Dynamic exercise group could be due to the fact that however isometric exercise is commonly used to increase muscle performance. Although no joint movement occurs, isometric exercise is considered functional because it provides a strength base for dynamic exercise. They also said dynamic exercise has the advantages that, there is increased movement of the joint, resulting in capsular, ligament and muscular flexibility and increased cartilage nutrition.

All the above mentioned factors in turn results in improved muscle strength and cervical ROM in all joint ranges achieved during the exercise and results in functionally more efficient muscle-joint complex.[15]

Effect of DNE on NME: The mechanism involved in the improvement in muscle endurance in dynamic exercise group might be due to the fact that there is increased motor unit recruitment, co-ordination and increased firing rate in each unit.[16] An increase in the number of capillaries in the muscle, all of which contribute to the improvement of cervical muscle endurance.[17] Apart from the fact that dynamic exercise has certain advantages than isometric exercise, some studies also proved that, isometric strength measurement is a useful and a practical method of objectively showing a functional improvement in response to rehabilitation.[8]

CONCLUSION

Present study suggests that both the exercises are effective in reducing pain and improving NME and ROM. However, significant difference is noticed between the groups and DNE are found to be more effective in improving all the three parameters than INE. Therefore, it is concluded that DNE can be effectively used in clinical practices for achieving speedy and early recovery in patient with CNNP.

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