



Effects of Sustained Natural Apophyseal Glide and Advanced Sensorimotor Training with Conventional Exercise Regime On Pain, Rom and Function in Young Adults with Mechanical Neck Pain: A Pilot Study

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Abstract

Background : Globally, 70% of people are usually suffered from neck pain at some point of their daily lives. Chronic neck pain can be linked with referred pain which can spread through nerves and may extend up to the group of muscle in front of the chest, upper extremities and thoracic spinal regions. The purpose of the study is to investigate and compare effectiveness of SNAG combined with conventional physiotherapy exercises and Sensorimotor Training combined with conventional physiotherapy exercises in young adults with Mechanical neck pain to determine which intervention is more effective.

Methodology: In this Pilot study 12 young adult participants with mechanical neck pain were included. 6 in Group A and 6 in Group B, participants were selected on the basis of inclusion criteria and exclusion criteria of study. Patients of Group A was taught about Advanced sensorimotor training (Cervical joint position sense(CJPS), Postural control training, Oculomotor training) along with common conventional physiotherapy exercises and patients of Group B was given intervention of Sustained natural apophyseal glide (SNAG) along with common conventional physiotherapy exercises. NPRS, NDI, joint position error Test and Cervical range of motion were used as outcome measures, Participants receive their treatment protocol for 6 weeks, Outcome measures was assessed on day 0 and after 42 day of treatment protocol. **DESIGN:** A Pilot study

Result: Advanced sensorimotor training (group A) and Sustained natural apophyseal glide (group B) with conventional exercise regime within group shows improvement in NPRS, ROM, NDI and joint position error after 6 weeks of intervention. Between group analysis sensorimotor training (group A) shows more improvement in NPRS, ROM, NDI and joint position error.

Conclusion: From the result obtained we can conclude that both group showed significant improvement in mechanical neck pain, ROM and function ability after giving 6 weeks of intervention but the group that received Sensorimotor training showed more improvement as compare to SNAG group intervention.

Keywords: Cervical joint position sense, Conventional exercise regime, Joint position error, Mechanical neck pain, Neck rotators stretching, Sensorimotor training, Sustained Natural Apophyseal Glide (SNAG).

INTRODUCTION

Chronic neck pain is a common muscle and joint problem that affects millions of people around the world. It is can make daily activities difficult and also reduce the overall quality of life of people who suffer from neck pain^[1]. About 70% of people experience neck pain at least once in lifetime. It is the second most common reason for disability around the world. Neck pain not only affects person's health but also creates financial problems, because treatment can be expensive, and many people may not be able to work properly during that time^[2].

Across the world , neck pain is a common problem, affecting between 16.7% and 75.1% of the population research shows that females are affected slightly more

as compare to male with rates about 5.7% in women compared to 3.9% in men, long lasting neck pain can sometime cause discomfort that spread behind the neck, including the upper back, chest areas, and arm due to involvement of related muscle area (myotomes) and in various cases there is no clear sign and symptoms of nerve root pressure or irritation, neurological

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examination finding may still appear normal, management of neck pain is commonly carried out by physiotherapist through the combination of patient education, advice on adequate rest, and structured exercises to improve posture and body awareness^[2].

According to 2010 study on the worldwide impact of disease, neck pain ranks as the fourth most prevalent reason for years lost to disability, after osteoarthritis, depression, and back pain. Around fifty percent of the population will experience a medically severe occurrence of neck ache at some point in their lives. An average prevalence rate of 37.2% was observed by one systematic analysis, but most epidemiological investigations indicated a yearly incidence ranking from 15% to 50% regardless of the wide variance in reported occurrence rates. Neck pain start being more worsen with middle age and is more prevalent in women. Headache, back pain, and discomfort in joint are just a few of many coexisting conditions that are associated with neck discomfort^[3].

Prognostic variables in the overall population were examined by *carool et al. (2008)*. Both sexes experienced neck pain, although neck pain is seen more commonly in women than men. However, younger age is more linked to better outcomes and gender shows only marginal effects on recovery from neck discomfort. On the other hand, advanced age is consider as a weak indicator of rehabilitation and a marker of the worst prognosis, and they were at most risk of neck pain similarly, the root cause of neck discomfort is already understood, now healing seen as a multifactorial process which is based on the degree of disruption, independent thinking, freedom, quality and intensity of symptoms, disability, activity, and engagement and self-satisfaction all effect the recovery^[4].

In essential health care setting, there is one common presenting issue that seriously hinders impairment in activity of daily life, given a comprehensive diagnostic process, physiotherapist must require to conduct an efficient yet comprehensive examination, warning signs play an important role here for early identification and management of more worrying disease such as injuries from accidents, bacterial and viral infection, malignancy, and cardiovascular emergencies. Neurological sensation that rises rapidly justify particularly through examination. The central spinal cord or the roots of nerve may be harmed by generative alterations, weight effects, trauma, infection, and other inflammatory or nerve degeneration disorders can harmed the spinal cord or roots of nerve. Clinician should remain vigilant for spinal cord dysfunction, even without an acute presentation myelopathy indicates to neurological impairments that is caused by an impairment of nerve roots of spinal cord route inside the vertebral canal^[5].

FSH (forward head posture demonstrates the most common postural anomaly of upper back region and it considered to be as an indicator for development of non specific neck pain or discomfort (MNP). The pathogenic mechanical aspect of MNP includes the composition and functionality of the thoracic and cervical spines. Where excessive anterior head placement accompanied with reduced thoracic spinal movement, which altered cervical spine positioning and impacts critical on posture control muscle groups^[6].

Sensorimotor control indicates the Brain and spinal cord capacity to regulate motion, coordination, alignment, and the stability of joints. To gain this, brain gathers information from

peripheral nervous system in form of visual, auditory, internal ear vestibular system, sense of position in form of maintaining joints balance, facilitating smooth, adjustable and accurate motoractions^[7]. Individuals with neck pain or discomfort frequently demonstrate Sensorimotor control problem including increased postural sway in standing and impaired joint position sense, as evidence by difficulty in locating the preceding head position^[1,7].

Patients with persistent neck discomfort are due to excessive use, recurrent trauma, severe injury, and muscle weakness lead to increase stretchability in inert tissue. And stabilize the an upright posture in individuals, but conversely weaken the inert tissues. Hence joint unstableness arises and induces excessive mobility in head and neck regions and limits the motion in thoracic segments, which eventually culminates in activity limitations^[8].

The physical assessment should prioritize the challenges highlighted in patients medical records, with a key goal of distinguish neurophysiology from biomechanical clinical features. Soft tissue sensitivity may suggest soft tissue pain, pathogenic infection, lymph node enlargement, where as specific bony soreness or protuberance is an indication that diagnostic imaging is required. Whereas range of motion (ROM) investigation are usually noted, it provide inadequate diagnostic significance; ROM examination proves more useful when identifying alignment or cause of discomfort, recent clinical investigation began concentration on the diagnosis and management of altered cervical joint position sense (JPS) in patients with non specific neck discomfort^[9].

Neck pain is anatomically considered as discomfort originating from any location around the area bounded inferior side by a inappropriate cross sectional line by carrying out the spinous process of first thoracic vertebrae^[10]. Treating biomechanical neck discomfort requires a complete functional restoration strategy focused on lowering pain or discomfort, enhancing function and preventing reappearance. Conventional physiotherapy treatment aligned with principle of mulligan technique. Typically incorporate moist heat pack (MHP), and sustained natural apophyseal glide (SNAGs), muscle lengthening exercises and muscle strengthening exercises. Ultrasound therapy can also be effective in treating nonspecific biomechanical neck pain^[2,11]. Stretching exercises were applied through passive full-cervical rotation in both side right side as well as left side and then continued as long as achievable while focusing on threshold limit of pain. Each rotation was performed withheld of 30 seconds, and then rest for another 30 second with the series replicated three times^[2].

Exercises for scapular stabilization focus on the muscle connected to scapula including those originated from the head and spine-named as scapulothoracic muscle / scapular stabilizers. Series of strengthening activities is known as stabilization training, and it helps in to maintain and improving muscle balance, proper posture when performing work related to activities of daily life^[12]. Research on cervical pain progressively emphasize sensorimotor control impairments in form of primary finding terms like body position sense, movement sense, sensory motor control are usually used simultaneously indicates to the identical systems, terms in the field of sensorimotor control can become difficult to understand^[13].

METHODOLOGY

The patient was selected on the basis of screening criteria. The

patient was then explained the purpose of the study.

THE INTERVENTION INCLUDED IN THIS STUDY WAS:

Intervention Group A Sensorimotor Training + Conventional exercise	Dosage
CJPS	3 sets, 5 repetition, thrice a week, for 6 week
Postural control training	3 sets, 5 repetitions, thrice a week, for 6 week
Oculomotor exercises	3 sets, 10 repetitions, thrice a week, for 6 week

Table: 1

Intervention Group B SNAG + Conventional exercise	Dosage
SNAG	3 sets, 6 repetitions per session, thrice a week for 6 week, 2-5 sec hold and rest for 30 sec rest. Glide were given with tip of thumb at 45 degrees.

Table: 2

Common conventional Therapy for both group	Dosage
MHP (moist heat pack)	15 min on neck area while sitting with head relaxing on couch with pillow.
Upper trapezius muscle stretching	3 sets, 3 repetitions per side, hold 30 sec, rest 30 sec to both side
Stretching exercise for neck rotators	3 sets, 3 repetitions per side, hold 30 sec, rest 30 sec to both side

Table: 3

INTERVENTION TO BE CONDUCTED ON THE PARTICIPANTS:

GROUP: A (SENSORIMOTOR TRAINING WITH CONVENTIONALEXERCISE)

- Cervical joint position Sense (CJPS)**

Cervical joint position sense was given (3 sets, 5 repetitions, 3 times in a week) the

Patient were sited on stool comfortably with back straight and feet was placed flat on the floor during CJPS a laser pointer was mounted on the forehead for participant and were aligned with the target which is placed on over the wall at distance of 90 cm from patient. In this participants were told to fix the laser dot on the centre on target and then move their head in various direction of neck movement by closing eye and return to neutral position while focusing on the target.

- Oculomotor Exercise:**

Oculomotor exercise was performed (3 sets, 10 repetitions, 3 times in a week). The patient was sited comfortably on stool with back straight and feet was placed flat on the floor, participants were instructed to maintain correct posture during intervention. Oculomotor includes Eye head coordination and gaze stability training.



Figure 2 Eye head coordination



Figure 3 Gaze Stability

- Postural control training :**

Postural control training was performed (3 sets, 5 repetitions, 3 times a week). The patient was sites comfortably on stool with back straight and feet was placed flat on floor, participant were instructed to maintain correct posture during intervention, it includes chin tuck and scapular setting exercise.



Figure 4 Chin tuck



Figure 5 Scapular setting



Figure 1 Cervical joint position senses.

GROUP: B (SNAG WITH CONVENTIONAL EXERCISES)

- SNAG (sustained natural apophyseal glide)

SNAG is sustained natural apophyseal glide in which physiotherapist applies supporting glide parallel to the intervention plane and participants actively try to move painful or tight joints through their range of motion

Participants in Group B were received sustained natural glide (SNAGA) along with common conventional physiotherapy exercise regime. Patient were sited on chair and therapist stand behind the patients by placing distal phalanx medial border of thumb on the cervical spine of one vertebra above affected area. Where participants were advised to perform active movement of cervical spine, the glide was given with tip of thumb placing it at an angle of 45 degree towards the direction of eyeball and placed thumb get reinforced by another thumb. SNAG technique was given in (3 sets, 6 repetitions) each glide were hold for 2-5 sec and rest for 30 second in between two consecutive glide.



Figure 6 Application of SNAG technique over cervical joint

CONVENTIONAL THERAPY FOR GROUP A & B

Conventional therapy was given in both Group A and Group B:

- MHP (Moist heat pack)

Moist heat pack were applied on participants of both Group A & B for 15 min on cervical region patients were having position in sitting with head relaxing on couch supported with pillow.



Figure 7 Application of MHP (Moist heat pack)

- Upper trapezius muscle stretching:

Upper trapezius muscle stretching were given to patients of both Group A & B. Patients were seated on stool in upright position, intervention were given (3 sets, 3

repetitions per side, hold 30 sec, rest 30 sec to both side) therapist were standing behind the patients by placing one hand over side of head and one hand over shoulder for making proper stabilization.



Figure 8 upper trapezius muscle stretching

- Neck rotators Stretching:

Patients were seated on stool in upright position, intervention were given (3 sets, 3 repetitions per side, hold 30 sec, rest 30 sec to both side). Therapist were stand behind the patients by placing one hand over shoulder for better stabilization and other hand on head laterally. Stretching exercise were by performing passive full rotation of neck in both right and left direction as possible but up to the limit of pain.



Figure 9 Neck rotators stretching

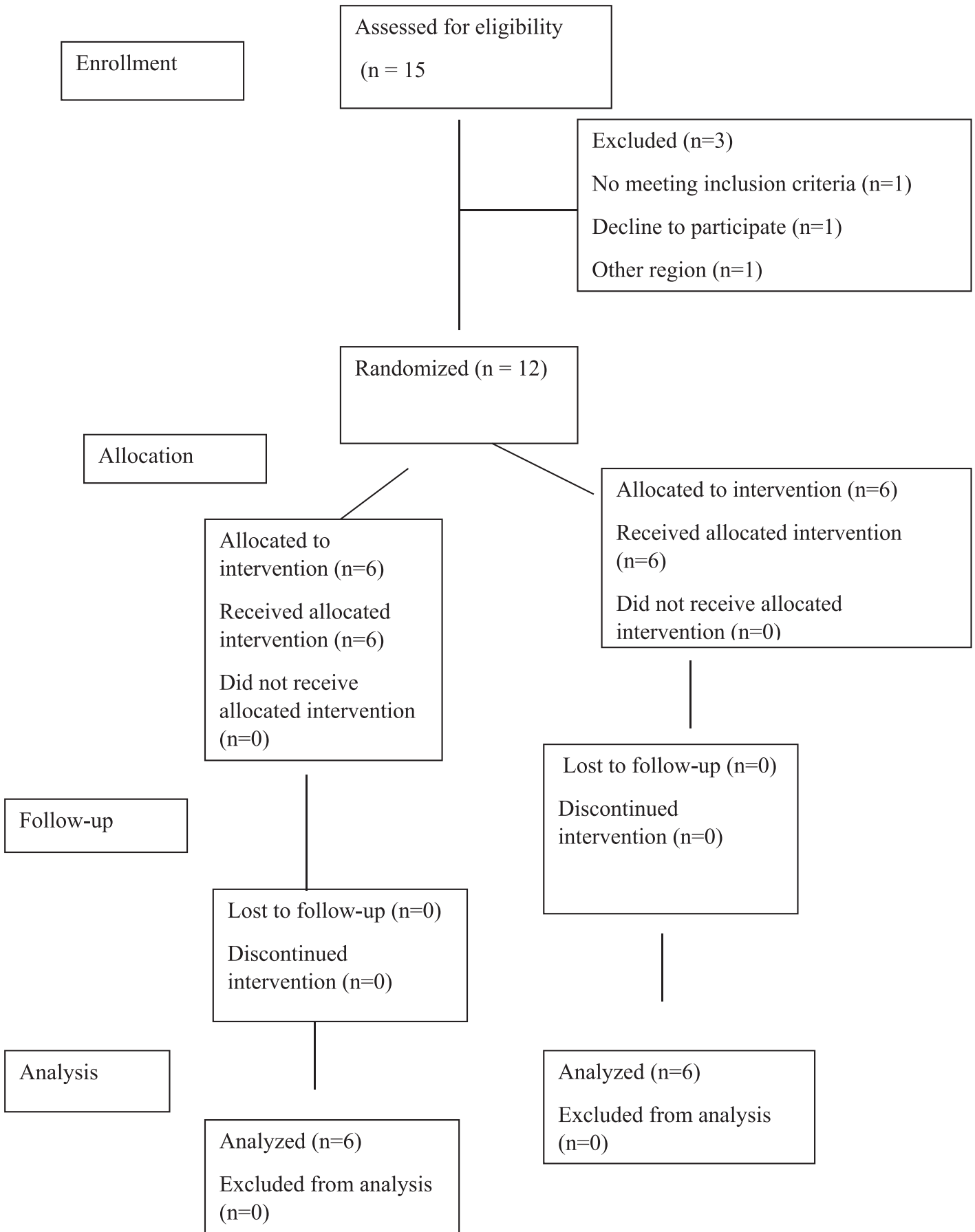
DATA ANALYSIS

The collected data were tabulated and analyzed using Microsoft excel. All outcome measures that is JPE (joint position error), NDI (neck disability index), NPRS (Numeric pain rating scale and goniometer (cervical range of motion) measured on day 0 and day 42. Graphical representation, Comparison of the pre and post intervention Mean $\pm$ SD and Mean difference between Group A and Group B is also done by using Microsoft excel.

RESULTS

All outcome measures that is JPE (joint position error), NDI (neck disability index), NPRS (Numeric pain rating scale and goniometer (cervical range of motion) measured on day 0 and day 42. Both groups showed Improvements after 6 weeks of intervention protocol as shown in within the group analysis were interpreted by use of graphical representation. Group A showed more improvement as compared to group B as shown in between the group analysis comparison were interpreted by use of graphical representation, and by performing Comparison of the pre and post intervention Mean $\pm$ SD and Mean difference between Group A and Group B is also done by using Microsoft excel.

CONSORT-FLOW DIAGRAM



COMPARISON OF PRE-AND POST-INTERVENTION MEAN $\pm$ SD AND MEAN DIFFERENCE BETWEEN GROUP-A AND GROUP-B

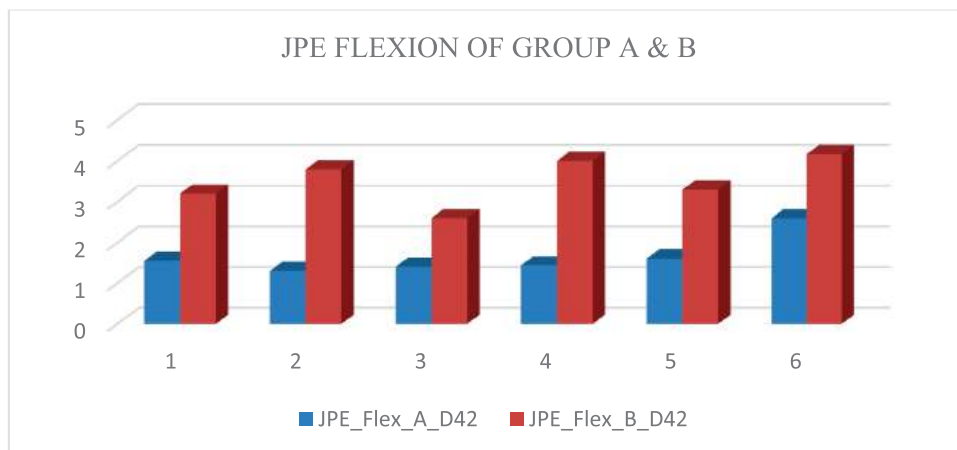
Table: 1

Outcome	Group A pre	Group A Post	Mean Diff A	Group B pre	Group B post	Mean Diff B
JPE FLEX	5.68 $\pm$ 0.70	5.51 $\pm$ 0.47	0.17	5.55 $\pm$ 0.72	3.51 $\pm$ 0.58	2.04
JPE EXT	5.68 $\pm$ 0.68	2.0 $\pm$ 0.59	3.68	6.03 $\pm$ 0.47	3.41 $\pm$ 0.57	2.62
JPE Lt R	5.5 $\pm$ 0.53	2.41 $\pm$ 0.47	3.09	5.65 $\pm$ 0.43	3.31 $\pm$ 0.73	2.34
JPE Rt R	5.01 $\pm$ 0.31	1.83 $\pm$ 0.65	3.18	5.73 $\pm$ 0.59	3.23 $\pm$ 0.79	2.5
NPRS	5.83 $\pm$ 1.16	1.66 $\pm$ 0.81	4.17	4.5 $\pm$ 1.37	2.0 $\pm$ 1.54	2.5
NDI	18.33 $\pm$ 5.20	6.66 $\pm$ 2.33	11.67	12.0 $\pm$ 2.28	7.33 $\pm$ 1.86	4.67
GONIO FLEX	37.83 $\pm$ 8.63	59.66 $\pm$ 8.11	21.83	43.16 $\pm$ 1.86	54.5 $\pm$ 1.87	11.34
GONIO EXT	43.16 $\pm$ 7.98	58.33 $\pm$ 11.16	15.17	49.83 $\pm$ 9.47	57.33 $\pm$ 8.80	7.5
GONIO Lt R	60.5 $\pm$ 9.52	75.83 $\pm$ 8.44	15.33	59.33 $\pm$ 9.87	68.0 $\pm$ 8.29	8.67
GONIO Rt R	55.33 $\pm$ 5.68	75.0 $\pm$ 6.35	19.67	62.66 $\pm$ 5.16	74.66 $\pm$ 3.20	12

INTERPRETATION: This table interpret about pre and post Mean $\pm$ SD and difference between mean value of GROUP A and GROUP A , on observation both groups shows significant improvement in all outcome measures after intervention. But GROUP A shows more

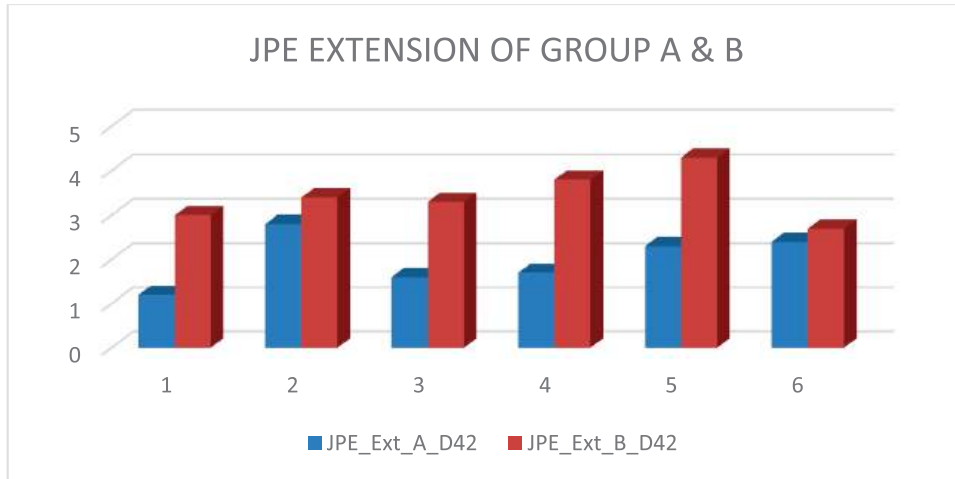
improvement in most of outcome measures as compare to GROUP B so overall results indicates that GROUP A intervention was more effective in improving mechanical neck pain, cervical range of motion and functional ability.

GRAPHICAL INTERPRETATION BETWEEN GROUP A AND GROUP B:

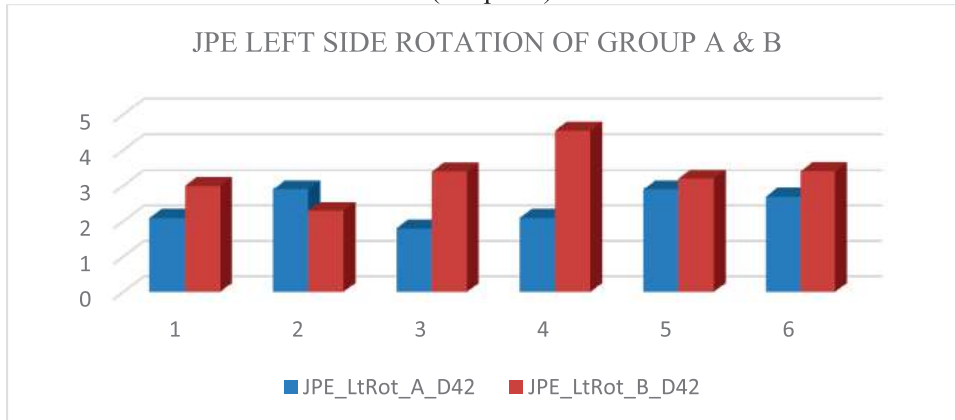


Interpretation: JPE flexion improved in Group A compared to Group B after 6 week

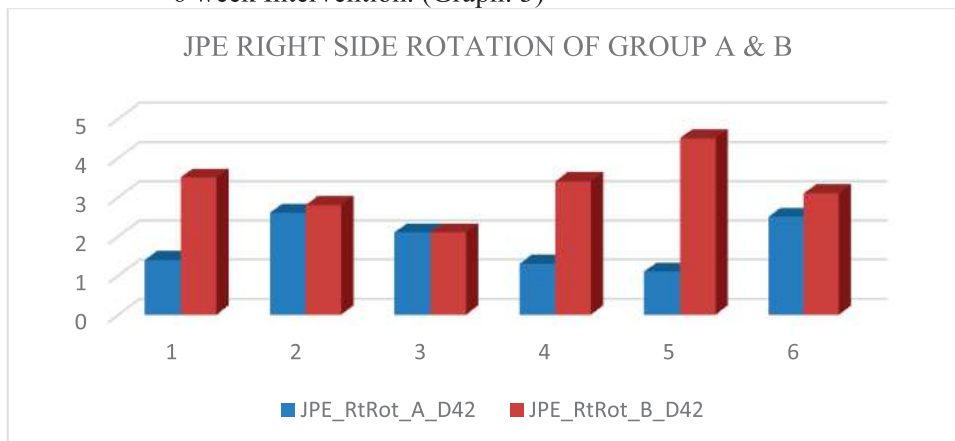
Intervention. (Graph 1)



Interpretation: JPE Extension improved in Group A compared to Group B after 6 Week Intervention. (Graph: 2)



Interpretation: JPE left side rotation improved in Group A compared to Group B after 6 week Intervention. (Graph: 3)



Interpretation: JPE left side rotation improved in Group A compared to Group B After 6 week Intervention. (Graph: 4)

DISCUSSION

This study aims to compare and investigate the effectiveness of sensorimotor training combined with conventional physiotherapy exercises and SNAG (sustained natural apophyseal glide) combined with conventional physiotherapy exercises on Pain, Cervical range of motion

and functional disability in young adults with mechanical neck pain.

In this study 12 young individuals with mechanical neck pain were included, 6 are in Group A and 6 are in Group B. Only those participants were selected who fulfil our inclusion criteria of the study. Participants of Group A were taught about advanced

sensorimotor training which include (Cervical joint position sense, Postural control training and Oculomotor training) along with common conventional physiotherapy exercises, and Group B were introduced with SNAG (Sustained natural apophyseal glide) intervention along with common conventional physiotherapy exercises. Outcome measure JPE (joint position error), NPRS, NDI, Cervical range of motion were measured and compared on Day 0 and Day 42. Both groups showed Improvements after 6 weeks of intervention protocol as shown in within the group and between the group analysis of data.

Another study done by *Sahar Zaid et.al (2025)* on Sensorimotor training effect on Discomfort, Cervical joint position sense, ROM, Balance and disability among chronic neck pain patients. In this review 23 records was assessed and shows effect of Sensorimotor training among chronic neck pain patients and can use as an therapeutic intervention for treating participants^[1].

CONCLUSION

The study conclude that both Group A (Advanced Sensorimotor training) with conventional exercise and Group B (Sustained natural apophyseal glide) along with conventional exercise, showed significant improvement in mechanical neck pain, ROM and functional ability after giving 6 weeks of intervention as compared outcome measures within the group and between the group, but the group that received Advanced Sensorimotor training showed more improvement as compare to SNAG group intervention. This shows that advanced sensorimotor training along with conventional physiotherapy exercise are more effective treatment for mechanical neck pain in young individuals.

LIMITATIONS OF THE STUDY

1. Results are applicable to subjects belongs to age group of 20 to 30 years only.
2. The study sample size is small (n=12).
3. The duration of study is small.
4. The study was conducted in urban areas which hindered the accuracy of results as it might have been different in rural areas.
5. The study was conducted in single place.
6. Neck proprioception was assessed by using a laser pointer mounted on head for joint position error test; measurement may vary due to of participant concentration and accuracy during repositioning.
7. Long-term follow-ups were not monitored in this study.

FUTURE SCOPE

1. Future study can be done with large sample size.
2. Better results can be drawn of the study will be conducted with different physiotherapy intervention for long term duration.
3. Long term follow-up of patients is recommended in future studies to observe long term effect of advanced sensorimotor training.
4. Different age groups and various type of neck pain can be included in future.
5. Advanced measurement tool can be used to examine the proprioception of neck and Cervical Joint position error.

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CONFLICT OF INTEREST: None

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