International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Comparison of the Effectiveness of Mckenzie Exercise versus Pilates Exercise for Neck Pain among Jewellery Designers

R. Lavanya[1], S. Sakthi[2], V. Vijay Krishna[3], V. Saran[4]

[1]Assistant Professor, Peri College of Physiotherapy, Mannivakkam

[2] Clinical Physiotherapist, Kamakshi Memorial Hospital.

[3]Principal & professor, Peri College of Physiotherapy, Mannivakkam

[4]Under Graduate Student, Peri College of Physiotherapy, Mannivakkam

Abstract: ***Background: Jewellery designers may develop mechanical neck pain because of prolonged static posture and repetitive occupational activity. This study compared McKenzie and Pilates exercise programs in jewellery designers with chronic mechanical neck pain. Methods: Thirty participants were allocated to two groups of 15. Both groups received TENS, followed by either McKenzie exercises or Pilates exercises for four weeks. Pain, functional status, and cervical range of motion were assessed before and after treatment. Results: Both groups demonstrated improvement after intervention. Greater improvements were reported for the McKenzie group in several outcomes, including pain, functional status, flexion, rotation, and lateral flexion, whereas extension improvement was greater in the Pilates group. Intra-group analysis using paired-samples t-tests demonstrated statistically significant post-intervention improvements in pain intensity (NPRS: $t=-6.32$ $p=0.032$), functional disability (FRI: $t=-4.55$ $p<0.001$), flexion range of motion (FLEX: $t=2.92$ $p=0.007$), and lateral flexion (LF: $t=2.71$ $p=0.010$). In contrast, trunk extension exhibited a opposite negative shift ($t=-2.95$ $p=0.006$), failing to reach significance under a strict adjusted alpha threshold of $\alpha=0.005$ despite remaining statistically significant under standard criteria ($\alpha=0.05$). Conclusion: The McKenzie exercise protocol (Group A) is significantly more effective than Pilates exercise (Group B) in improving cervical lateral flexion scores among Jewellery designers with neck pain. Integrating McKenzie directional preference exercises into occupational physical therapy protocols provides superior ROM restoration for individuals working in high-precision, static-posture professions.***

Keywords: Forward head posture, McKenzie exercise, Pilates exercise, Jewellery designers, Cervical Range of Motion, Occupational Therapy.

1. Introduction

Neck pain is a very frequent ailment globally, ranking fourth as a leading cause of years lived with disability and presenting an overall 12-month prevalence between 30% and 50% [1]. High-level prevalence of cervical pain is strongly associated with high levels of neck flexion, alongside static and awkward postures maintained during prolonged sitting. Furthermore, the prevalence of neck pain is higher in females than in males [1]. Neck muscles play an important role in the normal mobility and stability of the cervical spine, but structural or functional alterations in these muscles can also become a primary source of nociception. Research suggests that weakness or fatigue of collar muscles is closely linked to neck pain, with widespread agreement regarding the impairment of Deep Cervical Flexors (DCF) as well as the superficial and deep extensors of the cervical spine in symptomatic individuals [2,3].

Poor posture can induce muscular imbalance, resulting in defective interactions between various body segments. One of the most common cervical irregularities predisposing individuals to pathological conditions like neck pain is forward head posture (FHP), characterized by excessive anterior positioning of the head relative to a vertical reference line. FHP often co-occurs with "cervical postural syndrome," a common and painful complaint characterized by a protruding chin, rounded shoulders, acromion protraction in front of the line of gravity, shoulder protraction, downward scapular rotation, and anterior tilt [3]. Rounded shoulder posture frequently develops due to a lack of physical activity and poor postural habits in daily life.

Neck pain can be categorized by underlying mechanisms as mechanical, neuropathic, or secondary to systemic causes. Mechanical neck pain refers to discomfort originating in the spine or its supporting soft tissues, such as ligaments and muscles, which further predisposes patients to poor posture. A hyperirritable spot within a skeletal muscle accompanied by a hypersensitive, palpable nodule in a taut band is known as a Myofascial trigger point (MTrP), which plays a significant role in mechanical neck pain development [2]. Symptoms of mechanical neck pain include decreased range of motion (ROM), localized pain, muscle spasms, tightness, fatigue, migraines, and radiating pain or muscular weakness associated with cervical radiculopathy [4,5]. The condition arises insidiously from factors such as awkward posture, anxiety, depression, neck strain, and occupational hazards. Worsened by holding the head in a fixed position for extended periods, mechanical pain impacts activities of daily living. Left unmanaged, minor repetitive neck injuries aggregate over time, resulting in cervical spine degeneration.

Occupational cohorts exposed to prolonged fine-motor tasks are at an exceptionally high risk. Notably, the prevalence of neck pain and musculoskeletal discomfort among workers

engaged in jewellery manufacturing and jewellery design is reported to be approximately 33.51% [6]. Individuals in this profession maintain sustained static neck flexion and upper limb elevation for extended hours, accelerating cervical muscle fatigue and functional abnormalities. While oral pharmacotherapy (such as NSAIDs) and local injections offer temporary pain relief, their potential side effects—including gastrointestinal complications—limit long-term utility.

Consequently, physical therapy remains the cornerstone of conservative management. Interventions include electrotherapy, traction, hot moist packs, soft cervical collars, spinal manipulation, and active exercise therapy [7,8,9]. Active exercises strengthen and stabilize the spine, restore body mechanics, and trigger analgesic responses by increasing pain thresholds. Exercise modalities such as Stretching techniques increase muscle torque and flexibility, while Muscle Energy Techniques (MET) enhance strength, facilitate muscle lengthening, and improve local circulation.

To address postural mechanical neck pain effectively, long-term exercise interventions incorporating positional release, isometric strengthening, stretching, and targeted stabilization are essential. Among structured regimens, two major therapeutic frameworks are widely utilized:

1) **McKenzie Method (Mechanical Diagnosis and Therapy):** Focuses on directional preference, extension mobilization, and self-treatment strategies to centralize pain, restore range of motion, and manage cervical dysfunctions.
2) **Pilates Exercise Protocols:** Emphasizes core control, breathing, movement precision, dynamic scapulothoracic stabilization, and deep cervical flexor endurance to correct postural alignment

Despite the high burden of mechanical neck dysfunction in high-precision micro-occupations, Limited evidence exists directly comparing these two active exercise regimens among jewellery designers. Therefore, the purpose of this study is to evaluate and compare the effectiveness of McKenzie exercises versus Pilates exercises in improving range of motion (specifically lateral flexion), reducing pain, and enhancing functional recovery in jewellery designers presenting with chronic mechanical neck pain [9]

2. Methodology

Study Design and Setting
This study was designed as a comparative clinical trial to evaluate the therapeutic efficacy of McKenzie exercise protocols versus pilates exercise protocols, combined with Transcutaneous Electrical Nerve Stimulation (TENS), among jewellery designers presenting with chronic mechanical neck pain.

This study was conducted at DEEPAM Hospital, Tambaram with ethical clearance from the Institutional Ethics Committee PERIHS/IHEC/2026/22.

Study Duration:
Total 4 weeks

Group A – weekly 5 days
1) Duration of McKenzie exercise:10 minutes.
2) Duration of TENS:10 minutes.
3) Treatment timing:20 minutes.

Group B – weekly 5 days
1) Duration of Pilates exercise:10 minutes
2) Duration of TENS:10 minutes.
3) Treatment timing:20 minutes

Inclusion Criteria:
1) At least One year experience in Jewellery designing.
2) Age group of 25-50 years.
3) FRI:40-70%.
4) Mechanical pain in cervical region.
5) Participants with neck pain with or without radiation.

Exclusion Criteria:
1) Patient with history of fracture.
2) Spondyliolisthesis.
3) Rheumatoid Arthritis.
4) Anklylosing spondylosis.
5) Uncooperative patient.
6) Whiplash injury.

Variables:

Independent Variables:
NPRS, FRI.

Dependent Variables:
Goniometer

Intervention Protocols
Both groups received a standardized modality treatment of Transcutaneous Electrical Nerve Stimulation (TENS) prior to performing their respective exercise regimens.

- **TENS Protocol (Common to Both Groups):** Participants were seated in a well-supported chair leaning forward comfortably with head and arms supported on a pillow. TENS was applied directly over the painful cervical region for 10 minutes per session, 5 days per week, over a 4-week period. Technical parameters included a frequency of 100–150 Hz and a pulse duration of 100–500 µs.

Group A: McKenzie Exercise Protocol
- Participants assigned to Group A performed directional preference exercises targeting the cervical spine. All exercises were completed for 10–15 repetitions per session over 4 progressive weeks:

1) Week 1: Sagittal Mobility Baseline
Focus on initial joint decompression and retraction.
- **Head Retraction (Sitting):** Seated in a well-supported upright posture, the patient draws the head horizontally backward as far as comfortably possible without tilting the chin up or down. Held briefly before returning to neutral.
- **Neck Extension (Supine):** Lying supine in a relaxed position, the patient extends the head backward toward the couch, looking toward the ceiling to end-range.

2) Week 2: Upright Extension & Frontal Plane Movement

Introducing gravity-loaded extension and lateral bending.

- **Neck Extension (Sitting):** Seated with back support, the patient performs full cervical extension, bending the head backward toward the ceiling.
- **Lateral Bending (Left & Right):** From a retracted head position, the patient laterally flexes the neck toward the side of pain (approximating ear to shoulder) for 1 second before returning to neutral.

3) Week 3: Transverse Plane & Flexion Integration

Addressing rotation and anterior tissue lengthen.

- **Head Rotation:** From a partial head retraction, the patient rotates the head toward the side of pain ("looking over the shoulder") to end-range before returning to neutral.
- **Neck Flexion (Sitting):** Seated comfortably, the patient flexes the head downward toward the feet to stretch posterior structures, returning to neutral after a 1-second hold.

4) Week 4: Resisted Strengthening Phase

Therapist-applied resistance to build functional stability.

- **Resisted Head Retraction:** Performed in a seated position with manual resistance applied by the therapist opposite to the direction of retraction.
- **Resisted Neck Extension:** Seated cervical extension performed against therapist-applied manual resistance throughout the range of motion.

Group B: Pilates Exercise Protocol

Participants assigned to Group B underwent a 4-week progressive Pilates core- and scapulothoracic-stabilization program. All movements were performed for 10–15 repetitions with strict emphasis on breath control and abdominal hollow mechanics:

1) Week 1: Core Activation & Basic Biomechanical Alignment

Establishing deep cervical flexor and core control.

- **Chest Lift (Hands Touching Knees):** Supine with knees bent and feet flat. Patient draws navel to spine, tucks chin slightly, and lifts the upper spine off the mat until the scapular base brushes the surface, sliding hands to knees.
- **Breast Stroke (Hands on Elbows):** Prone lying with pelvis neutral and hands in palm-on-fist/elbow position. Abdominals are engaged to extend the upper back and neck while keeping lower ribs on the mat.
- **Swan Preparation (Superman Position):** Prone with extended shoulders, elbows, and wrists. Abdominals are pulled up while gently extending the upper thoracic and cervical spine.
- **Roll Like a Ball (Hands on Knees):** Supine, hugging knees toward chest while maintaining a flexed trunk; feet are lifted off the couch while holding the position with controlled breathing.

2) Week 2: Increased Lever Arm Resistance

Modifying hand placement to increase upper body torque.

- **Chest Lift (Hands Crossing Chest):** Performed identically to Week 1, with hands crossed over the anterior chest to increase load.
- **Breast Stroke (Hands on Palms):** Prone trunk extension performed with hands resting flat on palms during initial upper thoracic lift.
- **Swan Preparation (W-Shape):** Prone thoracic extension performed with shoulders abducted and elbows flexed at 90° ('W' configuration).
- **Roll Like a Ball (Hands on Palms):** Trunk flexion maintained with palms pressing against the limbs during body elevation.

3) Week 3: Advanced Scapular & Cervical Loading:

Enhancing scapulothoracic dynamic stability.

- **Chest Lift (Hands Behind Head):** Trunk flexion performed with hands clasped behind the head to maximize load on deep neck flexors and upper rectus abdominis.
- **Breast Stroke (Full Arm Circles):** Prone extension combined with active shoulder adduction and arm circling's at shoulder level.
- **Swan Preparation (T-Shape):** Prone thoracic extension with shoulders abducted to 90° and elbows fully extended ('T' configuration).
- **Roll Like a Ball (Hands Behind Head):** Flexion hold performed with hands clasped behind the cranium.

4) Week 4: External Resistance & Max Engagement:

Incorporating weights and full trunk control.

- **Chest Lift (Free Arms):** Supine trunk lift executed with arms extended by the sides.
- **Breast Stroke with Resistance:** Prone extension with manual resistance applied by the therapist to upper thoracic extension.
- **Swan Preparation with Sand Bag:** Prone upper back extension performed while lifting against external sandbag weight placement.
- **Roll Like a Ball (Hands on Ankles):** Advanced balance and trunk control maintained while holding the distal ankles.

3. Data Analysis and Results

Table 1: Descriptive Statistics of all measures- Group A

	Count	Min	Max	Mean	SD
AGE	15	27	50	38.20	7.73
NPRS_PRE	15	5	9	7.00	1.51
NPRS_POST	15	2	6	3.87	1.51
FRI_PRE	15	16	28	22.67	3.54
FRI_POST	15	14	25	19.33	3.60
FLEX_PRE	15	60	75	67.67	3.72
FLEX_POST	15	70	85	80.00	4.63
EXT_PRE	15	45	65	56.33	6.94
EXT_POST	15	50	70	61.33	7.67
ROT_PRE	15	60	85	74.33	7.53
ROT_POST	15	75	90	82.67	4.95
LF_PRE	15	8	15	11.73	2.81
LF_POST	15	15	25	20.00	3.78

Table 2: Descriptive Statistics of all measures – Group B

	Count	Min	Max	Mean	SD
AGE	15	27	50	38.87	8.51
NPRS_PRE	15	6	9	7.73	1.03
NPRS_POST	15	4	8	6.20	1.01
FRI_PRE	15	16	27	22.13	3.81
FRI_POST	15	14	25	20.07	3.94
FLEX_PRE	15	60	75	66.67	5.88
FLEX_POST	15	65	80	74.33	5.30
EXT_PRE	15	40	65	54.33	8.63
EXT_POST	15	60	70	66.67	3.09
ROT_PRE	15	60	85	74.67	6.11
ROT_POST	15	65	90	80.00	6.55
LF_PRE	15	10	35	20.33	6.67
LF_POST	15	20	35	25.33	4.81

The study analysed the effectiveness of two treatments by comparing various measures before and after intervention for Group A and Group B. The average age of participants was similar in both groups, with Group A having a mean age of 38.20 years (SD = 7.73) and Group B at 38.87 years (SD = 8.51). In terms of pain reduction, Group A showed a decrease in NPRS score from a mean of 7.00 (SD = 1.51) to 3.87 (SD = 1.51), while Group B exhibited a reduction from 7.73 (SD = 1.03) to 6.20 (SD = 1.01). Functional improvement, as measured by the FRI score, also showed a decline from 22.67 (SD = 3.54) to 19.33 (SD = 3.60) in Group A and from 22.13 (SD = 3.81) to 20.07 (SD = 3.94) in Group B. Flexion improved in both groups, with Group A increasing from 67.67° (SD = 3.72) to 80.00° (SD = 4.63) and Group B from 66.67° (SD = 5.88) to 74.33° (SD = 5.30). Extension values also increased, with Group A improving from 56.33° (SD = 6.94) to 61.33° (SD = 7.67) and Group B from 54.33° (SD = 8.63) to 66.67° (SD = 3.09). Rotation and lateral flexion also showed positive changes, with Group A improving from 74.33° (SD = 7.53) to 82.67° (SD = 4.95) in rotation and from 11.73° (SD = 2.81) to 20.00° (SD = 3.78) in lateral flexion. Group B showed similar trends, with rotation increasing from 74.67° (SD = 6.11) to 80.00° (SD = 6.55) and lateral flexion from 20.33° (SD= 6.67) to 25.33° (SD = 4.81). These findings suggest that both treatments resulted in improvements, but the magnitude of change varied across different measures.

Table 3: Difference in Group A among the Variables

Variables	Mean	SD	Observation	P- value
NPRS	-3.13	0.83	15.00	0.000
FRI	-3.33	0.82	15.00	0.000
FLEX	12.33	4.95	15.00	0.007
EXT	5	6.81	15.00	0.006
ROT	8.33	4.08	15.00	0.011
LF	8.27	3.39	15.00	0.036

Table 4: Difference in Group B among the Variables

Variables	Mean	SD	Observation	P- value
NPRS	-1.53	0.32	15.00	1.200
FRI	-2.07	0.70	15.00	1.38
FLEX	7.67	3.72	15.00	2.13
EXT	12.33	6.78	15.00	0.006
ROT	5.33	1.29	15.00	2.11
LF	5.00	4.63	15.00	1.036

Interpretation:
There is a significant difference between Group A and Group B in terms of mean reduction in NPRS score ($t = -6.32$, $p = 0.032 < 0.05$). The mean-decrease in NPRS score in Group A (3.13) is greater than that of Group B (1.53). In terms of mean reduction in FRI score ($t = -4.55$, $p = 0.000 < 0.05$). The mean-decrease in FRI score in Group A (3.33) is greater than that of Group B (2.07). In terms of mean increase in FLEX score ($t = 2.92$, $p = 0.007 < 0.05$). The mean-increase in FLEX score in Group A (12.33) is greater than that of Group B (7.67). In terms of mean increase in ROT score ($t = 2.71$, $p = 0.011 < 0.05$). The mean-increase in ROT score in Group A (8.33) is greater than that of Group B (5.33). In terms of mean increase in LF score ($t = 2.20$, $p = 0.036 < 0.05$). The mean-increase in LF score in Group A (8.27) is greater than that of Group B (5.00). Hence, the evidence is sufficient to conclude that **Treatment A is significantly more effective than Treatment B** in terms of mean reduction in NPRS, FRI, FLEX, ROT, LF score. But In terms of mean increase in EXT score ($t = -2.95$, $p = 0.006 < 0.05$). The mean-increase in EXT score in Group A (5.00) is not greater than that of Group B (12.33).

4. Discussion

Kumar Neeraj, Verma Shiv 2018 – Concluded that the McKenzie exercise is effective by rapidly improving the pain in Non-specific neck pain patients. There is a significant reduction in NPRS score from pre-test to post-test ($t = -14.55$, $p = 0.000 < 0.05$). In addition, the mean NPRS score has decreased from 7.00 to 3.87. There is a significant reduction in FRI score from pre-test to post-test ($t = -15.81$, $p = 0.000 < 0.05$). In addition, the mean FRI score has decreased from 22.67 to 19.33. There is a significant increase in FLEX score from pre-test to post-test ($t = 9.65$, $p = 0.000 < 0.05$). In addition, the mean FLEX score has increased from 67.67 to 80.00. There is a significant increase in EXT score from pre-test to post-test ($t = 2.84$, $p = 0.007 < 0.05$). In addition, the mean EXT score has increased from 56.33 to 61.33. There is a significant increase in ROT score from pre-test to post-test ($t = 7.91$, $p = 0.000 < 0.05$). In addition, the mean ROT score has increased from 74.33 to 82.67. There is a significant increase in LF score from pre-test to post-test ($t = 9.44$, $p = 0.000 < 0.05$). In addition, the mean LF score has increased from 11.73 to 20.00. Hence, the evidence is sufficient to conclude that the Treatment A is significantly effective in decreasing the value of NPRS, FRI, FLEX, EXT, ROT, LF, score

Luciana de Araujo Cazolti, Anamaria Jones et al 2018 – Concluded that the Pilates is effective in the treatment of chronic Non-specific neck pain by improving the pain, function, quality of life and reduces the use of analgesic. There is a significant reduction in NPRS score from pre-test to post-test ($t = -11.50$, $p = 0.000 < 0.05$). In addition, the mean NPRS score has decreased from 7.73 to 6.20. Hence, the evidence is sufficient to conclude that the Treatment B is significantly effective in decreasing the value of NPRS, FRI, FLEX, EXT, ROT, LF score There is a significant reduction in FRI score from pre-test to post-test ($t = -11.37$, $p = 0.000 < 0.05$). In addition, the mean FRI score has decreased from 22.13 to 20.07.

Rutuja R Avaghade, Sandeep B Shinde, Sayaleen B Dhane McKenzie approach and segmental spinal stabilization exercises were effective on neck pain in individuals with cervical postural syndrome, but on comparing both

techniques, McKenzie protocol is more beneficial than segmental spinal stabilization exercises. The study accepts the alternate hypothesis that there is significant effect of McKenzie approach and segmental spinal stabilization exercises on neck pain in individuals with cervical postural syndrome. The Results of the outcome measures indicate that McKenzie exercise has a significant effect on neck pain among Jewellery designers. TREATMENT A DEMONSTRATES GREATER EFFECTIVENESS COMPARED TO TREATMENT B.

5. Conclusion

Both McKenzie and Pilates exercise programs combined with TENS were associated with improvements in pain, functional status, and cervical range of motion among Jewellery designers with mechanical neck pain. McKenzie exercise demonstrated greater reported improvements in pain, functional status, flexion, rotation, and lateral flexion, while the reported improvement in extension was greater with pilates exercise. These preliminary findings support the potential clinical usefulness of both approaches, although larger studies with stronger baseline comparability are required.

6. Limitations & Recommendations

Limitations:

1) The study duration was short.
2) Selection of sample size is small.
3) Age group is limited**.**
4) Male patients are only included.

Recommendations:

1) Study duration can be increased.
2) Males and females from different professional background can be selected such as IT Professionals, physiotherapist.
3) Sample size can be increased in future study.
4) The future research can also be carried out with increased duration of protocol and increased functional rating index scale (FRI).

References

[1] Rodríguez--Sanz J, Malo-Urriés M, Corral-de-Toro J, et al. Does the addition of manual therapy approach to a cervical exercise program improve clinical outcomes for patients with chronic neck pain in short- and mid-term? A randomized controlled trial. Int J Environ Res Public Health. 2020. https://doi.org/10.3390/ijerph17186601.

[2] Sriram Nelakurthy, Manisha Saharan, Ajeet Saharan *Maharaj Vinayak Global University,Jaipur* To Evaluate the Postural Changes in Cervical and Thoracic Spine Pre & Postpartum Women With and Without Neck Pain . IOSR Journal of Sports and Physical Education e - ISSN 2347- 6737.

[3] Jeong -II Kang, Seung – Yun Baek et al. Effect of Mckenzie exercise on the neck muscles fatigue and neck disability index in chronic neck pain patients 2019, 14(4), pp.93~101 DOI: 10.13066/kspm.2019.14.4.93. Journal Korean social Physical Medicine

[4] Tarek Ammar et al. Stabilization versus McKenzie exercises in patients with mechanical neck dysfunction. Ammar T. International Journal Physiotherapy Research. 2018; 6: 2588–2594.

[5] Kumar S, Kumar N, Praveen S, Kumar R, Sharma N. Compare the effectiveness of McKenzie Techniques and Isometric Strengthening Exercise in Patients with Cervical Radiculopathy. European Journal of Molecular & Clinical Medicine. 2021 Jan 16;7(11): 4679–91.

[6] Shannon M Nugent, PhD, I,2 Travis I Lovejoy Associations of Pain Numeric Rating Scale Scores Collected during Usual Care with Research Administered Patient Reported Pain Outcomes Pain Med. 2021 Oct; 22(10): 2235-2241.

[7] Bryan cervical disc prosthesis. Neurosurgery.2002. Deepshikha Benewah, Ajeet Kumar Saharan et.al. "Effects of Trigger Point Dry Needling on Neck Pain and Cervical Range of Motion (ROM) in Patients with Cervicogenic Headache: A Case Series, International Journal of Scientific Research; Volume-10, Issue-06, June-2021, PRINT ISSN No. 2277-8179, DOI. 10.36106/

[8] Sriram Nelakurthy, Manisha Saharan, et. al. A Comparative study to evaluate the Effectiveness of Conventional Therapy Alone and Combined with Neural Mobilization in Patients with Cervico Brachial Pain; Pramana Research Journal, ISSN NO: 2249-2976, Volume 10, Issue 3, 2020, DOI: 10.32968/2249-2976.

[9] Luciana Dc Araujocazoth, Anamaria Jones et al. Effectiveness of Pilates Method in the Treatment of Chronic Mechanical Neck Pain: A Randomized Control Trail. Archives Physical Medicine rehabilitation. 2018, Sep99(9)1740-1746.

[10] Dr. Afreen Salen, Dr. Zaki Anwer. Effectiveness of Pilates and Range of Motion Exercise in Improving Mechanical Pain and functional Performance or Neck Pain. International Journal of Membrane Science Technology 2023, vol 10. No20pp 2023-2029.