A Comparison of Muscle Energy Technique (MET), Dynamic Stretching, and a Combination of Both on Cervical Pain and Range of Motion Amongst Residents of Negros Oriental: A Quasi-Experimental Study

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Abstract

Neck pain is one of the most common complaints among individuals, arising from various etiologies. Numerous techniques, such as muscle energy techniques (MET) and Dynamic Stretching (DS), have been utilized to manage neck symptoms. This quasi-experimental study compared MET, DS, and a combination of both in treating non-specific neck pain. Thirty participants from Negros Oriental were divided into three groups (MET, DS, and a combination) based on age and sex. VAS was used to measure pain, while goniometry was utilized to determine cervical lateral flexion. Results revealed that all three techniques are effective in decreasing pain and increasing lateral flexion ROM in terms of effect size after every session, but the progress every session is not enough to be considered effective according to the Minimal Detectable Change (MDC) and Minimal Clinically Important Difference (MCID). All three groups showed efficacy in treating neck pain and improving neck lateral flexion, except for VAS in the DS group, as shown by improved VAS scores and neck lateral flexion ROM measurements when pre- and post-test scores were compared. No intervention applied amongst the three groups is superior to the other.

Keywords: neck pain, muscle energy technique (MET), dynamic stretching (DS), range of motion (ROM)

Introduction

Neck pain, with concomitant neck tension, can result from poor or prolonged postures. The prevalence is 27 per 1000 people, and it has become a common ailment in office work, student life, and even in everyday activities such as texting with the frequent use of mobile devices (Kolahi et al., 2022). Cohen (2015) explained that with an annual prevalence rate that exceeds 30%, neck pain is the fourth leading cause of disability in the United States. In most cases, it resolves on its own, but around 50% experience a recurrence or persistent pain, primarily amongst females and the middle-aged.

The most common type of neck pain usually develops after being in a static position for several hours. Short-duration pain can be relieved with rest or self-stretching. They may, however, persist for a long time if contributing factors such as bad habits or poor work ergonomics are not corrected. Self-care measures become ineffective, leading to the need for a more formal medical intervention, which can be costly and difficult for many people.

As a multifactorial disease, several modifiable and non-modifiable risk factors contribute to neck pain, causing disability and economic burden (Hoy, et al., 2010). Kazeminasab et al. (2022) showed that these factors include age, female sex, low social support, prior history of neck or low back pain, sedentary lifestyle, duration of computer use, and perceived stress, which suggests a broad prevalence among different populations. Hunter, (2019) delineates how the modern lifestyle may increase neck pain complaints. The work environment contributes considerably since workers often lack proper postures or ergonomics. Stress and psychological factors also influence pain perception, heightening their complaints even more. These workers are also unaware of appropriate interventions and often develop chronic neck pain.

Cervical pain affects the overall functional performance. Restriction of neck mobility is one of the leading factors contributing to disability or limitation of physical functioning, highlighting the effect of the postural musculature of the neck, such as the upper trapezius. These muscles are frequently overused to compensate for neck pain. As a result of compensation for pain, people exhibit tenderness and/or tightness around this area. Brandt et al. (2014) discussed the association between neck pain and trapezius muscle tenderness among office workers. Their study shows a strong correlation between perceived neck pain intensity and trapezius muscle tenderness, which confirms that most neck pain is due to myalgia,

or muscle pain and tenderness.

There are a variety of approaches in which neck pain may be managed, some of which involve stretching and other physical therapy techniques in which cervical joint mobility may be improved, thus addressing perceived pain. Although people refer to the internet for self-management, one must be careful, as some techniques require more advanced training for proper application. This study investigated and explored the effects of two common forms of manual therapy, which have been proven effective in relieving neck pain. The study compared the effects of dynamic stretching and muscle energy techniques on individuals with cervical neck pain. These techniques are low-cost, easily administered, and teachable to the general population so that people can independently address their neck condition.

Babault and Opplert (2018) explained that stretching has been commonly used to increase joint mobility and has significantly affected neuromuscular control. Studies showed that stretching can also manage cervical pain, increase range of motion, and improve people's function and quality of life (Tunwattanapong et al., 2016; Chang, 2020). There is insufficient literature proving that dynamic stretching can improve neck pain, as it is commonly used primarily to increase flexibility. This type of stretching involves actively contracting and stretching the muscles as the joints are moved through their complete range of motion. These movements improve muscle temperature and reduce stiffness (Bramble, 2021).

According to Coons et. al (2017), dynamic stretching has been a popular choice over static stretching due to the improvements it has shown with performance parameters such as endurance, strength, power, and anaerobic. This form of stretching often improves agility, speed, and acceleration. It involves actively tightening the muscles while moving the joints to their full range of motion with sport-specific motions throughout the stretch. Concerning this, Bramble (2021) indicated that these movements allow muscle temperature to increase and muscle stiffness to decrease. A study by Park and Park (2019) found that static and dynamic stretching effectively increased neck ROM and decreased cervical disability; dynamic stretching also improved cervical rotational movements. This study consisted of 24 participants divided into two groups, treated three times a week for four weeks.

Muscle energy technique is another intervention of interest. Sbardella et al. (2021) defined Muscle Energy Technique (MET) as a “hands-on” therapy that induces muscle stretching, strengthening, and relaxation. This technique does not require the physiotherapist to control the corrective force. The users themselves perform voluntary contraction . MET has

improved pain, joint mobility, muscular weakness and contractures, localized edema, and blood flow (Bedekar et al., 2016). Additionally, Sbardella et al. (2021) reported that MET has been known to alleviate pain and reduce sympathetic tone using fascial stimulation and vasodilation in a localized manner.

No study was found on dynamic stretching and its effects on the neck musculature, specifically the upper trapezius. There is limited information on the combined impact of METs and dynamic stretching in the intervention of cervical pain and improvement of cervical ROM.

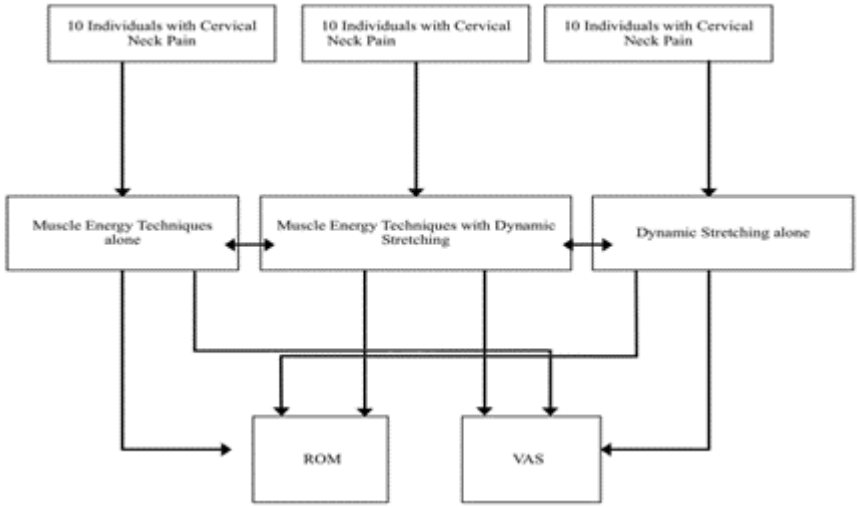
This study intended to compare the efficacy of MET and dynamic stretching on the upper trapezius muscle to address cervical pain and limitation of motion (LOM). Specifically, this study aimed to determine the following: (1) whether there is significant difference in cervical pain and ROM after every intervention session using MET only, dynamic stretching only or a combination of both (2) whether there is a significant difference between pre and post intervention following the use of muscle energy techniques alone, dynamic stretching alone, or a combination of MET and dynamic stretching on cervical neck pain scores and lateral flexion ROM (3) whether a combination of MET and dynamic stretching are superior to MET or dynamic stretching alone for pain management and increasing ROM in participants ages 18 years old and above with non-specific cervical pain.

Conceptual Framework

As a quasi-experimental study, this research focused on three non-randomized groups of participants with cervical neck pain who was evaluated based on the pre- and post-tests using the Visual Analogue Scale (VAS) for pain and goniometry for lateral flexion ROM changes to demonstrate the effects of the three interventions: MET alone, MET with dynamic stretching, and dynamic stretching alone. Evaluation improvements were compared based on significant differences after administering the interventions. This model outlined the possible interventions to treat neck pain (Figure 1).

Figure 1

Conceptual Framework of the Study



Methodology

This chapter presents the research design, sample of the population, sampling techniques, instrument for data collection, methods of data collection, and method of data analysis used for the study.

Research Setting

This research was conducted at the Silliman University Institute of Rehabilitative Sciences Free PT Clinic and the New Academic Building (NAB) for the individuals' organized collection, gathering, and intervention. Silliman University is located in the progressive town of Dumaguete, Negros Oriental.

Research Design

This study utilized a quasi-experimental, pre-test and post-test design to compare both results. Fetters et. al (2012) demonstrated that a quasi-experimental study is appropriate in testing causal relations with causal factors that may or may not be controlled or eliminated for a participant. The causal factors in this study were the METs and the Dynamic Stretching variables. As per DePoy, et. al. (2011), since randomization is absent in a quasi-experimental design, the researchers may make causal claims while

acknowledging the alternative explanations for these design limitations and avoid making causal inferences when they are unjustified by the design. The researchers focused on comparing pain severity changes using the Visual Analogue Scale (VAS) and range of motion improvements using a universal goniometer. The results from the VAS and goniometric measurements were administered before and after each intervention session. The intervention was applied for six sessions as guided by the study of Gillani et al. (2020), who surveyed the effects of METs and static stretching. The study had two groups of twenty participants each and was treated with a frequency of two sessions each for 3 weeks, having a total of 6 sessions to achieve the desired results.

Participants and Sampling Procedure

The purposive sampling technique was used to compare the pretest and posttest. A study by Akhilesh Ganti (2022) has supported the claims that sample sizes equal to or greater than 30 are often considered sufficient for the CLT (Central Limit Theorem) to hold, which supports the total number of participants in this study.

The central limit theorem (CLT) states that, regardless of how the data are distributed, the mean of a sample of data will get closer to the mean of the relevant population as the sample size grows. In other words, the data is accurate, regardless of whether the distribution is normal or aberrant. The CLT is typically thought to hold for sample sizes of 30 to 50, indicating that the sample means are roughly normally distributed. This means the graphed results follow a normal distribution as more samples are used. In statistics, a sample size of 30 is quite typical. A sample size of 30 frequently widens the population data set's confidence interval to the point where comments contradicting your findings are justified. The likelihood that the sample will represent the population increases with increasing sample size. Thirty (30) participants with non-specific cervical pain were recruited for this study. Participants were divided into the MET only, dynamic stretching only, and MET and dynamic stretching groups. Ten participants were assigned to each group. Residents of Negros Oriental who are 18 years old or above were recruited. The dependent variables were measured once per session before and after the intervention.

Potential participants were screened with a history taken through a basic subjective interview by the researchers and neck lateral flexion ROM measurement. Eligibility was determined using an inclusion and exclusion criterion. They were also asked to sign a consent form before participation.

The researchers assigned the participants' gender, age, and pain scale level. The participants were assigned to ensure characteristics were homogenous, primarily taking into consideration gender, age, and baseline pain rating.

Participants were recruited using the following inclusion criteria: (1) Age 18 years old or older with non-specific neck pain of any duration, which should be localized at the C1-C7 segments and/or the upper trapezius, with or without headaches (2) A Visual Analogue Scale (VAS) score of at least 3/10. (3) with the presence of limitations of motion of the neck in side bending, (4) consented to participate in the study.

Participants were excluded if they presented with (1) contraindication(s) to MET and dynamic stretching, (2) conditions such as acute cervical fracture, severe osteoporosis, neoplastic disorders involving the head and neck, or open wounds at the head and neck regions, (3) presence of comorbidities except for hypertension and diabetes, (4) symptoms of pain beyond the head, cervical, and upper trapezius regions, (5) active histories or diagnoses of visceral conditions that refer to the cervical spine such as acute coronary syndrome or colonoscopy-induced splenic injury, (6) vestibular problems, (7) currently receiving physical therapy, (6) illiteracy in the English, Filipino, or Cebuano languages, (8) lack of commitment and consent to participate in the full protocol of the study, (9) inability to participate in face-to-face sessions.

The exclusion criteria were based on a randomized control trial by Phadke et al. (2016) comparing METs and static stretching on pain and functional disability in participants suffering from mechanical neck pain. The excluded items are factors that may result in non-mechanical neck pain, which may affect the outcomes of the study.

Research Instrument / Procedure for Data Collection

Upon data collection, the following instruments were utilized to measure the changes observed in the progression of the study.

1. Psychometric Scale: The Visual Analogue Scale (VAS) was used to assess the pain complaints of the sample population. The VAS is a self-reported measure of pain utilizing a 10-cm line, the 0-cm line representing no pain at all and the 10-cm line representing the worst pain (Delgado et al., 2018). The user marks along the line their level of pain. The examiner then measures the level of pain with the use of a ruler or tape measure. This scale was used to assess the pain severity experienced by the participants throughout the study. This allowed comparisons of how the management affected the

participants' pain experience. Changes in pain complaints were monitored throughout the three weeks when the study was conducted. The minimally clinically important difference (MCID) of VAS, according to McDonald et al. (2019), ranging from 1.8 to 5.2 points, was noted and observed.

2. Goniometry measures joint angles or shows position angles using a goniometer (Norkin & White, 2009). It can measure the cervical side bending motion angle in the front plane in the anteroposterior axis. A recent study by Apti et al. (2023) shows that the normal cervical lateral flexion ROM is at 42.1+/-7.9 deg. The researchers tested only neck side bending of both left and right sides to assess the effects of improved muscular flexibility manifested by improved upper trapezius range of motion. This was done starting in the neutral neck position and then having the participant side bend the neck actively. The degree value is taken at the end range of the active movement from the neutral position. The shoulder girdle and chest were stabilized. The fulcrum of the goniometer was placed over the spinous process of the C7 vertebra. The proximal arm was aligned with the spinous process of the thoracic vertebra so that the proximal arm is perpendicular to the ground. The distal arm is aligned with the dorsal midline of the head, with the occipital protuberance as the reference point. The minimal detectable change (MDC) of neck side bending, according to Kuo et al. (2020), is at 5.9 to 9.1 degrees. Range of motion findings for side bending were compared to these values.

Data Gathering Procedure

The experiment was initiated once the proposal was approved and ethics clearance was received. The researchers then gathered participants in Dumaguete City. A Google form questionnaire or one-on-one interview was performed to determine eligibility for participation. The participants were informed that the intervention they received was free, and the intention was for research purposes.

Documents for consent, confidentiality, demographics, and baseline information were gathered. Baseline measures were collected. The research intervention and data gathering protocol were followed for three weeks. The Visual Analogue Scale (VAS) and goniometry were outcome measures. VAS and lateral flexion ROM were assessed every session. Participants were met face-to-face in the Institute of Rehabilitative Sciences Free Clinic (IRSFC).

One researcher supervised each MET intervention, another researcher supervised each Dynamic Stretching intervention, and these two researchers supervised the combination of both interventions. Furthermore, one researcher was assigned to take all goniometric measurements for range of motion to minimize intertester reliability issues.

All sessions started with taking vital signs (BP, PR, Temperature, Oxygen Saturation), then questioning VAS and measuring neck side bending ROM. The intervention for each group (as detailed below) was performed after the first two steps.

1. MET Group: Participants in this group were instructed to perform self-METs using reciprocal inhibition on the antagonistic upper trapezius muscle. The participant was in a sitting position. The head was positioned in mid-range ipsilateral side bending. The participant provided a counterforce or resistance against the opposite side of the head, contracting towards the contralateral side, bending (Siddiqui et al., 2022). The participant was instructed to provide more than 20% strength but less than 35%, with resistance counteracting the force equally. The isometric contraction was held for 5-7 seconds, followed by a "release and relax" instruction by inhalation and exhalation, with further rest as the head was taken to an increased range of contralateral side bending. The procedure was repeated 5 times until an increased stretched range was achieved (Chaitow & Franke, 2013).
2. Dynamic Stretching Group: The participants were asked to perform dynamic stretching exercises. The participant was in a sitting position with the head in neutral. The participant then actively performed contralateral side bending of the head with both shoulders and trunk maintained in neutral position. The participant was instructed not to hold the position any higher than 3 seconds. The stretch was released by allowing the head to return to a neutral position. The procedure was repeated 10 times, in 2 sets (Blahnik, 2011).
3. MET and Dynamic Stretching Group: With the abovementioned procedures, the participant was asked to perform the two interventions in one session. The participant performed the METs first in 3 repetitions with the procedure stated in the MET group, followed by performing dynamic stretching with 10 repetitions of 1 set with the same procedure stated in the Dynamic Stretching Group. The parameters were given as such to ensure that the interventions

provided were similar in duration and/or repetitions. After performing the procedure/s, VAS questioning and neck side bending ROM measurement were reassessed. The session concluded after the re-taking of the vital signs. Intervention application and data gathering were performed for three (3) weeks, for two (2) sessions per week, having a total of six (6) sessions.

Method of Data Analysis

The researchers outsourced a qualified data analyst to assess clinical effects between the pre-test and post-test (2-4 weeks after the start of interventions). The time interval and three intervention groups (METs alone, METs with Dynamic Stretching, and Dynamic Stretching alone) were considered fixed effects. The data analysis would be consistent with the treatment principle so that all participants would be included in the analysis of intervention outcomes. The VAS scores and lateral flexion ROM angles were taken every visit; therefore, information was available up to the visit before the drop out (Armijo-Olivo et al., 2009).

The paired T-test with a confidence interval of 95% was utilized for the mean difference computation, and the one-sample and two-sample t-test for the statistical hypothesis test. The Ryan-Joiner Normality Test was used to calculate the normal distributions between the data gathered, and One-Way Analysis of Variance (ANOVA) to compare the findings between each group. To represent the distribution of values under the descriptive analysis, histograms and dot plots were used to visualize the data distribution. Interval plots were used to illustrate the comparison of means between each group. Effect size and means were also calculated.

Ethical Considerations

The study was conducted with ethical considerations for the participants' information, identity, and consent. The individuals' responses were kept confidential, and the University Research Ethics Committee of Silliman University approved the study. The participants were fully informed of the procedure before starting the study. The entire process was explained in detail with the corresponding rationale for full transparency. Information gathered by the researchers was stored in a Google Drive and was only accessible to the researchers, the research advisor, and the statistician. All information will be deleted within 5 years. Participation of the participants was voluntary, and they were free to withdraw anytime when there was a

need or a will to do so. Although there was no monetary remuneration, participants gained the chance to learn self-management techniques for their neck pain.

Results and Discussion

This chapter presents the results of the study and the relevant data taken from the experimental procedure that were analyzed using various statistical tools.

The participants were grouped according to age and sex among all three groups. For the MET group, there were six females and four males with a mean age of 31.8. The DS group had eight female and two male participants with a mean age of 27.2. The combination groups had three female and seven male participants with a mean age of 22.4. Although an attempt was made to distribute the participants equally based on sex and age, this was impossible as the participants who voluntarily agreed to participate had varying ages and sexes. Most participants in all three groups were females in their early 20s (see Figure 2). Four of the 34 participants who were gathered did not return for their intervention despite follow-ups. These dropouts were excluded from the statistical analysis. Only one participant out of the 30 finished the six (6) sessions to achieve total relief of pain. The other 29 participants did not return for intervention because of reports of pain relief. They verbally reported on the phone that there was no more pain felt when contacted before the day of their session and during missed sessions. A follow-up call was done a week after data gathering to check for the recurrence of pain, and the participants reported that the pain did not return. There was one participant who reported the recurrence of pain due to return to work reasons, but the pain level was not as high as before the intervention. The average number of sessions completed in all three groups tested is four. The 30 participants achieved the maximal benefits despite not finishing six (6) sessions, as evidenced by a 0 score in the VAS during the last encounter.

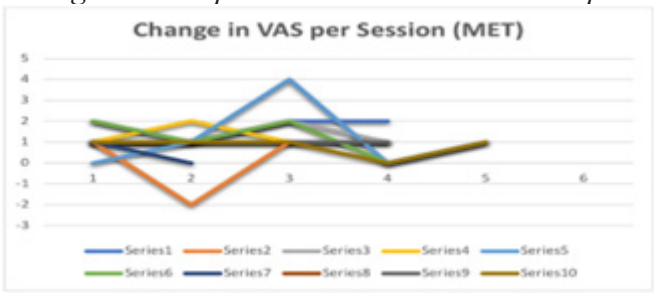
Results were analyzed, and comparisons with hypothetical predictions were made based on the analysis and interpretation of the results. Said predictions were based on whether a combination of MET and dynamic stretching is superior to MET or dynamic stretching alone for pain management and increasing ROM in participants aged 18 years and above with non-specific cervical pain.

Difference in Cervical Pain and ROM after Every Intervention session Using Muscle Energy Techniques

The trends for the change in VAS after every intervention session in the MET group were analyzed descriptively through line graphs. The different colors showed the results for each participant. The values in the y-axis showed the difference in pain level taken from that session, subtracting the post-intervention pain level from the pre-intervention pain level. At the same time, the x-axis represented each intervention session. The graph trend showed similar changes after every intervention session in the VAS MET group, which was further explained in the statistical analysis in Figure 2.

Figure 2

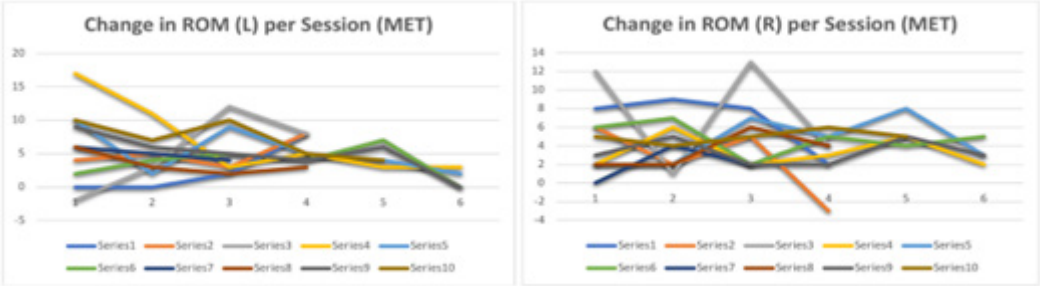
Changes in VAS per Session in the MET Group



In the ROM group for both the right and left sides, the trends showed a similar level of decrease for each session. The y-axis represented the degrees of change, while the x-axis represented the number of sessions. The differences per session on the right side were more than on the left when looking at the graph. This was further statistically analyzed below (Figure 3).

Figure 3

Changes in lateral flexion ROM in the MET Group



The changes in cervical pain using the VAS and lateral flexion ROM after every intervention session were statistically analyzed using the mean and effect size. The effect size was calculated to determine if there was a significant difference. The effect size determined the relationship between variables and whether the group was significant. Statistically, the effect size is the mean divided by the standard deviation. A number greater than one (1) indicates that the intervention was effective. The bigger the number is above 1, the higher the effect. There is no maximum value for effect size. The MCID was checked based on the mean change after every intervention session.

The VAS scores gathered were analyzed for effect size and compared to the MCID of 1.8-5.2 points to determine a significant difference in cervical pain (McDonald et al., 2019). The effect size determined a significant change in lateral flexion ROM and was cross-checked with the minimal detectable change. According to Kuo et al. (2020), the MDC of neck side bending is 5.9 to 9.1 degrees. Any value going lower than this range would mean the change was insignificant. Cervical pain was measured using the VAS before and after every intervention session. For the MET group, the mean decrease in pain after every intervention session was 1.070. The effect size for this group was 2.93. The effect size was larger than the mean since it was a determinant of how significant the effect of the intervention was, considering its standard deviation. Any number higher than one (1) indicated a significant difference. The bigger the number, the bigger the change. The mean was the average of all the differences taken at the end of each intervention session.

The range of motion values were taken for neck side bending on the left and right sides. Active range of motion measurements were used to focus on functionality. After every session in the MET group, the ROM values in both left and right-side bending increased to an average of 5.362 (right) to 6.84 (left) degrees. There are some cases where the ROM decreased on both the left and the right after intervention, but this increased again in the following intervention session. The cause for the decrease in ROM after the intervention may be extrapolated to be related to the activities done before the intervention session. However, the actual reasoning for this was not assessed since this was not part of the study. The effect size is 1.91 on the left and 4.12 on the right. The MET group in right-side bending showed the highest effect size among all the other intervention groups. This was also consistent with the dot plot on the number of sessions. The right-side bending had a larger effect size than the left-side bending. The reason for this must be further analyzed by knowing the hand dominance of the

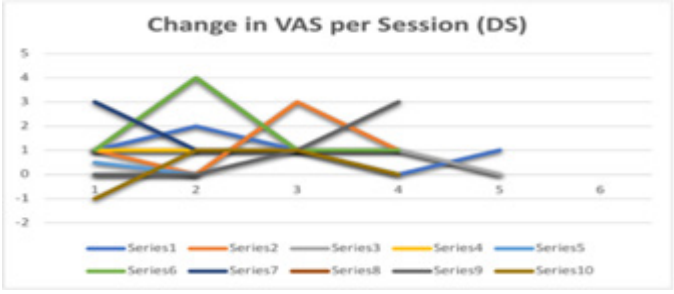
participants regarding neck pain.

Using Dynamic Stretching

A line plot was created to determine the trends in the changes in the DS group after every intervention session. The line graph showed a higher difference in pain reduction in some participants than in others, with some participants having a stagnant decrease in pain. This was further analyzed statistically (Figure 4).

Figure 4

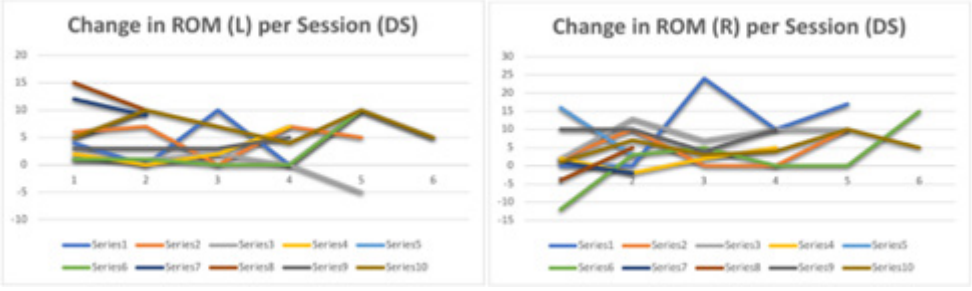
Changes in VAS per session in the DS Group



The lateral flexion ROM for the DS group was also descriptively analyzed in a line graph. Based on this data, the differences in the lateral flexion ROM after every intervention session were closely similar (Figure 5). The statistical analysis showed a more detailed explanation of the differences for each session.

Figure 5

Changes in lateral flexion ROM per session in the DS Group



The exact process was used to gather the VAS in the MET group. The mean reduction of pain after every intervention session in this group

was 0.90. The effect size was 1.40. This showed that DS was effective in reducing pain after every intervention session.

A similar trend in the lateral flexion ROM values of the MET group was seen in the DS group. After every session for this group, the mean increase in lateral flexion ROM was 5.88 degrees on the left and 5.15 degrees on the right. The effect size on the left was 1.55 and the right was 1.31 (Table 6). This has proven that DS effectively increased side-bending ROM after every intervention session.

The mean and the effect size were independent of each other. The effect size greater than one (1) indicates that the intervention was effective, while the mean indicates the average improvement the participants felt per session.

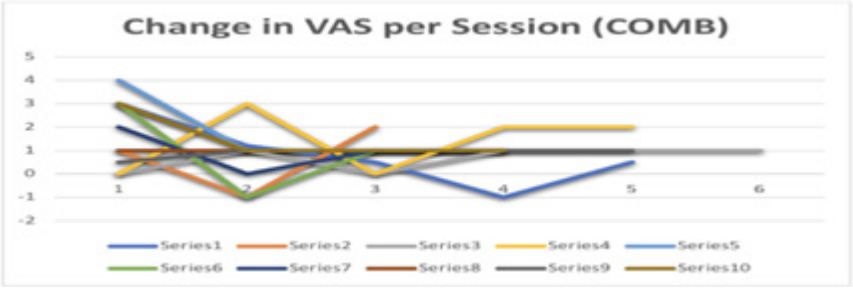
The p-value was taken for the DS group for the VAS (.005) and lateral flexion ROM (.002) to prove further that there was a significant change after every intervention session, independent of the MCID, MDC, and effect size. For the DS group, the p-values showed a significant positive change after every intervention session in decreasing cervical pain and increasing lateral flexion ROM.

Using Both MET and Dynamic Stretching

Using both MET and dynamic stretching fell under the combination group. The exact process in the previous groups was used to get the VAS values. A line graph was created to show VAS's differences in the combination group. The graph showed a varying difference in the decreasing pain and cases where the pain increased at the end of the session (Figure 6). This was further statistically analyzed.

Figure 6

Changes in VAS per session in the Combination Group

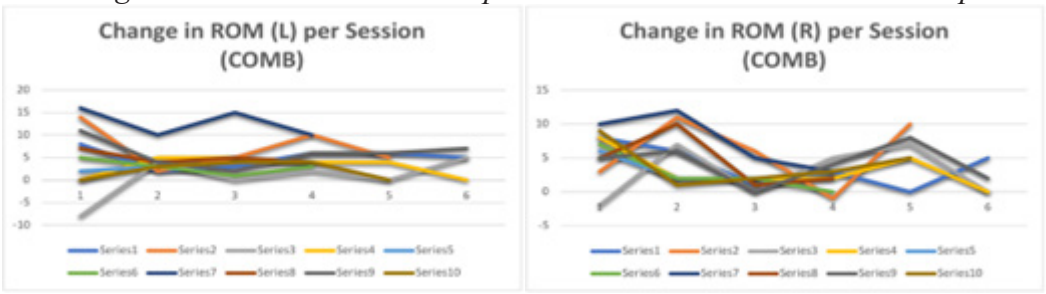


The lateral flexion ROM for the combination group was plotted in a

line graph to show the trends in the increase in lateral flexion ROM after every intervention session. It showed a similar increase for both sides (Figure 7). This was further statistically analyzed.

Figure 7

Changes in Lateral Flexion ROM per Session in the Combination Group



The lateral flexion ROM for the combination group was plotted in a line graph to show the trends in the decrease of pain after every intervention session. It showed that the right ROM had gradual improvements in mobility, as evident in large ROM changes, then plateaus later on by the 3rd to 4th sessions. Greater improvements were seen at the last sessions, where most participants had increased ROM for right neck side bending.

The mean difference in pain was 1.147 in this group, with the effect size at 2.093, which is considered a significant difference.

A similar trend is seen in MET and DS in the increase of the lateral flexion ROM after each intervention session. After every session for this group, the mean increase in lateral flexion ROM was 5.96 degrees on the left and 5.215 degrees on the right. With the effect size as the basis, both have significant changes, with 1.19 on the left and 2.04 on the right.

Similar to the intervention of the values in the MET and DS group, the combination group were also analyzed for their p-values (.009 for VAS, .000 for R ROM and .005 for L ROM) to determine if there was a positive effect of a combination of MET and DS in decreasing cervical pain and increasing side-bending ROM after every intervention session independent of the MCID, MCD, and effect size. The results showed p-values less than 0.05, proving that the combination group was also effective (Table 10).

Based on the results and discussion, H01 was rejected since there was a significant change for the VAS and lateral flexion ROM after every intervention session, as proven by the effect size greater than 1 and the p-values less than 0.05 in all three groups. However, the mean values show no significant difference from the MCID for VAS and MDC for lateral flexion ROM. There was an exception in the left side bending of the combination

group since the value surpassed the MDC. These results were expected since decreasing pain and increasing ROM require multiple sessions before seeing significant results. Formal comparison was not statistically acceptable between the different groups as they were independent of one another's MCIDs and MDCs, which did not show significant change.

Difference between Pre and Post-test VAS Scores and Lateral Flexion ROM Following the Intervention of Muscle Energy Techniques Alone, Dynamic Stretching Alone, or a Combination of MET

Pre-test and post-test, following six (6) sessions of two (2) times per week for three (3) weeks, VAS for pain, and both left and right lateral flexion ROM scores were gathered for this study. According to the editorial by Stratton (2019), comparing the pre- and post-test scores will determine whether the intervention was successful for the participants.

All post-test VAS results yielded zero scores in all participants. Still, they varied only by the total number of intervention sessions needed to reduce the pain to zero, or no pain was present in the next session. Under the MET group, the pre-test mean score was 4.6, 4.3 under the dynamic stretching group, and 4.8 under the combination of the MET and dynamic stretching groups. All groups have a post-test score of zero. Although changes in VAS in the DS group were not significant according to the p-value, it did reach the VAS MCID, suggesting a possible positive effect in decreasing pain (Table 1). Please refer to Appendix C7-C8 for the supporting data.

To determine which technique performed better in reducing pain and increasing lateral flexion ROM, one-way ANOVA with a confidence interval of 95% was used to determine the relationship between the means of all three groups. The means of the VAS and lateral flexion ROM in the MET, dynamic stretching, and the combination groups were compared (Appendix C4, C5, and C6).

The difference between baseline and post-intervention was recorded and analyzed. For the VAS in the MET group, the mean is 3.90. This p-value is 0.002, indicating a significant change since it is less than 0.05. The p-value was 0.078, making no significant change in VAS in the DS group from pre to post all intervention sessions. The combination group had a p-value of 0.019, implying a significant change (Table 1).

Table 1

Summary of Means from Pre- and Post-test and p-values from MET, Dynamic Stretching, and Combination of Interventions on VAS and Neck Side bending ROM.

	Pre-Test Mean Scores	Post-Test Mean Scores	VAS MCID / ROM MDC	P-value	Remarks
VAS					
MET	4.6	0	1.8 - 5.2	0.002	Significant
Dynamic Stretching	4.3	0	1.8 - 5.2	0.078	Non-significant
Combination of both MET and dynamic stretching	4.8	0	1.8 - 5.2	0.019	Significant
Right Neck Side Bending ROM					
MET	28.9	50	5.9 - 9.1	0.000	Significant
Dynamic Stretching	34.5	50.5	5.9 - 9.1	0.000	Significant
Combination of both MET and dynamic stretching	31.1	47.7	5.9 - 9.1	0.000	Significant
Left Neck Side Bending ROM					
MET	27.5	50.6	5.9 - 9.1	0.000	Significant
Dynamic Stretching	29.8	49.7	5.9 - 9.1	0.006	Significant
Combination of both MET and dynamic stretching	28.1	51	5.9 - 9.1	0.000	Significant

According to Kuok et. al. (2020), the MDC for neck side bending is at 5.9 to 9.1 degrees as mentioned above. All participants had increased neck-side bending ROM in either of the three interventions provided. For ROM, the MET group's pre- and post-test mean scores were 28.9 to 50 (right) and 27.5 to 50.6 (left). Under the dynamic stretching group, the pre-

and post-test mean scores are 34.5 to 50.5 (right) and 29.8 to 49.7 (left). For the combination of MET and dynamic stretching group, the pre- and post-test mean scores are 31.1 to 47.7 (right) and 28.1 to 51 (left). Based on the MDC, all three groups significantly improved lateral flexion ROM based on the pre- and post-test scores (Appendix C8).

It was statistically proven that all three groups positively reduced pain and increased lateral flexion ROM for the participants with cervical neck pain.

Although all interventions showed a decrease in mean VAS scores when compared during pre- and post-intervention, the dynamic stretching group did not yield a statistically significant difference. When the baseline to post-intervention values of the VAS in the DS group are analyzed based on the MCID, the value falls under the MCID, which means that it effectively reduces pain as per the MCID. Further studies regarding this matter may be conducted to determine the minimal effects of DS on cervical pain.

Based on the statistical results, muscle energy techniques alone, dynamic stretching alone, or a combination of MET and dynamic stretching have an equal effect on improving cervical neck pain and neck side bending ROM.

In terms of the length of intervention, all three interventions varied in the number of sessions needed before a 0/10 pain was achieved. For the MET group regarding VAS scores, 1 participant achieved absence of pain after the first session, another participant experienced absence after three intervention sessions, 5 participants had no pain after four intervention sessions, and 3 participants no longer experienced pain after five sessions. Under the dynamic stretching group, 3 participants had no neck pain after two intervention sessions, 3 participants no longer had pain after four intervention sessions, and 4 participants achieved the absence of pain after five intervention sessions. For the combination of both MET and dynamic stretching group, two participants had 0/10 VAS scores after two intervention sessions, 2 participants required only three intervention sessions, 2 participants after four intervention sessions, 2 participants after five intervention sessions, and 1 participant after six intervention sessions, all of whom had no pain. The smallest number of intervention sessions with the greatest number of participants in each group was used to determine which intervention had the shortest time needed to achieve a 0/10 VAS pain reduction. MET, having achieved no pain after four intervention sessions for 5 out of 10 participants, has the shortest pain reduction time among all three groups. This is followed by the dynamic stretching group, with 4 out of 10 participants having 0/10 VAS after five intervention sessions, and 2 out of 10

participants achieving no pain after the 2nd, 3rd, and 4th intervention sessions for the combination of MET and dynamic stretching group.

The research study proved that MET, DS, and a combination of MET and DS are independently effective in decreasing cervical pain and increasing neck side bending ROM. There are no studies available that show the effects of a combination of MET and DS in reducing pain and increasing ROM in other parts of the body aside from the neck. The researchers hypothesized that combining two effective techniques would result in faster pain reduction and increased ROM. This study, however, showed that the combination group had the most gradual decrease in pain among the three groups. In a study made by Phadke et al. (2016) that aims to compare the effect of MET with passive stretching on pain and functional disability in people with mechanical neck pain, VAS and NDI scores have shown a significant improvement in both MET and stretching groups on the sixth day post-intervention. However, both VAS and NDI scores improved better in the MET group than in the stretching group. This study showed better returns from individual intervention than the combination of MET and dynamic stretching.

Superiority of the Combination MET and Dynamic Stretching Intervention as Compared to MET Alone or Dynamic Stretch Alone in Decreasing Pain and Increasing Lateral Flexion ROM

The Two-Sample T-test and Confidence Interval (CI= 95%) were used to analyze the data comparing the combination of MET and dynamic stretching versus MET alone, and the data comparing the combination of MET and dynamic stretching versus dynamic stretching alone. This type of statistical test was used since the means of the two comparisons were assessed (Table 2).

The T-test p-values (significant <0.05) were all considered insignificant when differences in mean VAS were compared in both the combination group versus the MET group (p-value 0.358). The means were taken to take the average effects of the participants per intervention group for all sessions within 3 weeks. VAS of the combination group and dynamic stretching group rendered similar differences in mean with a p-value of 0.183. Regarding lateral flexion ROM, the analysis method was the same. Differences in the mean in the combination and MET groups regarding Right and Left ROM were insignificant (Right ROM p-value=0.563, Left ROM p-value=0.672). Insignificant differences were also seen with the combination and dynamic stretching groups in both Left and Right ROM

p-values (Right ROM p-value 0.483, Left ROM p-value 0.485).

The paired t-test showed the p-values of the VAS and lateral flexion ROM in all three groups. A p-value less than 0.05 rejected the null hypothesis, stating that there was a significant change between the values without considering the MCID and MDC. The p-value in the MET group was found to be 0.000, which suggested that MET alone effectively decreased pain and increased ROM.

Table 2

Two-Sample T-test p-values of Combination versus MET and Dynamic Stretching from VAS and Lateral Flexion ROM Mean

	Mean change after every intervention	P- values
VAS: Combination versus MET		
VAS Combination	1.147	0.358
VAS MET	1.070	
VAS: Combination versus Dynamic Stretching		
VAS Combination	1.147	0.183
VAS Dynamic Stretching	0.900	
Right Neck Side Bending ROM: Combination versus MET		
Right ROM Combination	5.21	0.563
Right ROM MET	5.36	
Right Neck Side Bending ROM: Combination versus Dynamic Stretching		
Right ROM Combination	5.21	0.563
Right ROM Dynamic Stretching	5.15	
Left Neck Side Bending ROM: Combination versus MET		
Left ROM Combination	5.96	0.672
Left ROM MET	6.84	
Left Neck Side Bending ROM: Combination versus Dynamic Stretching		
Left ROM Combination	5.96	0.485
Left ROM Dynamic Stretching	5.88	

Although it was already evident in the previous results that all three interventions had similar effects in improving pain and mobility, analysis

was further done to test Null Hypothesis 3 (H03) and find out whether the combination of techniques, MET and dynamic stretching, was better than either of the two interventions by themselves. Differences in post-tests from pre-tests from all sessions of VAS and lateral flexion ROM were compared based on their mean average using the thresholds of VAS MCID (1.8 to 5.2) and lateral flexion ROM MDC (5.9 to 9.1 degrees) in all three intervention groups. The difference in means per intervention group was also compared and analyzed through the Two-Sample T-test (Table 10).

Based on the results, data suggested acceptance of H03, showing no superiority in combining muscle energy techniques and dynamic stretching based on VAS and lateral flexion ROM mean differences compared to MET or dynamic stretching alone.

Additionally, it is worth noting that after the fifth session, all participants of both the MET and DS groups no longer had pain. The dot plot on the number of sessions needed to reduce the pain to 0 showed that the MET group had 7 participants reporting 0 pain levels at the end of the fourth session. In comparison, the other two groups only had 6 participants who had 0 pain at the end of the fourth session (Appendix C9). The combination group had 1 participant reach session 6 before the actual relief of pain. The researchers initially believed combining MET and DS would be the most effective and efficient in reducing pain since it combined two effective techniques. This was not the case in this study since the combination group was the last to achieve complete pain relief. This study suggested that MET or dynamic stretching alone will improve pain and ROM.

The mean number of sessions for the MET group to achieve 0 pain was 3.9. There were 3.8 sessions for the DS group and 4.1 for the combination group. This showed that an average of 4 sessions among all three groups were needed before relief of non-specific cervical pain following the application of MET alone, DS alone, or a combination of both.

When comparing the effect size of the three groups with the dot plot on the number of sessions, there was a consistency in the highest effect size of the MET group with the number of sessions needed to reduce pain. The dot plot (see Figure 2) showed that the MET group is the fastest mode of intervention to relieve pain, which was consistent with the effect size since the MET group had the highest effect size among all three groups.

Conclusion

The study revealed a significant difference in cervical pain and ROM

after every intervention session using MET, dynamic stretching, or a combination of both. The effect sizes for every intervention show values greater than one for the VAS and lateral flexion ROM. Furthermore, the paired T-Test of the VAS and lateral flexion ROM groups had p-values less than 0.05, which states that after every intervention session, there is a reduction in pain and an increase in ROM in all three techniques.

Secondly, the research showed a significant difference in pre- and post-intervention VAS scores and lateral flexion ROM measurements following MET alone and combination treatment. A significant difference was only found following dynamic stretching in improving the lateral flexion range of motion. There was no difference found in VAS scores.

The combination of MET and dynamic stretching did not yield superior results to MET or dynamic stretching for pain management and increasing ROM in participants aged 18 years and above with non-specific cervical.

In comparing the effectiveness of the three techniques, MET, dynamic stretching, and the combination of both in managing cervical pain and range of motion show that all are effective in reducing cervical pain and increasing active lateral flexion ROM after every session, according to effect size. However, there is no one group superior among all three groups. Although generally found to be statistically significant in terms of effect, it should be noted that the values presented did not meet the acceptable MDC and MCID. Either of these three techniques can be used to manage cervical pain effectively. Increasing lateral flexion ROM requires more studies with a bigger sample size for improved statistical power.

Recommendations

The researchers recommend using either technique: MET alone, dynamic stretching alone, or a combination of both. However, since the combination did not yield superior results, it may be prudent to suggest using a single intervention to save time and effort for the patient.

To obtain more precise MDC and MCID values for changes after each intervention session, it would be best to include participants with a pain scale rating greater than 5/10, as this could show a greater potential for pain reduction. A limitation of motion of at least 40% of the normal range is also recommended to increase the measurable change in degrees after each session. Additionally, a wider age range among participants would help reveal trends in neck pain and limitations of motion (LOM) across age groups. Due to time constraints and the availability of qualified participants

each group included only 10 people, resulting in 30 participants. Increasing the number of participants to 30 per group is highly recommended to improve the study's statistical power. Furthermore, a longer intervention and observation period could help examine the long-term effects of each intervention.

Further research on the effectiveness of MET, dynamic stretching, and their combination as a home exercise program for non-specific cervical neck pain would provide valuable insight into the utility of these techniques. These non-contact interventions, which do not require special equipment, make them practical in a home exercise program.

Declaration of Originality and Competing Interests

The authors declare that the paper is an original research investigation and contains no materials previously published or written by another author that have not been appropriately cited or include falsified or fabricated data from the data-gathering procedure.

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Appendix A: MET on the Upper Trapezius Muscles

The following procedure explains how Self-MET was performed on the left upper trapezius muscle using the reciprocal inhibition approach:

a. In a sitting position, the participant positioned their head in mid-range left neck side bending.

b. The participant applied resistance against right neck side bending using the right upper extremity with hand placement on the right side of the head.

c. The participant exerted only >20% of force but <35% with resistance equally given.

d. The contraction was held for 5-7 seconds. A relaxation phase of inhalation and exhalation was given after resistance was released, followed by an increased range towards right-side bending.

e. Self-MET was performed on the left upper trapezius following steps a to d, with a newly stretched position achieved after every repetition. The same procedure was executed for applying self-MET on the right upper trapezius with literalities interchanged upon performance.

At the end- range of right side- bending, resist the motion by placing one hand on the right side of the head for 5-7 seconds while contracting the right upper trapezius. Inhale and exhale after resistance is applied.

Stretch the left upper trapezius by going into right side- bending. Place the left arm behind the back to increase the stretch.

Stretch the left upper trapezius into the new range. Repeat these steps for 5 repetitions. Repeat all these steps on the opposite side to for the right upper trapezius.

At the new range, resist right side bending again. Perform inhalation and exhalation after the resistance.

f.Each position with intervention resistance was repeated 5 times or until the increased stretched range was achieved.

Appendix B: Dynamic Stretching on Both Upper Trapezius Muscles

The following procedure of dynamic stretching was performed on both upper trapezius muscles:

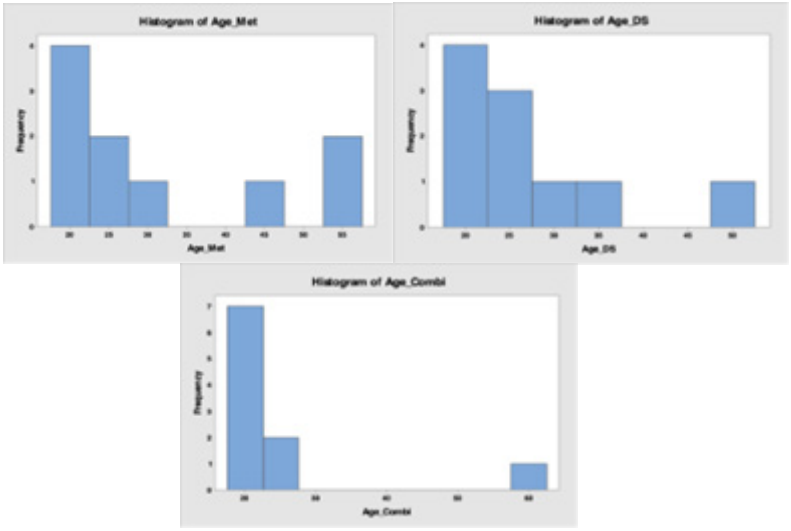
a. The participant was in a sitting position with the head in neutral.
b. The participant side flexed the head contralaterally until a stretch was felt on the ipsilateral side (left upper trapezius of the participant) while keeping the shoulders and trunk in neutral.

c. The position was not held for more than 3 seconds. The participant returned the head to neutral position and repeated the dynamic stretch 10 times in 2 sets (Blahnik, 2011).
d. The same procedure from steps a to c was repeated towards the left neck side, bending to target the right upper trapezius.

Appendix C: List of Figures

Appendix C1

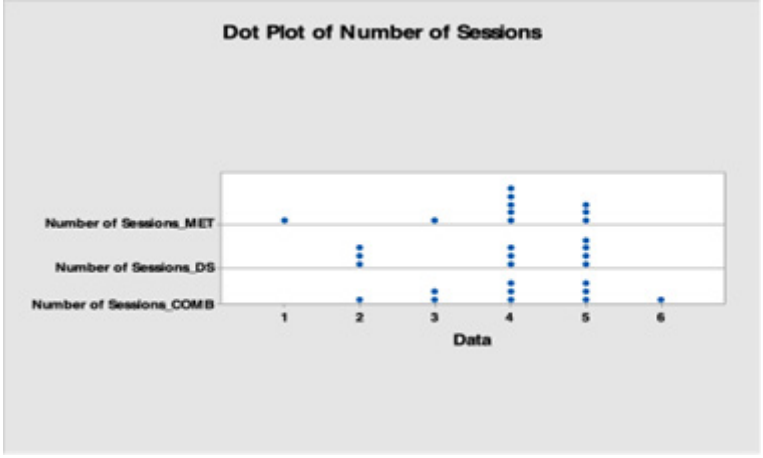
Histogram of Age in the Three Groups



Appendix C1 shows the distribution of the participants based on age in the three groups. The x-axis shows the age of the participants, while the y-axis shows the frequency or the number of participants under that age group. The participants are mostly in their 20s and are among the three groups.

Appendix C2

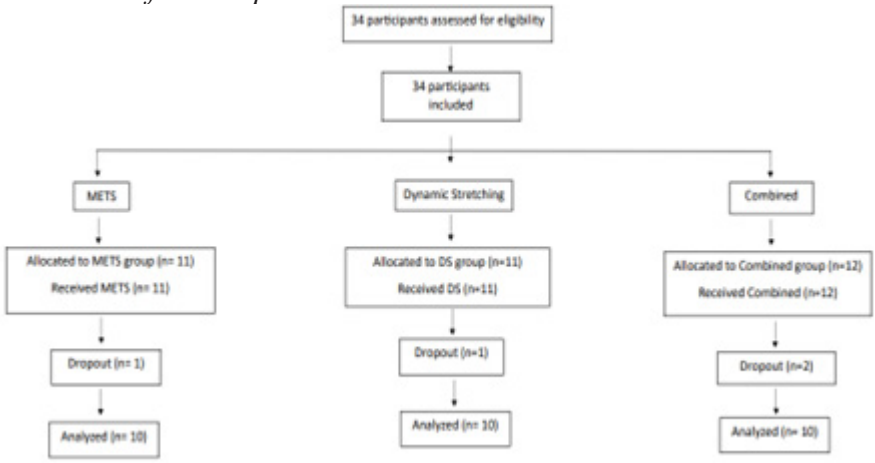
Dot Plot on the Number of Sessions needed by the participants before reporting 0 pain levels



The individual plots show the number of sessions required to treat the participants before the pain was reduced to 0.

Appendix C3

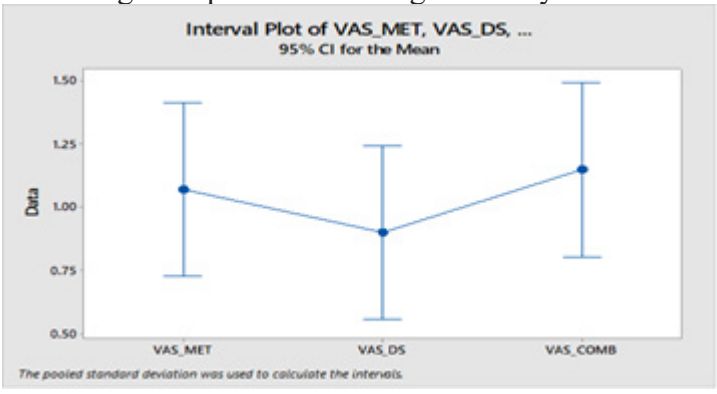
Flowchart of Participants



participants shows that 34 participants were initially included in the study. Four dropouts were incurred, 1 in the MET group, 1 in the DS group, and 2 in the combination group. There are 10 participants in each group. Thirty participants were statistically analyzed in total.

Appendix C4

Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for VAS using One-Way ANOVA

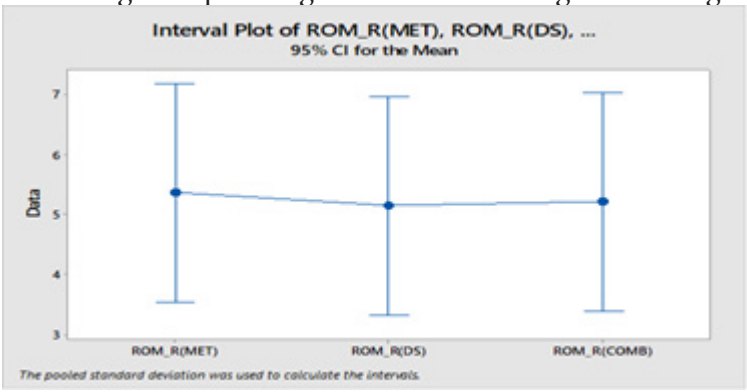


Note. The y-axis indicates the pre- and post-test changes of VAS in the MET, dynamic stretching, and the combination of both MET and dynamic stretching groups. The blue vertical lines represent the data set for each group, with its mean represented by a blue dot. The blue lines that connect

all three means represent the relationship among all three groups. The x-axis represents the respective data set of the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups.

Appendix C5

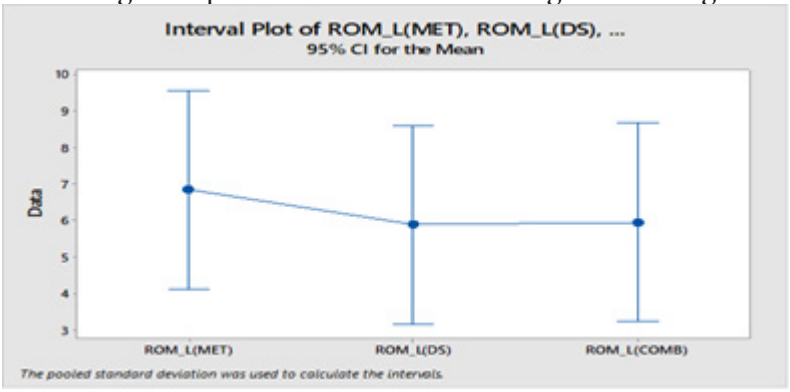
Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for right neck side bending ROM using One-Way ANOVA



Note. The y-axis in this interval plot represents the right neck side bending ROM pre- and post-test changes. A blue dot shows the mean for each group. The vertical blue line represents the data set for each group. The relationship between the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups is then plotted by connecting the means using a blue line.

Appendix C6

Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for left neck side bending ROM using One-Way ANOVA



Note. The y-axis in this interval plot shows the left neck side bending ROM pre- and post-test changes. A blue dot is used to indicate the mean for each group. Blue vertical lines represent the data set for each group. The means of the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups are plotted by a blue line to visualize the relationship between each group.

Appendix C7

Raw Data of the Visual Analogue Scale Scores in all intervention sessions

VAS												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	4	3	1	0	5	3	3	1	0	0	0	0
MET P2	6	5	0	2	2	1	1	0	0	0	0	0
MET P3	5	3	4	3	3	1	2	1	0	0	0	0
MET P4	4	3	4	2	2	1	1	0	0	0	0	0
MET P5	3	3	3	2	6	2	0	0	2	1	0	0
MET P6	6	4	5	4	4	2	0	0	1	0	0	0
MET P7	5	4	0	0	0	0	0	0	0	0	0	0
MET P8	3	2	3	2	1	0	0	0	0	0	0	0
MET P9	5	4	5	4	2	1	1	0	0	0	0	0
MET P10	5	4	4	3	3	2	1	1	1	0	0	0
P is Participant												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	4	3	4	2	2	1	1	1	1	0	0	0
DS P2	5	4	3	3	5	2	2	1	3	3	0	0
DS P3	5	4	5	4	5	4	4	3	3	3	0	0
DS P4	8	7	7	6	6	5	5	4	0	0	0	0
DS P5	2	1.5	1	1	0	0	0	0	0	0	0	0
DS P6	5	4	4	0	3	2	1	0	0	0	0	0
DS P7	3	0	3	2	0	0	0	0	0	0	0	0
DS P8	5	5	4	4	0	0	0	0	0	0	0	0
DS P9	3	3	2	2	2	1	3	0	0	0	0	0
DS P10	3	4	4	3	4	3	3	3	1	1	0	0
P is Participant												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	6	3	4	2.8	2	1.5	1	2	2	1.5	0	0
Combi P2	4	3	4	5	7	5	0	0	0	0	0	0
Combi P3	8	8	4	3	3	3	3	2	2	1	1	0
Combi P4	4	4	5	2	0	0	4	2	4	2	0	0
Combi P5	4	0	1	0	0	0	0	0	0	0	0	0
Combi P6	4	1	0	1	1	0	1	0	0	0	0	0
Combi P7	5	3	0	0	1	0	0	0	0	0	0	0
Combi P8	5	4	5	4	4	3	3	2	0	0	0	0
Combi P9	5	4.5	5	4	4	3	4	3	3	2	0	0
Combi P10	3	0	3	2	2	1	1	0	0	0	0	0
P is Participant												

Appendix C8

Raw Data of the Range of Motion Values in all intervention sessions on the left and right side

RIGHT LATERAL FLEXION ROM												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	30	38	32	41	30	38	45	47	UTT	UTT	UTT	UTT
MET P2	28	34	35	37	45	50	45	42	UTT	UTT	UTT	UTT
MET P3	20	32	30	31	30	43	40	44	UTT	UTT	UTT	UTT
MET P4	30	32	28	34	43	45	45	48	48	53	53	55
MET P5	28	30	34	36	38	45	45	50	47	55	50	53
MET P6	24	30	36	43	38	40	41	46	46	50	50	55
MET P7	32	32	41	45	40	42	UTT	UTT	UTT	UTT	UTT	UTT
MET P8	30	32	38	40	40	46	46	50	UTT	UTT	UTT	UTT
MET P9	38	41	39	44	40	42	45	47	50	55	55	58
MET P10	29	34	37	41	35	40	40	46	45	50	54	54
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	46	46	40	40	28	52	50	60	43	60	UTT	UTT
DS P2	34	36	30	40	40	40	50	50	45	55	UTT	UTT
DS P3	30	32	27	40	31	38	40	50	30	40	UTT	UTT
DS P4	36	38	34	32	37	39	45	50	UTT	UTT	UTT	UTT
DS P5	24	40	47	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P6	43	31	39	42	45	50	50	50	50	50	45	60
DS P7	35	36	32	30	40	40	43	45	UTT	UTT	UTT	UTT
DS P8	36	32	40	45	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P9	30	40	30	40	40	44	40	50	UTT	UTT	UTT	UTT
DS P10	31	32	31	38	40	43	40	44	40	50	45	50
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	30	38	38	44	41	42	37	40	47	47	45	50
Combi P2	31	34	25	36	39	45	45	44	30	40	UTT	UTT
Combi P3	32	30	35	42	45	45	45	50	43	50	50	50
Combi P4	32	40	38	40	38	40	39	41	45	50	50	50
Combi P5	32	38	48	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
Combi P6	33	40	40	42	42	44	45	45	UTT	UTT	UTT	UTT
Combi P7	30	40	36	48	45	50	47	50	UTT	UTT	UTT	UTT
Combi P8	25	30	32	42	39	40	40	42	UTT	UTT	UTT	UTT
Combi P9	35	40	30	36	42	42	38	42	35	43	43	45
Combi P10	31	40	39	40	43	45	50	53	50	55	UTT	UTT
P is Participant	UTT is unable to test; participant did not return since there was no more pain											

Appendix C8

Raw Data of the Range of Motion Values in all intervention sessions on the left and right side

LEFT LATERAL FLEXION ROM												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	34	34	39	39	40	42	42	50	UTT	UTT	UTT	UTT
MET P2	30	34	34	39	44	47	42	50	UTT	UTT	UTT	UTT
MET P3	32	30	30	33	30	42	35	43	UTT	UTT	UTT	UTT
MET P4	22	39	20	31	40	43	47	52	47	50	50	53
MET P5	20	30	38	40	30	39	40	45	36	40	40	42
MET P6	18	20	38	42	30	35	40	44	48	55	55	55
MET P7	24	30	45	50	45	49	UTT	UTT	UTT	UTT	UTT	UTT
MET P8	30	36	36	39	43	45	49	52	UTT	UTT	UTT	UTT
MET P9	35	44	37	43	42	47	49	53	50	56	55	55
MET P10	30	40	33	40	30	40	46	51	53	57	57	57
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	30	34	30	30	30	40	50	50	50	60	UTT	UTT
DS P2	34	40	38	45	40	40	40	47	50	55	UTT	UTT
DS P3	30	31	31	32	33	35	50	50	45	40	UTT	UTT
DS P4	36	38	31	31	43	45	45	52	UTT	UTT	UTT	UTT
DS P5	40	45	40	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P6	39	40	40	41	50	50	50	50	50	60	45	50
DS P7	20	32	29	38	38	40	45	50	UTT	UTT	UTT	UTT
DS P8	20	35	30	40	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P9	24	27	24	27	45	48	50	55	UTT	UTT	UTT	UTT
DS P10	25	30	25	35	48	55	51	55	40	50	45	50
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	32	40	40	42	40	43	40	46	44	50	50	55
Combi P2	22	36	40	42	40	45	30	40	40	45	UTT	UTT
Combi P3	30	22	39	43	40	40	50	52	50	50	50	55
Combi P4	30	30	40	45	40	45	40	44	45	49	50	50
Combi P5	30	32	44	47	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
Combi P6	30	35	42	45	45	46	47	50	UTT	UTT	UTT	UTT
Combi P7	22	38	40	50	35	50	45	55	UTT	UTT	UTT	UTT
Combi P8	25	32	32	36	36	41	40	44	UTT	UTT	UTT	UTT
Combi P9	30	41	30	34	40	42	40	46	45	51	47	54
Combi P10	30	30	40	43	44	48	50	54	55	55	UTT	UTT
P is Participant	UTT is unable to test; participant did not return since there was no more pain											

Appendix C9

Dot Plot on the Number of Sessions needed by the participants before reporting 0/10 VAS