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THE ACUTE EFFECT OF PASSIVE STATIC STRETCHING AND SELF-STRETCHING IN NON-SPECIFIC NECK PAIN IN YOUNG ADULT POPULATION

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Abstract: *The purpose of this study was the assessment of the acute effect of passive static stretching and self-stretching at the upper trapezius muscle in reducing current non-specific neck pain in young population. Forty young adults (14 males, 26 females) aged 18 to 25 years, who were experiencing current non-specific neck pain, were allocated randomly in two groups (self-stretching vs. passive static stretching of the upper trapezius muscle. Pain, as evaluated with the Short-Form McGill Pain Questionnaire and Visual Analogue Scale, was significantly lower after the intervention in both groups ($p < 0.05$). Thus, self-stretching could be considered as a low-cost, efficient intervention to acutely relieve neck pain.*

Key words: *pain assessment, flexibility, stretching.*

1. Introduction

Neck pain is a common musculoskeletal symptom [37]. It can be caused by trauma, disc degeneration, disc herniation, or by tension of the neck muscles [34]. About two-thirds of the population will complain of neck pain once in their lifetime [37].

The most common type of pain that occurs is non-specific cervical pain. The causes may be either poor posture, psychological factors such as anxiety and depression or injuries due to work or sports. The main symptom is neck pain, which is usually accompanied by limited range of motion and a feeling of stiffness. These symptoms may worsen when specific neck movements or postures are performed [25].

There are a variety of ways to treat mechanical neck pain [25]. These modalities are conservative therapy which may include stretching the muscles of the neck and shoulder blade, strengthening exercises, physical therapy combined with home exercises, mobilization of the spine, medication, injections at the points of muscle pain triggers, and injections of

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botulinum toxin [3,7]. Nevertheless, there is low certainty evidence that supports the efficacy of cervical joint mobilization techniques [4], and biased results are found in the literature related to the efficacy of adding stretching exercises to typical interventions to reduce neck pain [1], [38].

There are several types of stretching, such as static stretching, dynamic stretching, and pre-contraction stretching. Static stretching is a technique in which the muscle is lengthened to its full range and held in that position for a specific time duration [11]. Its types are self-stretching, which is performed by the individual alone, and passive stretching, which is performed by a second person [30]. Stretching is considered beneficial in terms of increasing muscle elongation, preventing injuries, enhancing muscular or athletic performance, releasing mechanical energy from the myotendinous complex, accelerating the healing of muscle injuries, and potentially reducing the occurrence of muscle pain [25]. Furthermore, it is an effective way to reduce pain [38].

Stretching may be harmful if the intensity of discomfort or muscle injury is not variable [9]. Regarding self-stretching at home, there is a fear of an increased risk of injury [35], which in this case will worsen the pain. Furthermore, according to past research [18,30], stretching cannot be recommended as a single method of treating pain, as it is claimed that there is no improvement in neck pain after a program consisting exclusively of them. Nevertheless, stretching the trapezius muscle resulted in considerable improvements in terms of pain reduction and functional scores [21].

Recently, an increasing world-wide trend for prevalence of neck pain among adolescents and young adults that calls for actions to prevent negative public health out-comes was marked [15]. Thus, it is of importance to examine interventions to address neck pain in young population. To the best of our knowledge, no study has been conducted on the effectiveness of static passive stretching and self-stretching for the immediate relief of non-specific neck pain in college students aged 18 to 25 years old.

1.1. Objectives

The purpose of this study was to evaluate the effectiveness of static passive stretching and self-stretching in the immediate relief of current non-specific neck pain in individuals aged 18 to 25 years old. A secondary aim was to compare which stretching modality was more effective in terms of pain reduction. The research hypothesis was that static passive stretching and self-stretching are effective regarding the acute reduction of current non-specific neck pain in college students aged 18 to 25 years old, with no differences between methods.

2. Material and Methods

2.1. Participants

The study was conducted in accordance with the Declaration of Helsinki. Forty (14 men, 26 women) physiotherapy students voluntarily participated in the study (Table 1). The inclusion criteria were that the participants were aged 18 to 25 years old, a college student and suffered neck pain at the period of data collection. The exclusion criteria were: diagnosis of spinal disc herniation, cervical spinal stenosis, cervical vertebra fracture, cervical spine

fusion, any operation conducted at the cervical spine and the shoulder joint, any past incident of shoulder dislocation, injuries to the cervical spine and shoulder muscles, as well as the presence of instability, peripheral nerve entrapment, migraine, shoulder joint hypermobility, and pregnancy. In addition, further criteria for the exclusion of the participants were the reception of pain relief medication, and the reception of pain treatment in the period of two weeks before the participation in the study in the cervical spine.

The anthropometric data of the participants (mean ± standard deviation) Table 1

Parameter	**passive stretching group (*n* = 20)**	**self-stretching group (*n* = 20)**	***t***	***p***	***d***
sex (men:women)	6:14	8:12			
age (years)	19.85 ± 1.84	20.35 ± 1.66	0.619	0.543	0.29
body height (cm)	168.25 ± 10.24	169.85 ± 9.49	0.512	0.611	0.16
body mass (kg)	73.95 ± 21.43	69.9 ± 12.78	0.726	0.472	0.23
body mass index (kg/m^2)	25.78 ± 5.02	24.09 ± 3.05	1.282	0.208	0.41

2.2. Experimental procedure

Through measurements and an interview that included basic questions based on a typical patient history sheet, the anthropometric data of the participants were obtained, and their condition was assessed. The body mass and height were assessed using a typical electronic scale and the Seca 220 stadiometer (Seca Deutschland, Hamburg, Germany). Afterwards, the participants completed the Short Form McGill Pain Questionnaire (SFMGPQ) which includes the Present Pain Index (PPI) and the Visual Analogue Scale (VAS) to assess the present pain before the intervention was performed.

Then, the participants were randomly assigned in a 1:1 order and formed two groups. The self-stretching group performed an intervention of self-stretching of the upper trapezius muscle. The researcher in this group instructed the participants on how to perform the self-stretching, which was performed according to Evjenth and Hamberg [13]. The participants sat on a stable chair, their back were straight without leaning on the chair, and their head was kept at its anatomical position. The participants were asked to stretch the trapezius muscle by executing the following steps: 1) to hold the side of the chair with the ipsilateral hand to the side that was in pain, 2) to place the contralateral hand on the head, specifically under the ear, and at the opposite side from that which was in pain, 3) to perform flexion of the neck, 4) to perform lateral flexion of the neck to the opposite side from that which was in paint, 5) to perform an ipsilateral neck rotation and to turn to the opposite side from that which was in pain. In case where corrections were required, the therapist guided the participant.

The passive stretching group received an intervention of static passive stretching of the upper trapezius muscle. The therapist performed the passive stretch. The participants were asked to lie supine on a physiotherapy bed with their head

extending outside the bed. Then, using one hand and with the aid of the therapist's body, the therapist placed the participants' head in flexion, contralateral flexion, and ipsilateral rotation. All flexions and rotations were performed in full range and to the participants' pain threshold. With the other hand, the therapist pressed the participants' ipsilateral shoulder [19] to the pain threshold to stretch the muscle.

The duration of each intervention was 30 seconds, with a 30-second break. This was repeated three times [39].

2.3. Data collection

Measurements were conducted before and immediately after the intervention to assess pain intensity and perception. The SFMGPQ, which includes the PPI and the VAS was used for the measurements. The SFMGPQ includes 15 descriptive adjectives of pain perception, 11 sensory and 4 affective, which are rated by the patient themselves according to their level of intensity on a four-point rating scale (0=none, 1=mild, 2=moderate, 3=severe). The PPI is a five-point rating scale for describing present pain when completing the questionnaire. The sensory and affective domain scores are calculated by adding their values [20]. The SFMGPQ is commonly considered an easy and multidimensional pain measurement instrument [17] and its Greek version meets all the criteria for its use [16]. It is standardized in Greek and has been shown to have internal validity and consistency [17], as well as its reliability in time and day measurements and its significant sensitivity for the perception of pain change after the application of an intervention [16]. It is also considered appropriate for use in the assessment of neck pain [27].

Regarding the VAS scale, it is a one-dimensional pain intensity measure that is used in various adult populations. It consists of a horizontal or vertical line, usually 10 cm (100 mm) long, on which two extreme pain intensities are written at its two ends. At one end '*no pain*' was written (score 0) and at the other end '*intolerable pain*' (score 100) [100-mm scale], with scores of 0 to 4 mm, 5 to 44 mm, 45 to 74 mm, and 75 to 100 mm were interpreted as no pain, mild pain, moderate pain, and severe pain, respectively [22]. The patient was asked to rate the current or last 24-hour pain intensity [20]. It is considered an easy and understandable scale and has been shown to be a reliable and valid instrument for measuring the intensity of experimental and chronic clinical pain as well as for assessing its sensation [32]. Furthermore, it has been shown to be a fairly reliable measuring instrument for assessing the intensity of acute pain. It is important to mention that the VAS is suitable for use in studies comparing two types of samples (paired) for the direct measurement of pain change [5], as well as the fact that it easily detects changes in pain [28]. In addition, it has been considered a suitable scale for the assessment of neck pain [27].

2.4. Statistical analysis

The normality of distribution was examined using the Shapiro–Wilk test ($p > 0.05$). The equality of variance was examined with Levene's test ($p > 0.05$). The results of these tests showed that the assumptions for the use of parametric statistical were met. Thus, separate paired samples T-tests were conducted to

examine the possible differences between the pre- and post-measurements and an independent samples T-test for between-group differences. The effect size of the comparisons was interpreted with Cohen's *d*, where the magnitude of $d \geq 0.2$, $d \geq 0.5$, and $d \geq 0.8$, was interpreted as small, medium, and large effect sizes, respectively. The statistical tests were conducted using the IBM SPSS Statistics v.29.0.1.0 software (IBM Corp., Armonk, NY, USA), where the level of significance was set at $\alpha = 0.05$ for all analyses.

3. Results and Discussions

For the whole cohort of participants, 57.5% suffered pain at the right side of the neck, whereas 42.5% at the left side (Table 2).

Results regarding the effect of the interventions (mean ± standard deviation) Table 2

parameter	test	passive stretching group (*n* = 20)	self-stretching group (*n* = 20)	stretching group	pre- vs. post-comparison		
					t	*p*	*d*
Pain side (L:R)		8:12	9:11				
SFMGPQ	pre	14.80 ± 7.21	16.60 ± 6.83	passive	9.016	<0.001	2.02
	post	6.75 ± 7.08*	8.45 ± 7.72*	self	7.059	<0.001	1.58
	Δ% [95%CI]	54.4% [6.18,9.92]	49.1% [5.73,10.57]				
sensory domain	pre	11.20 ± 5.64	12.85 ± 5.16	passive	8.308	<0.001	1.86
	post	5.40 ± 5.11*	6.95 ± 6.25*	self	7.081	<0.001	1.58
	Δ% [95%CI]	51.8% [4.33,7.36]	45.9% [4.16,7.64]				
affective domain	pre	3.60 ± 2.19	3.75 ± 2.05	passive	6.485	<0.001	1.45
	post	1.35 ± 2.03*	1.55 ± 1.70*	self	5.993	<0.001	1.34
	Δ% [95%CI]	62.5% [1.52,2.98]	58.7% [1.43,2.97]				
PPI	pre	1.90 ± 0.85	2.10 ± 0.97	passive	4.485	<0.001	1.00
	post	1.30 ± 0.73*	1.35 ± 0.75*	self	4.265	<0.001	0.95
	Δ% [95%CI]	31.6% [0.32,0.88]	35.7% [0.38,1.12]				
VAS	pre	4.80 ± 1.47	5.10 ± 1.25	passive	6.282	<0.001	1.41
	post	3.00 ± 1.72*	3.45 ± 1.61*	self	5.819	<0.001	1.30
	Δ% [95%CI]	37.5% [1.20,2.40]	32.4% [1.06,2.24]				

*: $p < 0.05$. L: left side of the neck; R: right side of the neck; SFMGPQ: Short Form McGill Pain Questionnaire; PPI: Present Pain Index; VAS: Visual Analogue Scale; Δ%: pre- vs. post-intervention percentage difference; CI: confidence interval.

The results of the paired samples T-test showed, for the self-stretching group, a significant ($p < 0.05$) pre- vs. post-intervention difference with large effect size for SFMGPQ, PPI, and VAS, as well as the subscores for the sensory and the affective domain. Regarding the passive stretching group, significant differences

(large effect size) were also observed in all examined parameters. No differences (p > 0.05) were found between groups in both the pre- and the post-intervention assessments.

According to the VAS scale, both static passive stretching and self-stretching directly reduced non-specific neck pain in Physiotherapy students aged 18 to 25 years old from a "mild pain" level to "no pain". The difference in effectiveness between the two interventions was minimal since in the self-stretching group there was a reduction in pain assessment by approximately 33.3% and a marginally better result in the passive stretching group (37.5% reduction in pain assessment). Additionally, passive stretching was marginally superior in the qualitative characteristics of pain according to the 15 questions of the SFMGPQ as the percentage improvement in self-stretching was approximately 48.8% while in passive stretching 51.1%.

The results of the present study are also in agreement with the previous studies [8]. Improving pain perception may result in advanced pain reduction, leading to a sense of well-being [8]. Another study that supports the results of this study is by Ylinen et al. [39] who compared the effectiveness of mobilization and stretching, specifically self-stretching, on chronic neck pain and dysfunction in working women aged 25 to 53 years with non-specific neck pain. Their results were that self-stretching is effective in reducing pain. However, this study refers to an intervention that lasted 4 weeks. Finally, a 4-week static stretching intervention reduced pressure pain threshold in females aged between 20 and 60 years [26]. Regarding passive stretching, there is also research that agrees with the results of the present study [6,24,38], as a reduction in pain immediately after passive stretching was found.

Based on the results of the SFMGPQ's PPI, self-stretching is marginally superior in percentage improvement in pain perception as it showed an improvement of approximately 35.7% while passive stretching showed approximately 27%. This is likely because PPI gives a narrow range of options to the participant, making it more difficult for the individual to define the exact sensation and choose a similar explanation of the sensation.

Both passive stretching and self-stretching were effective in terms of qualitative characteristics of pain. One explanation for the reduction in pain after static stretching is the inhibitory effects induced in the Golgi tendon organ, which restore the myotendinous junction to its original position by modifying the nerve sensor capsule. This results in a reduction in the tension of the myotendinous junction and subsequently a reduction in pain perception [31]. In addition, in the case where the muscle is stretched, monosynaptic spinal reflex excitability is suppressed, resulting in increased tissue extensibility [1]. The lack of significant differences between the experimental groups after the intervention is not uncommon in studies examining treatments to address non-specific neck pain [40]. Past research also found that self-stretching did not result in improved functional capabilities against other treatments [12]. In addition, it is also suggested that self-stretching should be implemented in combination with other treatments to optimize the efficiency of the therapeutic intervention [23]. A similar common trend, namely the absence of a significant superiority of an intervention against another intervention, is also reported in the literature regarding

passive stretching treatments against other therapeutic methods [14]. However, it is proposed that combining static stretching and muscle energy techniques could be effective when treating mechanical neck pain [29].

The study had some limitations. There was no threshold for low pain intensity on the VAS scale, which meant that individuals who did not have very severe pain did not feel much difference compared to people with increased pain and this may have affected the results to some extent. In addition, although the study was focused on the stretching exercises of the upper trapezius muscle, the contribution of other muscles, namely the scalenes, levator scapulae, longus capitis, longus colli, and sternocleidomastoid, along with deep neck muscles, that could have been enabled in the cervical spine mobilization during the stretching exercises applied was not examined. Also, no follow up was conducted to monitor the long-term effect of the stretching interventions. In future studies, an algometer could be used to measure and retrieve objective results [2]. Furthermore, the generalization of the outcome of the present study is limited since a small sample of Physiotherapy students was examined. Thus, future research on the effectiveness of stretching on non-specific neck pain should be conducted in a larger sample and for a longer duration of the intervention. Finally, further evaluations including the assessment of the range of motion could add context in studies examining non-specific neck pain [33,36], taking into consideration the intra-individual characteristics with regards to neck pain related factors [10].

4. Conclusion

The low-cost self-stretching approach could be a useful tool that an individual can perform on his/her own at any time, even at home, to deal with current non-specific neck pain.

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