Research, Physiotherapy Review, 2024, 28(1), 69-77

Comparison of the effect of a 5-week series of positional release therapy and muscle energy technique on pain threshold and mobility of the cervical spine in people with the upper crossed syndrome

Dawid Mateusz Janczarzyk[1], Krzysztof Jamka[2], Edyta Mikołajczyk[3], Aleksandra Zarzeka[4], Piotr Krężałek[5]

[1] Doctoral School, University of Physical Education in Cracow, Cracow, Poland

[2] Rehabilitation Practice FIZJOterapia Krzysztof Jamka in Cracow, Cracow, Poland

[3] Institute of Applied Sciences, Faculty of Rehabilitation, University of Physical Education in Cracow, Cracow, Poland

[4] Graduate Student of the Faculty of Rehabilitation, University of Physical Education in Cracow, Cracow, Poland

[5] Laboratory of Biophysics and Motion Analysis, University of Physical Education in Cracow, Cracow, Poland

Correspondence to: Dawid Mateusz Janczarzyk, email: losos0@o2.pl

DOI: https://doi.org/10.5114/phr.2024.136490

Received: 06.08.2023 **Reviewed:** 14.09.2023 **Accepted:** 15.09.2023

Abstract

Background: Upper crossed syndrome (UCS) manifests as a distinctive posture resulting from imbalances in muscles and fascia in the upper body. Among the various therapeutic approaches addressing pain and limited range of motion in individuals with UCS, positional release therapy (PR) and muscle energy techniques (MET) are widely employed.

Aims: This study aims to compare the efficacy of PR and MET in inducing changes in pressure pain threshold and cervical spine range of motion among patients with UCS.

Material and methods: A group of 45 patients exhibiting myofascial trigger points (MTrPs) in the trapezius muscle were divided into three equal groups. Group A received a five-week series of PR treatments, while Group B underwent five series of MET treatments, both administered weekly. Both interventions targeted muscles shortened in UCS. Group C (control) received no treatment. Pressure pain threshold and cervical range of motion, assessed using a three-dimensional motion analysis system, were measured before and after the therapy.

Key words

range of motion, pain threshold, muscle energy technique, positional release, upper crossed syndrome.

Results: Both Groups A and B demonstrated a significant increase in the trapezius muscle pain threshold, while no changes were observed in Group C. Moreover, a noteworthy improvement in range of motion was observed: Group A exhibited enhancements in the sagittal and transverse planes, and Group B showed improvements in the frontal and transverse planes. No statistically significant changes were noted in other parameters.

Conclusions: MET and PR are equally effective in alleviating pain associated with MTrPs in patients with UCS. Furthermore, both techniques enhance range of motion, albeit in specific planes. The application of MET and PR proves effective in addressing pain and movement limitations attributed to MTrPs.

Introduction

The term upper crossed syndrome (UCS) describes a characteristic body posture resulting from muscular and fascial imbalances in the upper half of the body. Typical features of the UCS include a protracted positioning of the head, shoulder girdle, deepening of cervical lordosis, and thoracic kyphosis. These symptoms are sustained by the shortening of specific muscle groups and the consequent lengthening of antagonist muscles. Within the shortened muscles, such as the Descending part of the trapezius (DPT), Levator scapulae (LS), Suboccipital muscles (SM), Sternocleidomastoid (SCM), Pectoralis major (PM) and Pectoralis minor (Pm) muscles, myofascial trigger points (MTrPs) develop [1].

Active MTrPs result in significant pain in the cervical spine, shoulder girdle, and head, along with limitations in the mobility of these body parts. These symptoms greatly reduce the quality of life for patients and are the reason they seek specialized assistance. The scale of this phenomenon is significant enough that it is currently recognized as the primary cause of disability among individuals aged 25 to 65 [2].

Among the various therapies used in treating pain and limited range of motion (ROM) in individuals with UCS, positional release (PR) methods and muscle energy techniques (MET) are highly popular. Assessing their effectiveness, the extent of changes, and the duration of maintained effects still require ongoing research [3,4].

Aims

The aim of the study was to compare the effectiveness of two therapy methods: PR and MET methods on changes in pressure pain threshold (PPT) and ROM in the cervical spine in individuals with UCS.

Material and methods

Participants and settings

For the research approved by the bioethics committee under the number 4/KBL/OIL/2021, a total of 45 students, consisting of 24 females and 21 males, were ultimately enrolled. Inclusion criteria comprised a characteristic body posture indicative of UCS, an age range of 18-26 years, the presence of active MTrPs in the DPT muscle, and limited mobility in the cervical spine. Excluded from the study were individuals declaring participation in organized physical activity and utilizing other forms of physiotherapeutic interventions. The primary aim of these selection criteria was to ensure result consistency and minimize the impact of other factors on therapy outcomes. Additionally, participants included in the project were requested not to alter their daily lifestyle.

Study groups

After the initial qualification for the study, participants were divided into three equally-sized groups based on the number and gender. Each group consisted of 15 individuals (8 females and 7 males). The investigated groups did not differ significantly in basic characteristics such as age, height, and body mass (**Table 1**).

Interventions

Group A underwent a series of 5 PR MTrPs therapies conducted once a week over a period of 5 weeks. During each session, the therapy was performed bilaterally and encompassed the muscles in the following sequence: DPT, LS, SM, SCM, PM, and Pm. The therapy for each muscle was conducted in a supine position, following Jones' methodology, involving: compression of MTrPs within the muscle, adjustment of specific joint components to the position of maximum slack, maintaining the achieved painless position for 90 seconds, and finally, a passive return to the initial position.

In Group B, the same muscle groups were subjected to therapy with the same frequency and sequence of treatment as in Group A. The technique employed was post-isometric relaxation (PIR), a MET belonging to the TEM group, following the principles developed by Mitchell. According to these principles, after an isometric muscle contraction with a force not exceeding 30% of the maximum force and a duration of 5-7 seconds, a passive elongation was introduced to a new tissue barrier position [5]. For each muscle, the sequence was repeated three times, and the final achieved position was maintained for 30 seconds.

Group C served as the control group, without any therapeutic intervention. All participants underwent assessment one day before and one day after the completion of the 5-week therapy, which included bilateral measurement of the pressure pain threshold in the DPT and evaluation of the ROM of cervical spine.

Mesurement tools

To assess the PPT, the Wagner Pain Test FPX50 Algometer was employed, with a measurement accuracy of 0.1 kgf. The pressure from the measurement device was applied to the central part of the DPT, defined as the midpoint between the spinous process of the C7 vertebra and the scapular spine. The measurement device was oriented at a 90-degree angle to the muscle, and the recorded result was the force value causing the patient's initial

Table 1. General characteristics of the group.

Characteristics	Group A	Group B	Group C	p-value[1]
Number of people (M/F)	15 (8/7)	15 (8/7)	15 (8/7)	1
Age (years)	23.7 (SD=2.3)	22.9 (SD=1.9)	23.0 (SD=1.9)	0.98
Body height (cm)	174.0 (SD=7.5)	175.2 (SD=11.6)	175.5 (SD=7.5)	0.98
Body weight (kg)	68.2 (SD=10.2)	69.5 (SD=18.0)	69.8 (SD=10.7)	0.98

Abbreviations: *p-value[1] – significance of intergroup differences, SD – standard deviation, (F/M) – number of females/ number of males.*

Notes: *differences significant at $p < 0.05$.*

pain discomfort. To enhance measurement reliability, the entire procedure was repeated twice, with the final value considered as the arithmetic mean obtained from the two measurements.

For the assessment of cervical spine ROM, the BTS SMART-D 3D motion analysis system (BTS Bioengineering, Milan, Italy) was used, equipped with 6 cameras operating at a 70 Hz sampling frequency. Based on the research assumptions of other authors [6], markers were placed on the bodies of the subjects according to a proprietary scheme (**Fig. 1**). Key markers for subsequent measurements included: 1 – frontal tuberosity on the right side, 2 – frontal tuberosity on the left side, 4 – external occipital protuberance, 8 – right scapular process, 9 – left scapular process, 12 – spinous process of the Th6 vertebra (**Figs. 1** and **2**). The positions of individual markers during motion were then recorded using the BTS SMART Capture module. The mobility assessment was conducted in a standing position, evaluating sequential movements in three planes – sagittal (flexion and extension movements), frontal (lateral flexion movements to the right and left), and transverse (rotation movements to the right and left).

After marker registration, they underwent identification in the BTS SMART Tracker module. Subsequently, coordinate changes smoothed by these markers were used for angle calculations in the BTS SMART Analyzer module, allowing for the assessment of spinal ROM in the cervical region. For each of the assessed planes, angles formed by segments of the model related to the head and torso were calculated. Positions of markers 1, 2, and 4 were utilized to determine the head segment, while markers 8, 9, and 12 were used for the torso segment (**Fig. 2**).

To calculate the ROM in each plane, differences were computed between the angles corresponding to the neutral position and the maximum values achieved by the study participants in specified movements. Therapies and measurements were conducted by doctoral students and employees of the Central Laboratory of Scientific Research at the University of Physical Education in Krakow. Each research group was assigned one therapist with the appropriate qualifications for performing therapeutic techniques. Measurements were carried out by individuals with experience and completed specialized training in handling measurement equipment.

Statistical analysis

All statistical analyses and calculations were performed using the Statistica 13 package (Tibco Software Inc., Palo Alto, USA). For each parameter, descriptive characteristics were generated. The attached tables provide mean values and standard deviations. Normal distribution was verified using

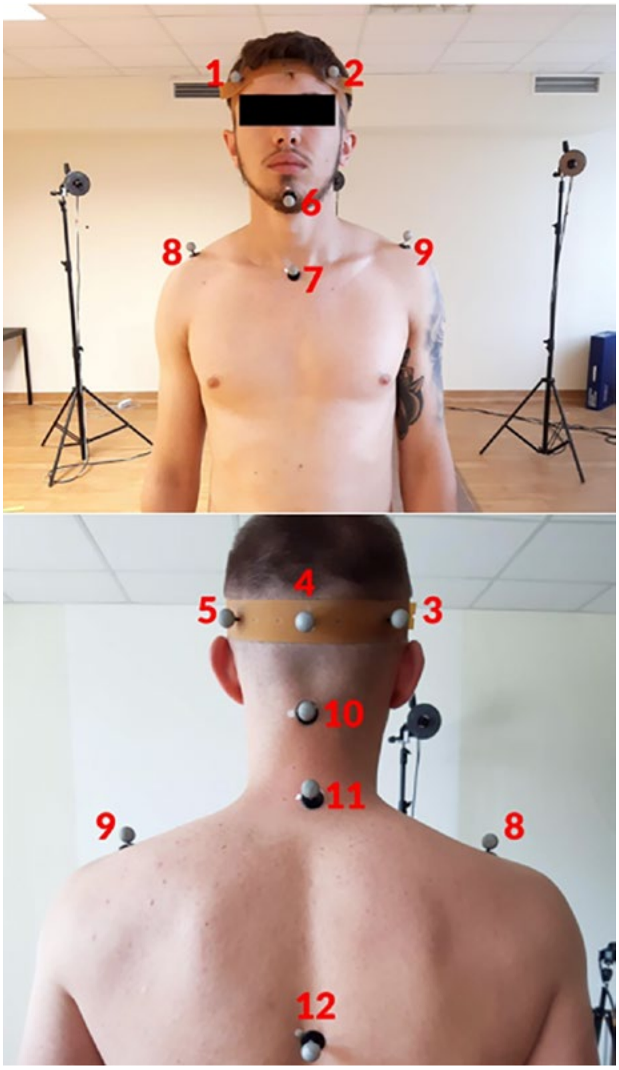

Figure 1. Diagram of marker placement during cervical spine range of motion analysis.

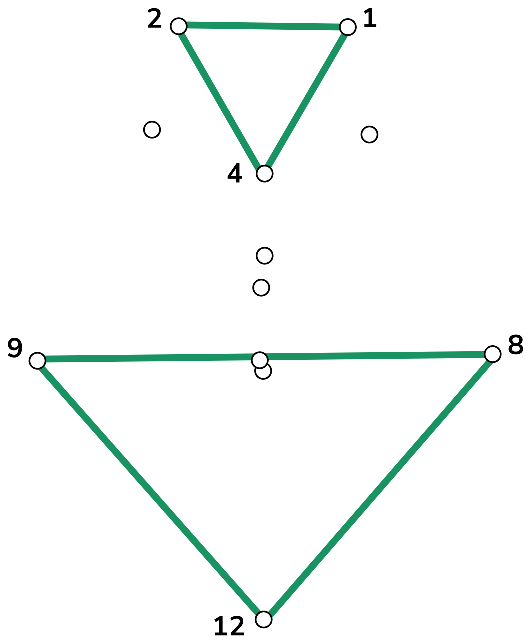

Figure 2. Model with separation of head and trunk segments (BTS SMART Tracker module).

the Shapiro-Wilk test. Dependent variables were compared using the paired t-test, and for independent variables, the independent samples t-test was applied. A significance level of $p < 0.05$ was adopted for the analysis.

Results

The results were divided into two parts. The first part is associated with the impact of the applied therapies on changes in the pressure pain threshold. The second part involves the assessment of changes in the ROM in the cervical spine in response to the applied therapies.

Comparing the results before and after the application of therapy within the studied groups, a statistically significant increase ($p < 0.05$) in the pressure pain threshold on both the right and left sides of the body was achieved in Group A (PR) and Group B (MET), with no significant changes in Group C (control) (**Table 2**).

Table 2. Comparison of changes in pressure pain threshold within study groups A, B and C.

Measure / Group	Group A (PR)		Group B (TEM)		Group C (control)	
	R	L	R	L	R	L
Measurement 1 (kgf)	7.93 (SD=3.04)	7.92 (SD=3.26)	8.28 (SD=3.95)	8.08 (SD=3.83)	9.72 (SD=3.39)	9.42 (SD=4.18)
Measurement 2 (kgf)	11.16 (SD=3.88)	10.48 (SD=3.88)	10.27 (SD=3.89)	9.76 (SD=2.51)	9.06 (SD=2.86)	8.56 (SD=2.78)
p	0.001*	0.012*	0.033*	0.037*	0.078	0.119

Abbreviations: *PR – positional release, TEM – muscle energy techniques, R – right side, L – left side, SD – standard deviation, kgf – kilogram-force, p – probability of error of the first kind of Student's t-test for dependent groups.*

Notes: ** differences significant at p < 0.05.*

Comparison of the results of this parameter between the study experimental groups in both study one and study two were found not to be statistically significantly different ($p > 0.05$) (**Table 3**).

Regarding changes in ROM, PR techniques (Group A) significantly increased the ROM of flexion, extension, and left rotation ($p < 0.05$). Meanwhile, MET techniques (Group B) significantly improved lateral flexion to the left and right, as well as left rotation. The remaining parameters in Groups A, B, and C did not exhibit significant changes (**Table 4**). Intergroup comparisons of changes in ROM showed no statistically significant differences in both the first and second assessments ($p > 0.05$) (**Table 4**).

Table 3. Comparison between study groups of changes in pressure pain threshold in measurement 1 and 2.

Measurement	Measurement 1		Measurement 2	
	R	L	R	L
The p-value (Student's t-test for independent variables)	0.587	0.932	0.495	0.550

Abbreviations: *R – right side, L – left side.*

Notes: ** differences significant at $p < 0.05$.*

Table 4. Comparison of intra- and intergroup changes in range of motion in groups A, B and C.

		Group A	Group B	Group C	p^2
Flexion (°)	Before	56.25 (SD=7.5)	56.34 (SD= 7.75)	59.89 (SD=10.54)	0.975
	After	61.19 (SD=8.16)	58.69 (SD= 8.83)	57.78 (SD=7.33)	0.437
	p	0.009*	0.442	0.226	
Extension (°)	Before	57.5 (SD=8.66)	58.35 (SD=11.31)	62.11 (SD=9.21)	0.805
	After	63.23 (SD=7.5)	62.99 (SD=10.4)	59.47 (SD=9.18)	0.947
	p	0.03*	0.294	0.092	
Right lateral flexion (°)	Before	39.27 (SD= 7.14)	39.36 (SD=4.08)	38.74 (SD=6.01)	0.676
	After	40.62 (SD=6.56)	41.75 (SD=5.27)	39.63 (SD=5.77)	0.612
	p	0.712	0.008*	0.333	

Left lateral flexion (°)	Before	37.73 (SD=5.48)	37.93 (SD=8.32)	40.44 (SD=6.85)	0.852
	After	39.83 (SD=5.58)	40.12 (SD=7.37)	39.11 (SD=4.75)	0.668
	p	0.113	0.032*	0.119	
Rotation to the right (°)	Before	62.55 (SD=6.46)	63.65 (SD=6.93)	63.93 (SD=5.65)	0.829
	After	64.97 (SD=6.46)	64.88 (SD= 8.05)	62.75 (SD=6.68)	0.947
	p	0.185	0.424	0.444	
Rotation to the left (°)	Before	64.59 (SD=2.62)	66.16 (SD=6.44)	65.29 (SD=6.28)	0.436
	After	69.09 (SD=5.52)	69.76 (SD=9.66)	64.89 (SD=4.92)	0.362
	p	0.008*	0.012*	0.818	

Abbreviations: (°) – *degree, p – probability of error of the first kind of Student t-test for dependent groups,* p^2 *–probability of error of the first kind of t Student t-test for independent groups.*

Notes: * *differences significant at* $p < 0.05$.

Discussion

Numerous studies have explored the impact of positional PR and MET on reducing pain and improving limited ROM caused by MTrPs. An example is the study by Kojidi et al. [7], investigating the influence of positional release therapy on 28 individuals experiencing pain in the trapezius muscle due to active MTrPs. Three therapies were conducted within one week, significantly reducing pain assessed by the Visual Analog Scale (VAS) and algometry. Another study involved a group of 60 individuals also experiencing pain in the trapezius muscle associated with MTrPs [8]. In this case, two types of therapy were applied: positional release and ischemic compression in the second half of the study. Both groups showed significant improvement in the perceived pain level and ROM in the cervical spine. Interestingly, the therapy was administered daily for only four days, indicating that even such a small number of sessions and a short duration can have a positive impact on patients' pain symptoms.

Interesting observations regarding the synergistic effect of PR therapy with other techniques such as muscle stretching and postural correction exercises are provided by the study of El-Khateeb et al. [9]. The study extracted two groups, each consisting of 30 participants. In Group A, a series of positional release therapies were combined with stretching and postural correction exercises, while in Group B, the same therapeutic procedure was applied, excluding the positional release technique. Therapy based on positional release techniques, conducted three times a week for four weeks, induced greater changes in increasing the pressure pain threshold, neck ROM, and reducing trapezius muscle tension compared to the control group. Positive effects of muscle energy techniques and positional release therapy also persist over time, as demonstrated by the study of Kashyap et al. [10]. Assessments on days 1, 5, 10, and 15 after the cessation of these techniques revealed their significant beneficial impact on neck pain assessed by the VAS, ROM, and neck muscle stiffness, unlike the control group.

Not only individual studies but also systematic reviews based on numerous investigations confirm the positive impact of MET and PR therapy on improving ROM and reducing pain. The first review concerns MET and was conducted by Sbardella et al. [11]. It analyzes 15 studies on acute and 6 studies on chronic neck pain published between 2010-2020. The quality of the analyzed studies was assessed using the PEDro scale, and the conclusions suggest that MET have a favorable clinical effect in reducing pain and improving ROM, with their effectiveness increasing when combined with other manual techniques. The second systematic review by Barnes and Rivera [12] covers 9 rigorously selected studies that applied positional release techniques. All identified studies were randomized and assessed by two independent reviewers. In the majority of them, significant improvements were observed in pain perception and an increase in the restricted ROM.

The results of our own studies, applying a 5-week series of PR and MET therapy in individuals with UCS, align with the findings of the authors cited earlier. This serves as additional evidence pointing to the effectiveness of these techniques in reducing pain and improving ROM. Concerning the improvement in the ROM, our observations indicate that PR techniques induce favorable changes in the sagittal-transverse plane, while MET affects the frontal and transverse planes. These observations align with the results of Wendt and Waszak [13], suggesting that the isolated application of MET and trigger point therapy techniques influences the improvement of ROM in specific planes. The combination of both techniques yields optimal effects in enhancing this parameter.

The analgesic effects of PR technique can likely be explained by a reduction in afferent input, thereby decreasing stimulation of the facilitated segment. On the other hand, muscle energy techniques rely on neurological reflexes from the Golgi tendon organ, leading to a secondary reduction in tension of extrafusal fibers [14,15]. The reduction in pain perception and normalization of muscle tension are associated with an improvement in the ROM observed after the application of both techniques. Distinct physiological mechanisms underlying the effectiveness of both techniques do not preclude their synergistic action, which should be assessed in future studies.

Study limitations

One of the main limitations of the present study is the absence of baseline measurements before the completion of the 5-week therapeutic series. Such measurements would allow for a more precise determination of the time frame for potential therapy effects. In the future, it is also essential to conduct research on a larger sample size and compare the synergistic effects of both therapies, contributing to the enhanced reliability of the obtained results.

Conclusions

MET and PR therapy are equally effective in reducing pain caused by myofascial trigger points in individuals with UCS. Both techniques, when applied to individuals with myofascial trigger points associated with UCS, lead to an improvement in the restricted ROM in the cervical spine, specifically in certain planes of movement.

References

1. Seidi F, Bayattork M, Minoonejad H, Andersen LL, Page P. Comprehensive corrective exercise program improves alignment, muscle activation and movement pattern of men with upper crossed syndrome: Randomized controlled trial. Sci Rep. 2020; 10 (1): 1–11.
2. Pico-Espinosa OJ, Aboagye E, Côté P, Peterson A, Holm LW, Jensen I, et al. Deep tissue massage, strengthening and stretching exercises, and a combination of both compared with advice to stay active for subacute or persistent non-specific neck pain: A cost-effectiveness analysis of the Stockholm Neck Trial (stone). Musculoskelet Sci Pract. 2020; 46: 102109.
3. Aneis YM, El-Badrawy NM, El-Ganainy A-EA, Atta HK. The effectiveness of a multimodal approach in the treatment of patients with upper crossed syndrome: A randomized controlled trial. J Bodyw Mov Ther. 2022; 32: 130–136.
4. Bethers AH, Swanson DC, Sponbeck JK, Mitchell UH, Draper DO, Feland JB, et al. Positional release therapy and therapeutic massage reduce muscle trigger and tender points. J Bodyw Mov Ther. 2021; 28: 264–270.
5. Satria Nugraha MH, Antari NK, Saraswati NL. The efficacy of Muscle Energy Technique in individuals with mechanical neck pain: A systematic review. Sport Fit J. 2020; 8 (2): 91–98.
6. D'Anna C, Schmid M, Conforoto S. Linking head and neck posture with muscular activity and perceived discomfort during prolonged smartphone texting. Int J Ind Ergon. 2021; 83: 103134.
7. Mohammadi Kojidi M, Okhovatian F, Rahimi A, Baghban AA, Azimi H. The influence of positional release therapy on the myofascial trigger points of the upper trapezius muscle in computer users. J Bodyw Mov Ther. 2016; 20 (4): 767–7673.
8. Pathan N, Thakur S, Kadam K, Lohade S, Chandak N. Immediate effects of positional release therapy and Manual Trigger Point release on Neck Pain and range of motion in computer users with Upper Trapezitis. J Family Med. Prim Care. 2021; 10 (8): 2839–2844.
9. El-Khateeb YS, Mahmoud AG, Mohamed MH, Abd El-Azeim AS. Influence of adding strain-counterstrain to standard therapy on axioscapular muscles amplitude and fatigue in mechanical neck pain: A single-blind, Randomized Trial. Eur J Phys Rehabil Med. 2022; 58 (4): 621–629.
10. Kashyap R, Iqbal A, Alghadir AH. Controlled intervention to compare the efficacies of manual pressure release and the Muscle Energy Technique for treating mechanical neck pain due to upper trapezius trigger points. J Pain Res. 2018; 11: 3151–3160.
11. Sbardella S, La Russa C, Bernetti A, Mangone M, Guarnera A, Pezzi L, et al. Muscle Energy Technique in the Rehabilitative Treatment for Acute and Chronic Non-Specific Neck Pain: A Systematic Review. Healthcare. 2021; 9 (6): 746–761.
12. Barnes P, Rivera M. The effect of active release technique® on clinician and patient-reported outcomes: A systematic review. J Sport Rehabil. 2022; 31 (3) :331–336.
13. Wendt M, Waszak M. Evaluation of the combination of Muscle Energy Technique and trigger point therapy in asymptomatic individuals with a latent trigger point. Int J Environ Res Public Health. 2020; 17 (22): 8430–8450.
14. Danazumi MS, Yakasai AM, Ibrahim AA, Shehu UT, Ibrahim SU. Effect of integrated neuromuscular inhibition technique compared with positional release technique in the management of piriformis syndrome. J Osteopath Med. 2021; 121 (8): 693–703.
15. Faqih AI, Bedekar N, Shyam A, Sancheti P. Effects of muscle energy technique on pain, range of motion and function in patients with post-surgical elbow stiffness: A randomized controlled trial. Hong Kong Physiother J. 2019; 39 (01): 25–33.