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Effect of Kinesio taping versus mechanical cervical traction combined with physiotherapy program on chronic neck pain in young female university students

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Background: Mechanical neck pain is common among young female university students and can lead to disability and reduced physical activity.
Objectives: The aim of this study was to compare the effect of Kinesio taping (KT) to mechanical cervical traction (MCT) on young female university students with chronic neck pain.
Methods: Sixty young female university students with mechanical neck pain participated in this study; their ages ranged from 19 years to 23 years. They were assigned to three equal groups: the control group (A) received infrared, massage, stretching, and strengthening exercises three days per week for 6 weeks. Experimental group B received cervical traction in addition to the same program as the control, and experimental group C received KT in addition to the same program as the control group. Absolute pain intensity by the visual analogue scale (VAS) and neck disability index (NDI) were measured pre-and post-treatment intervention. Data were gathered at baseline, and after 6 weeks of intervention for three groups.
Results: The MANOVA test showed a significant reduction in NDI and pain level after 6 weeks between pre- and post-treatment intervention in group B ($P < 0.001$ and $P < 0.001$, respectively). There was a significant reduction in pain after 6 weeks in group C. There was also a significant reduction in NDI and pain level after 6 weeks in group B versus control group ($P < 0.001$ and $P = 0.001$, respectively). In addition, a significant

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reduction in pain level and NDI after 6 weeks was detected in group B compared to group C ($P < 0.001$, $P = 0.014$, respectively) while a significant reduction in pain level only between the control group (A) and group C was detected ($P < 0.001$).
Conclusion: In young female university students with mechanical neck pain, cervical traction combined with physiotherapy program was found to be more effective than KT with physiotherapy program or physiotherapy program alone in reducing pain and enhancing functional abilities after 6 weeks. This will help physiotherapists make more informed decisions concerning the clinical effects of MCT.

Keywords: Cervical traction; Kinesio taping; neck pain; headache.

Introduction

Mechanical neck pain symptoms are common health problems among female university students aged 18–25 due to studying posture and the use of electronic devices.[1] An epidemiologic study proved that the yearly occurrence rate of neck pain is 10.4–21.3% with an advanced rate for computer and office workers which represents a burden on society.[2] Almhdawi *et al.*[3] reported that the prevalence of neck pain was much greater in females and was significantly associated with an increase in clinical training load, symptoms of mental stress, and average smartphone use time. In developing countries, mechanical neck pain is most common in university students.[4] A study conducted by Gharib and Hamid[5] in Saudi Arabia showed that the prevalence rate of cervical pain among female university students was 54%.

This disorder has a multifactorial aetiology including ergonomic factors such as strenuous physical activity, inappropriate posture, and repetitive movement. There are also individual factors such as age, gender, body mass index (BMI), and musculoskeletal ache history as well as psychosocial factors such as job dissatisfaction, stress level, nervousness, and depression. In addition, the use of several electronic devices (computer, tablet, and cell phones) for a long period of time with static posture can increase the risk.[6–8]

Studies on the prevalence and risk factors for neck pain in various populations are important because they have an impact on the economy and society, thus affecting both the government and individuals. The socio-economic burden of mechanical neck pain is high and includes many discrepancies such as increasing treatment costs and work absenteeism. It is also a problem related to mechanical neck pain that can significantly disturb work productivity and the economies of individuals and communities.[9] Most of the available literature delivers different treatment strategies for mechanical neck pain and includes drug therapy, manual techniques, electrophysical therapy, stretching and strengthening exercises, and massage.[10] Other physiotherapeutic interventions such as Kinesio taping (KT)[10] and mechanical traction are most frequently used by a physiotherapist.[11]

KT is a treatment technique used clinically for managing pain[12]; it was established by Kenso Kase in the 1970s, but its application has become more common in recent years.[13] It has been theorized that KT may yield its effects in reducing pain through the (a) improvement of blood circulation; (b) reduction of oedema by improving lymphatic blood flow; (d) training of muscle relaxation to deliver proper joint alignment; and (e) providing muscle balance and joint support without affecting the range of motion (ROM).

Mechanical cervical traction (MCT) is a therapeutic technique that includes pulling force on the different structures of the cervical region to lengthen the soft tissue and provide mechanical correction of cervical joints.[14] Moreover, it was hypothesized that the static stretching of the muscle fibres tends to cause muscle relaxation and relieve pain[15] but to date, there is still a shortage of literature that detects the superiority of one of these modalities over the other. Considering these points, the objective of this study was to determine the effectiveness of KT versus MCT in reducing neck pain in young female university students.

Materials and Methods

Study design

A pre- and post-test control group design (between and within groups' comparisons) was conducted. The three tested groups were examined before and

after treatment intervention to detect the superiority of the intervention in the management of chronic mechanical neck pain (CMNP).

Participants

We enrolled 60 female university students between the ages of 19 years and 23 years clinically diagnosed by an orthopaedic consultant as having a history of CMNP for at least three months without any other musculoskeletal abnormalities. CMNP was defined as generalized neck pain that became worse by abnormal static neck postures or neck movement, or tender palpation of the muscles surrounding the cervical region without referred pain. Both the participants and the examining physiotherapist were unaware of the intervention groups. Blinding occurred at the evaluation and data collection stages. The process was only known to the physiotherapist who administered the therapy because each participant's physiotherapy session was private and isolated from the other participants. The sessions were held at different times and days, and thus the participants in the physiotherapy program did not know the other participants. Participants in the trial were also uninformed about the assigned intervention or the distinctions between KT and MCT.

The participants were recruited from the clinic of the Faculty of Physical Therapy, Cairo University (Convenient sample), and assigned randomly into three equal groups using the sealed envelope method; the participants were divided into three groups. Each patient selected a random envelope and handed it to the physical therapist. The control group (group A) received a source of heat (infrared), massage, stretching, and strengthening exercises. Group B received cervical traction in addition to the same program as the control group, and group C received KT replaced two times per week or when urgently needed in addition to the same program as the control group. All three groups received physical therapy sessions three days a week for 6 weeks. The KT and cervical traction were given on the same day of other physical therapy treatments, and patients in group C received the KT after exercising and applying infrared.

The inclusion criteria were female university students aged from 19 years to 23 years with a history of CMNP for at least three months without any other musculoskeletal abnormalities. CMNP was defined as generalized neck pain worse by abnormal static neck postures or neck movement, or tender palpation of the muscles in the surrounding cervical region (posterior and side muscles of the neck; levator scapulae, trapezius, sternocleidomastoid, and scalene muscles).[10] Participants were excluded if they had a clinical recommendation of severe abnormalities or disorders of the cervical spine such as ligamentous injury, joint dislocation or disruption, disk prolapse, cervical stenosis, referred pain, radiculopathy, recent surgery or fracture in the cervical region, pregnant women, and allergy to KT.

The sample size was detected using G*power software version 3.1.9.7 (Universities, Dusseldorf, Germany). The estimation depends on a pilot study; the main outcome of this study was neck pain intensity. This led to a power of 0.85 with an alpha level of 0.05 and effect size of 0.88; the total size of the sample was 12 contributors per each group. The total sample size was 20 participants for each group considering the dropout rate (Fig. 1). There were no dropouts and no adverse reactions reported by participants in any of the three intervention groups after a suitable sample of 60 subjects was chosen from the enrolled sample of 75 subjects.

The study was approved by the research ethics committee of the Faculty of Physical Therapy, Cairo University (Approval No. P.T.REC/012/003907) and the registration number is (PACTR202307610793616). All participants signed a consent form before the beginning of the study. The main outcome measures were neck pain intensity measured by the visual analogue scale (VAS) and functional disability measured by the neck disability index (NDI).

Instrumentations

The VAS is a simple and common method for the evaluation of differences in pain intensity. It is a horizontal line of 10 cm that represents a continuum between 0 cm, where 0 is "no pain" and 10 cm where 10 is "worst pain". VAS is considered a valid and reliable method for pain evaluation and it is suitable for use in clinical sessions.[16]

The NDI consists of 10 sectors including six probable responses for functional activities in each sector (from 0 to 5). The NDI is counted from 0 to 50, with a higher score signifying greater disability. The degree of disability can be obtained by

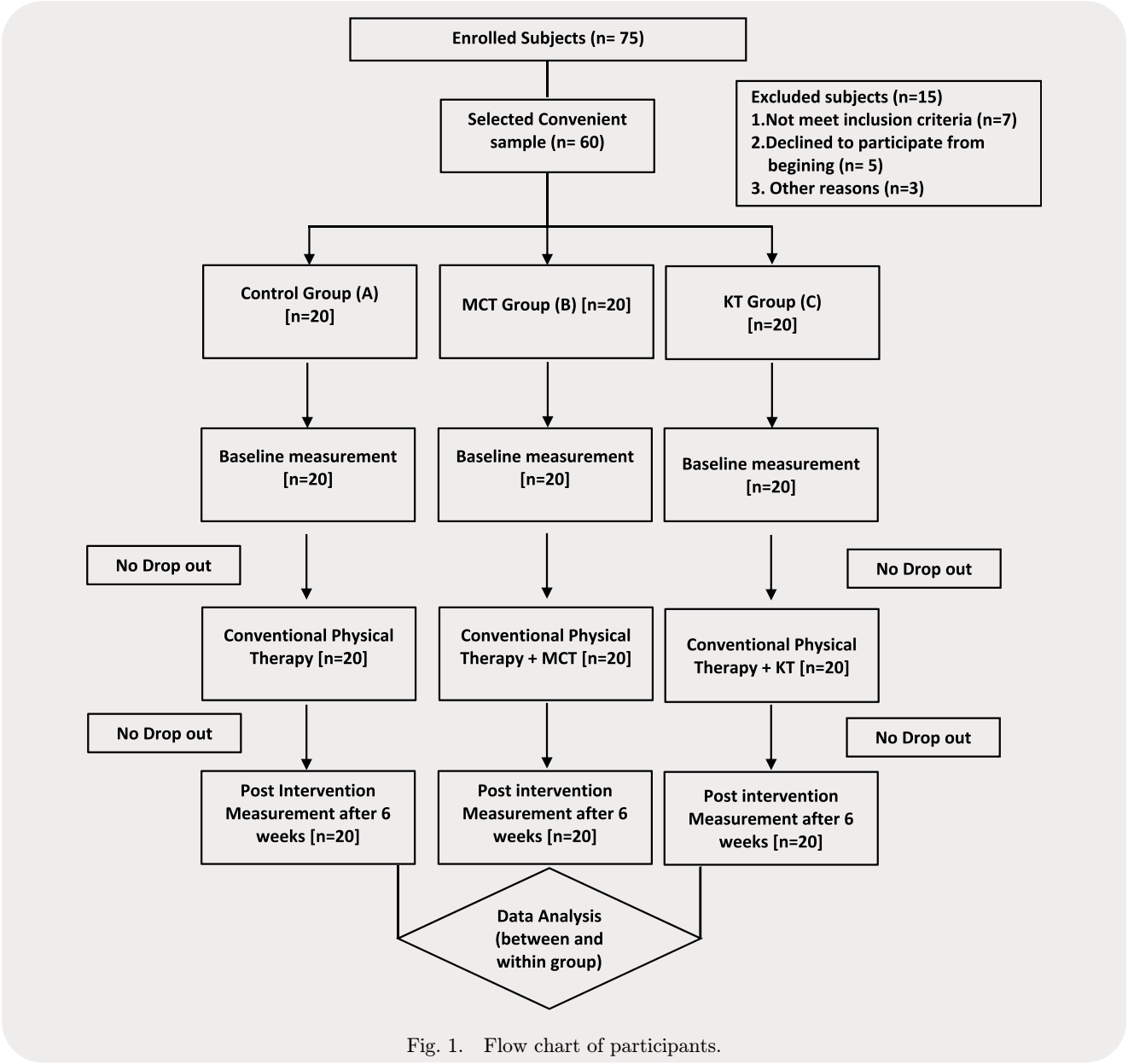

Fig. 1. Flow chart of participants.

percentage, which is minimum (0–20%), moderate (21–40%), severe (41–60%), invalidating (61–80%), and bed bound (80–100%). The validity and consistency of the NDI have been well recognized.[17]

For the treatment interference, the original KT (IC: 87683491, made in Korea) was applied in this study. It is composed of 100% latex-free hypoallergenic cotton that is non-restrictive and has a water-resistant coating; it is easy to apply. This tape is thin and has high elasticity, which enables it to extend to 100% of its original length. The tape is 5 cm wide and 5 m long. The sensitivity assessment was applied before the application of KT. In addition, the MCT was applied using å Triton Traction Unit (Chattanooga, USA, Model No. 4749) consisting of an adjustable traction table, traction unit, and head halter.

Procedure

The study had three sessions per week for a total of 6 weeks. Each session lasted almost an hour. All sessions were conducted in the morning. Each participant in group B received MCT. The position of the patient was a supine lying position with the neck of the subject flexed 30°. The head halter was applied and fit to the subject comfortably and attached to the traction unit as shown in Fig. 2. The patient was properly aligned for the pulling force after the traction unit was activated. The type of

Fig. 2. Cervical traction unit with the neck of the subject flexed 30°.

traction application is intermittent with a hold time and rest time of 10 sector each.[11] The starting traction force is between 5 kg and 6 kg, and it is modified based on the patient's tolerance and to avoid muscle fatigue and pain.[18] None of the participants exceeded the 6 kg traction force.

Each participant in group C received a standard KT application from a sitting position. The posterior and side part of the neck was free of clothes, and the area was cleaned with distilled water and shaved from any hair to facilitate proper tape application. The stem of the Y-shaped KT (about 15 cm) is stacked over the beginning of the dorsal region between T1 and T2 without tension. The KT was applied with a tension of approximately 15–25% paraspinal. Each patient was asked to bend and rotate the neck to the opposite side during the application of each Y-shaped band to the upper cervical region (C1–C2). In addition, an I-shaped band with 50% tension was placed crossed to the Y-shaped band over the mid-cervical region (C3–C6) while flexing the patient's cervical spine to exert pressure on the back tissues as shown in Fig. 3. The tape was placed and changed two times a week or more frequently as necessary.[19]

Each participant in all groups received a source of heat (infrared radiation) for 15 min/session. The patient was placed in a sitting position with forwarding leaning of the trunk and supporting the head over the plinth to obtain the maximum position of support and relaxation. An infrared lamp was located between 50 cm and 75 cm for three sessions per week for 6 weeks.[20] In addition, deep effleurage was conducted on the extensors and side bending muscles of the cervical region while the patient lay in prone position with the forehead supported on the patient's hands to insure maximum relaxation position. The massage therapy was targeted at the painful areas in the neck and upper back regions. Techniques differ from superficial effleurage to firm motion including

Fig. 3. The applications of Kinesio tape.

compression and force release; deep muscle/fascia massage was used in other areas.[21] The massage duration was 20 min per session.[22] The same physiotherapist applied the deep effleurage to each participant for 15 min which included in the 20 min mentioned before. Moreover, each participant in all three groups received different types of exercises. There was a stretching exercise in the form of an elongation to the posterior and side flexors of the neck (levator scapulae, upper fibres of trapezius, sternocleidomastoid, and scalene muscles). This moved from a supine laying position for 30 s followed by 30 s of relaxation with three repetitions.[23] There was also a strengthening exercise in the form of isometric contraction of flexors, extensors, rotators, and side muscles of the neck moving from a sitting position with the palm of the physiotherapist pressed against the patient forehead for cervical flexors, pressed against the side of the patient head for cervical side flexors and rotators, and pressed against back of the patient head for cervical extensors. The exercise was applied for 6 s of contraction followed by 6 s of relaxation five times in each direction.[24]

Statistical analysis

Data analysis helped detect normality and homogeneity of data via the Shapiro–Wilk test. The VAS and NDI variables exhibited a parametric distribution. Mixed design MANOVA was used to compare means within and between the three

groups in pre- and post-treatment interventions. In addition, the difference of the means in participants' demographic data was examined. Numerical data were shown as mean and SD. The statistical significance level was set at a p-value ≤ 0.05. Statistical analysis was conducted using IBM SPSS version 20 (SPSS Inc., Chicago, Illinois, USA).

Results

There were no statistically significant differences in the mean values of demographic data (age, weight, height, and BMI) among the three groups (p-values ≥ 0.05; Table 1). The results of variables of interest indicated statistically significant group-time interaction for neck pain among the three groups ($F = 108.5$, $P < 0.001$) after a period of 6 weeks of treatment interventions. There were no statistically significant differences in the mean values between pre-and post-treatment intervention in the control group ($P = 0.662$), but there were statistically significant differences in cervical traction and KT groups ($P < 0.001$; Table 2). In addition, there were no statistically significant differences in the mean values in pre-treatment intervention among the three groups ($P \geq 0.05$), but post-treatment intervention showed statistically significant differences among the three groups ($P < 0.05$) with significant reduction of pain values in the cervical traction group more than KT group (Table 3).

The NDI showed a statistically significant group-time interaction for NDI among three groups ($F = 5.031$, $P = 0.008$) after a period of 6 weeks of treatment interventions. The subjects who received a physiotherapy program combined with MCT experienced a greater reduction in NDI than subjects who received a physiotherapy program only; there was no statistically significant difference in the mean values between the control and KT group ($P = 0.567$) as shown in Table 2. There were no statistically significant differences in the mean values in pre-treatment intervention among the three groups ($P \geq 0.05$). The post-treatment intervention showed statistically significant differences between the control group and cervical traction group and between cervical traction group and KT group ($P < 0.001$, $P = 0.014$, respectively) as shown in Table 3.

Discussion

The results showed that patients with mechanical neck pain had statistically significant improvements in experimental groups B and C (MCT and KT groups, respectively) versus group A (control group) with more improvement in the MCT group than the KT group. In addition, the NDI showed a statistically significant reduction in the experimental group B only (MCT group) versus control group A and experimental group C (KT group). This indicated the effect of KT and MCT in reducing neck pain in a patient with mechanical neck pain and the superiority of MCT in reducing the neck pain in those patients versus the conventional treatment alone or KT with conventional treatment after 6 weeks of treatment interventions.

These findings suggest that the improved blood flow and muscle relaxation resulting from KT with a conventional treatment program can reduce the pain in patients with mechanical neck pain.[13] In addition, the stimulation of mechanoreceptors through the stretching effect of KT tends to reduce pain.[25] Furthermore, the instant effect of KT may be via the stimulation of Golgi organ receptors that

Table 1. Participants' demographic data.

	Control group (A) (mean ± SD)	MCT group (B) (mean ± SD)	KT group (C) (mean ± SD)	p-value	F-value
Age (years)	20.8 ± 1.4	20.9 ± 1.52	21.1 ± 1.48	0.806	0.217
Weight (kg)	52.2 ± 7.47	53.4 ± 9.60	53.85 ± 9.51	0.833	0.183
Height (cm)	157.35 ± 5.69	159.15 ± 6.38	159.70 ± 6.46	0.459	0.790
BMI (kg/m^2)	21.07 ± 2.77	20.95 ± 2.53	20.97 ± 2.46	0.988	0.012

Notes: Abbreviations: MCT = Mechanical Cervical Traction; KT = Kinesio-taping; BMI = Body Mass Index; SD = Standard Deviation; cm = centimeter; Kg = Kilogram; Kg/m^2 = Kilogram per meter square. *Significant at p-value < 0.05.

Table 2. MANOVA of VAS and NDI within groups.

	Control group (A)				MCT group (B)				KT group (C)			
Measured variables	Pre (mean ± SD)	Post (mean ± SD)	MD (95%CI) (lower limit, upper limit)	*p*-value	Pre (mean ± SD)	Post (mean ± SD)	MD (95%CI) (lower limit, upper limit)	*p*-value	Pre (mean ± SD)	Post (mean ± SD)	MD (95%CI) (lower limit, upper limit)	*p*-value
VAS	7.65 ± 0.933	7.14 ± 0.734	−0.215 (−0.690,0.440)	0.662	7.63 ± 9.33	2.1 ± 0.788	5.550 (4.985, 6.115)	< 0.001*	7.40 ± 1.13	6.20 ± 0.834	1.200 (0.635, 1.765)	0.002*
NDI	33.40 ± 12.405	33.20 ± 12.605	−0.306 (−7.211, 6.598)	0.930	33.50 ± 11.633	19.02 ± 60.47	14.485 (7.580, 21.390)	< 0.001*	31.80 ± 110.344	29.10 ± 10.506	2.700 (−4.205, 9.605)	0.440

Notes: Abbreviations: KT = Kinesio-taping, MCT = Mechanical Cervical Traction, SD = Standard Division, VAS = Visual Analogue Scale, NDI = Neck Disability Index, MD = Mean Difference. *Significant at *p*-value < 0.05.

Table 3. MANOVA of VAS and NDI among the three tested groups.

	Group (A) versus Group (B) versus Group (C)								
	Control group (A) versus MCT group (B)			MCT group (B) versus KT group (C)			Control group (A) versus KT group (C)		
Measured variables	Pre	Post	MD (95%CI) (lower limit, upper limit)	Pre	Post	MD (95%CI) (lower limit, upper limit)	Pre	Post	MD (95%CI) (lower limit, upper limit)
VAS	$P = 1.000$	$P = 0.001$*	2.838 (2.348, 3.327)	$P = 1.000$	$P < 0.001$*	−1.925 (−2.415, 1.435)	$P = 0.996$	$P < 0.001$*	0.913 (0.423, 1.402)
NDI	$P = 1.000$	$P < 0.001$*	7.296 (1.307, 13.285)	$P = 1.000$	$P = 0.014$*	−4.193 (−10.181, 1.796)	$P = 0.968$	$P = 0.567$	3.103 (−2.886, 9.092)

Notes: Abbreviations: KT = Kinesio-taping, MCT = Mechanical Cervical Traction, SD = Standard Division, VAS = Visual Analogue Scale, NDI = Neck Disability Index, MD = Mean Difference. *Significant at *p*-value < 0.05.

can reduce the muscle spasms.[13] A fear of movement is linked to pain intensity in patients with neck pain, and it is also possible that the tape reduced the pain by inhibiting mechanisms. The KT application may have improved neck pain and ROM by giving patients the proper sensory feedback and reducing the fear of movement. KT may also enhance the ROM and functional capacity by supporting the cervical region's spinal segments.[26,27] The increased ROM and improved NDI performance of the cervical muscles might be explained by a reduction in pain. On the contrary, KT had limited effect in improving neck disability — especially over a short time of treatment intervention.[28–30]

Intermittent cervical traction can be used to treat patients with mechanical neck pain as well as more advanced cases such as cervical radiculopathy as shown by Moeti and Marchetti,[31] which proved the reduction of pain and disability in a patient with cervical radiculopathy using mechanical intermittent cervical traction. However, these cases (radiculopathy) were not included in our study. Most of the available literature studies recommend intermittent cervical traction rather than continuous MCT to reduce pain via stimulation of mechanoreceptors.[31–33] This may be ascribed to the cervical traction successfully improving or restoring the cervical lordotic curve through muscle relaxation and relieving muscle spasms through stretching while overcoming the resistance of the muscle and other surrounding tissue that tends to cause muscle inhibition.[34]

Bid *et al.*[34] stated that MCT has numerous possible mechanisms of action with very little increase in intervertebral space (a few millimetres). These then stabilize the activity of the trapezius muscle over the first three to 6 min in addition to the inhibition of pain through the nociceptive reflux transmission. All of these techniques can lessen neck pain and enhance spinal function.

On the other hand, Borman *et al.*[35] showed no effect between traction and conventional physical therapy with chronic neck pain, but this may be because of the different characteristics of the sample cohort in our study. The pain duration in the selected sample was only 6 weeks, which is different from that in the current study which was at least three months. In contrast, another study by Jellad *et al.*[18] showed the effect of MCT in rehabilitation — especially when combined with other approaches of rehabilitation.

Limitations and Future Research

Our study has an obvious limitation: The selection of female subjects only without considering gender variations. Thus, the results are restricted to women. To ensure the optimal efficiency of KT and MCT, it is advised that both male and female subjects be included in future studies. Additionally, a strong study design, such as a randomized control trial, should be chosen because a lack of randomization can lead to selection bias. Further studies are needed to conduct an extensive comparison between KT and MCT. Moreover, subgroup classifications of neck pain patients are not included in the current study. Future work should identify which subgroup has a better likelihood of having a favorable effect when using KT or traction.

Conclusion

There are limited studies that compare the effect of KT with cervical traction. Here, we clarify the superiority of one of the most common methods (KT and MCT) used with chronic neck pain in reducing neck pain and improving neck function. The findings confirm the superiority of MCT. Cervical traction combined with physiotherapy program was found to be more effective than KT with a physiotherapy program or a physiotherapy program alone in reducing pain and enhancing functional abilities after 6 weeks. This will help physiotherapists make more informed decisions concerning the clinical effects of MCT in young female university students with mechanical neck pain.

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Conflicts of Interest

The authors declare that there were no potential conflicts of interest.

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Author Contributions

The provision of the research idea and scheduled the research methods to obtain the results, providing oversight, responsibility for organization and application, writing of the manuscript, and collection of literature. In addition, the selection of the sample with inclusion and exclusion criteria was done by A. E. Abd-Eltawab and M. A. Ameer.

Responsible for statistical analysis, assessment, presentation, and interpretation of the results done by M. A. Ameer.

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