

REVIEW ARTICLE / DERLEME MAKALESİ

The Effect of Kinesio Taping in Patients with Neck Pain: A Systematic Review

Boyun Ağrısı Olan Hastalarda Kinezyo Bantlamının Etkinliği: Sistematik Derleme

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ABSTRACT

The present review was aimed to indicate the existing evidence in the literature on Kinesio Taping (KT) applications used in individuals with neck pain. The literature search was carried out in “PubMed, Science Direct, Scopus, and Web of Science (WoS)” databases. Twelve studies were included to the review. The quality assessment was conducted using “The Physiotherapy Evidence Database (PEDro)” scale. More than half of the included studies (58.3%) had a “PEDro” scoring score ranging from “6 to 8”. The median and mode “PEDro scores” of the studies were “6.5 and 8”, respectively (min:4, max:9). “Range of Motion (ROM)” and “Neck Disability Index” are the most widely used (75%) measurement methods. In the studies, it was determined that the most improvement was in the pain parameter. Kinesio Taping applications may provide additional advantages in terms of pain, ROM and function in the short term. On the other hand, it was deduced that Kinesio Taping applications could contribute to proprioception, psychosocial status and quality of life in the medium term. With further studies, the effect of Kinesio Taping on different parameters such as kinesiophobia, catastrophizing pain, and avoidance of fear should be evaluated.

Keywords: Chronic neck pain, kinesio taping, rehabilitation, review, symptom

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ÖZ

Bu derlemede, boyun ağrılı bireylerde kullanılan Kinezyo Bantlama (KB) uygulamalarına ilişkin literatürdeki mevcut kanıtların gösterilmesi amaçlanmıştır. Literatür taraması “PubMed, Science Direct, Scopus ve Web of Science (WoS)” veri tabanlarında yapılmıştır. On iki çalışma derlemeye dahil edildi. Kalite değerlendirmesi, “Fizyoterapi Kanıt Veri Tabanı (PEDro) ölçeği” kullanılarak gerçekleştirildi.

Dahil edilen çalışmaların yarısından fazlası (%58,3) 6 ile 8 arasında değişen bir PEDro skoruna sahiptir. Çalışmaların medyan ve mod PEDro skorları sırasıyla 6,5 ve 8’dir (min:4, maks:9). “Eklem hareket açıklığı (EHA)” ve “Boyun Özur İndeksi” en yaygın olarak (%75) kullanılan ölçüm yöntemleridir. Yapılan çalışmalarda en fazla iyileşmenin ağrı parametresinde olduğu belirlenmiştir. Kinezyo Bantlama uygulamaları kısa dönemde ağrı, EHA ve fonksiyon açısından ek avantajlar sağlayabilir. Öte yandan Kinezyo Bantlama uygulamalarının orta vadede propriyosepsiyon, psikososyal durum ve yaşam kalitesine katkı sağlayabileceği sonucuna varılmıştır. Daha fazla çalışma ile Kinezyo Bantlamının, kinezyofobi, ağrıyı felaketeleştirme, korkudan kaçınma gibi farklı parametreler üzerindeki etkisi değerlendirilmelidir.

Anahtar Kelimeler: Kronik boyun ağrısı, kinezyo bantlama, rehabilitasyon, derleme, semptom

INTRODUCTION

Neck pain occurs in 16.7% to 75.1% (average 37.2%) of the general population. Up to 70% of the general population experience neck problem once in their lifetime, and it is a significant public health problem (1, 2). Neck pain is divided into acute and chronic types. Acute neck pain usually recovers with or without treatment, but some pain levels may persist or recur. Chronic neck pain, on the other hand, is a condition that causes disability lasting longer than three months, causes loss of workforce and generates social and

economic burden that negatively affects the quality of life (3-5).

Altered activation of increased superficial and decreased deep muscles and decreased joint movement leads to pain, which causes limitations in daily living activities and decreased quality of life. Mechanical neck pain is defined as cervical pain aggravated by posture, mobility, or palpation of the cervical muscles (6). Although its etiology is not clear, it is considered to be multifactorial. The source of the pain could be various cervical structures such as “intervertebral joints, nerves, discs, muscles or ligaments”. In addition, it is remarked that trigger points localized, particularly in the upper back muscles, can also be the source of pain (2). One of the passive methods in treating chronic neck pain; is mobilization, manipulation, massage, kinesio taping (KT). Among the active methods, strengthening, stretching, and stabilization exercises are frequently used in the treatment (7-9).

KT is a non-invasive treatment technique commonly used in patients with musculoskeletal disorders that can extend up to 140% of their original length (10, 11). KT does not provide structural support and does not limit movement; it is waterproof, thin and air permeable, as well as adhesive; it can be utilised for 3 to 4 days without removal (12). KT supports weak muscles, improves muscle function, reduces pain, re-positions subluxated joints, improves blood/lymph circulation and proprioceptive function (13).

Although several clinical KT studies have shown positive effects, its effectiveness in the literature is still controversial. Therefore, the present systematic review aimed to indicate the existing evidence in the literature on KT application used in individuals with cervical pain and to evaluate the application results in these patients.

MATERIALS AND METHODS

The articles to be selected within the scope of the study were searched by two researchers “*blinded for peer-review*” using “PubMed, Scopus, Web of Science (WoS), Science Direct databases”. Only English publications were searched in the databases with a following keywords: (“kinesiotape”

OR “kinesio tape” OR “kinesio taping” OR “kinesiotaping”) AND (“neck” OR “cervical”) AND (“pain”).

The inclusion criteria were: (a) Studies with human participants published in English in peer-reviewed scientific journals between baseline and 2022 (b) study design randomized controlled trial (RCT) (c) studies involving participants aged 18 years or older with neck pain regardless of pain duration, type, gender (d) studies comparing KT with placebo taping or another intervention (e.g., electrotherapy, exercise, dry needling) or adding KT to another intervention (e) studies evaluating at least pain, disability, or range of motion for the KT effect. The exclusion criteria were: (a) absence of a control group (b) non-randomized controlled studies (c) non-peer-reviewed publications (d) case reports (e) quasi-experimental studies (f) cohort (g) published theses (h) expert opinions (i) English article without full text (j) articles whose full text is not in English (k) articles whose participants are <18 years old.

Study selection and data extraction: “PRISMA guidelines” were used (14). “Titles and abstracts” were reviewed by using keywords independently by two researchers “*blinded for peer-review*”. The studies were examined in detail using the Rayyan software to detect duplications in systematic reviews. The first and second researchers “*blinded for peer-review*”, reviewed the “titles and abstracts” of the relevant articles. A total of 485 studies [PubMed (n=51, Scopus (n=61), Web of Science (n=75), Science Direct (n=298)] were accessed through databases. This process is given in Figure 1.

Decisions regarding papers suitability for the current systematic review were carried out by two authors “*blinded for peer-review*”. Disagreements between researchers at each stage were discussed and resolved by the third researcher “*blinded for peer-review*” to reach a consensus. Twelve studies were included in the current systematic review. The contents of the studies are shown in Table 1.

Methodological quality assessment: The PEDro scale was used for the quality assessment of the current systematic review. Quality assessment was done by two independent researchers “*blinded for peer-review*”. The third researcher “*blinded for peer-review*” resolved disagreements through discussion and consensus.

Table 1. Summary of included articles

Article	Study Design	Objective	Disease of the Sample	Age	Control Group (CG) (n)	Intervention Group (IG) (n)	Interventions	Outcomes/ follow-up	Results
Mariana&Carmen-Oana (2014) ¹¹	Randomized controlled trial	To investigate the effects of massage and kinesiotape together with a kinetic program on outcome measures in the cervical region	Mechanically triggered neck pain	20-40	n=3 F: %100	n=3 F: %66.6	IG: After the physiotherapy program, kinesiotape was applied once a week. "Y" taping was applied to the paravertebral muscles between C2-T2. "I" band was applied to C7 level. ^a CG: Relaxing massage maneuvers were applied before each physiotherapy session. After the massage, passive mobilizations were applied in every direction and possible range of motion. ^a	NPRS, NDI, ROM at 1, 2, 3 and 4 weeks	The difference between the two groups in terms of NPRS is a decrease of -3.34 points in favor of the kinesiotape group. The difference between the two groups in terms of NDI is a decrease of %12.81 in favor of the kinesiotape group. The difference between the two groups was 7.8° increase in flexion direction, 0.63° increase in extension direction, 7.24° increase in right lateral flexion direction, 1.53° increase in left lateral flexion direction, 8.16° increase in right rotation direction and 3.43° increase in left rotation direction in favor of the kinesiotape group.
Kılınc et al. (2015) ¹²	Randomized controlled trial	To investigate the effects of kinesiotape in addition to mobilization techniques in chronic mechanical neck pain	Mechanical neck pain	18-50	n=14 F: N/A	n=14 F: N/A	IG: In addition to the treatment applied to CG, kinesiotape was applied to the upper trapezius, levator scapula and sternocleidomastoid muscles. Mechanical correction technique was applied to correct the scapula and upper body posture. The tape remained on the body for 4 days. CG: Scapular mobilization, ischemic compression for trigger points, antero-posterior and medio-lateral cervical gliding and cervical manual traction	Cranio-cervical flexion test with pressure biofeedback tool, VAS and BDI at baseline and 4 days later.	There was NS difference between the groups in Cranio-cervical Flexion Test Scores (p=0.322), severity of headache (p=0.728) and neck painless time (p=0.857).
Puerma-Castillo et al. (2018) ¹³	Single-blind randomized clinical trial with parallel design	To determine the effectiveness of kinesiotape in addition to conventional rehabilitation in patients with neck pain	Mechanical neck pain	18-55	(PG) n=15 F: %80 (CR) n=15 F: %83.3	n=15 F: %69.2	IG: Kinesiotaping and conventional rehabilitation. Kinesiotape was applied in the cranial direction up to C1-C2 with 25% tension in a "Y" shape parallel to the cervical paravertebral muscles. Taping was done in the form of "I" with 50% tension at a 90° angle to the first taping. The bands were changed at the end of the 4th physiotherapy session CG (CR): Conventional rehabilitation CG (PG): Sham kinesiotaping and conventional rehabilitation. It was done in the form of 2 strips like the kinesiotape application, but different material was used and tension was not applied. ^b	SF-36 at baseline and 1 month. VAS, ROM, diary of medications taken at baseline, 24 hours later, 4 th day and 1 month.	There was NS difference between the groups in terms of outcome measures.

<p>El-Cendy et al. (2018)¹⁴</p>	<p>Randomized, double-blinded controlled trial</p>	<p>To investigate the effect of kinesiotape application together with exercises on outcome measures in patients with chronic mechanical neck pain</p>	<p>Mechanical neck pain</p>	<p>30-40</p>	<p>n=30 F: %73.3</p>	<p>n=30 F: %66.6</p>	<p>IG: In addition to the same program of the control group, kinesiotape changed every 4 days was applied. A Y-shaped band applied with 15-25% tension from the dorsal region (T1-T2) to the upper cervical region (C1-C2). Another medium tension I-shaped tape was applied perpendicular to the Y strip at the C3-C6 level.^c CG: Infrared, stretching (levator scapula, upper trapezius fibers, sternocleidomastoideus, scalene muscles), isometric contraction and strengthening exercises (deep cervical flexors, shoulder retractors, scapular pinch, serratus anterior).^c</p>	<p>VAS, NDI and ROM at baseline, 1 week and 6 weeks</p>	<p>There was NS difference over time for neck pain after 1 week and 6 weeks of treatment (p=0.016, p=0.892, respectively). The IG group experienced greater reductions in pain intensity after 1 week and similar improvement in both groups after 6 weeks. There was a statistically significant group interaction on a time basis for NDI after 1 week of treatment (p=0.034) and no significant interaction after 6 weeks of treatment (p=0.567). The IG group experienced greater reductions in NDI after 1 week and similar improvement in both groups after 6 weeks. After 6 weeks of treatment, flexion (p=0.021), left lateral flexion (p=0.007) and right rotation (p=0.024) were statistically significant in favor of IG. The IG group showed greater improvement in flexion, left lateral flexion and right rotation than CG at the end of treatment; however, both groups showed similar improvements in overall ROM at weeks 1 and 6.</p>
<p>Genç et al. (2019)²¹</p>	<p>Prospective, double-blinded, randomized controlled study</p>	<p>To investigate the short-term effects of kinesiotape applied to the cervical spine on outcome measures in patients after thyroidectomy</p>	<p>Total thyroidectomy</p>	<p>>18</p>	<p>n=34 F: %79.41</p>	<p>n=34 F: %70.58</p>	<p>IG: A 5 cm Y-shaped tape was applied symmetrically over the posterior cervical extensor muscles with 25% tension and from the dorsal region (T1-T2) to the upper cervical region (C1-C2). The second strip was 5 cm wide and applied in an I shape. It was applied perpendicular to the Y-strip over the mid-cervical region (C3-C6). CG: While the patient's cervical spine was flexed without applying tension in the transverse plane, only a 5 cm wide I-shaped tape was applied to the mid-cervical region.</p>	<p>VAS at before surgery, 30 minutes-4 hours-12 hours-24 hours and 7 days after post-anesthesia care unit discharge. ROM at before and 24 hours after the procedure. NDI at before and 7 days after surgery.</p>	
<p>Onat et al. (2019)²⁰</p>	<p>Randomized clinical study</p>	<p>To evaluate the effects of kinesiotape and dry needling in patients with mechanical neck pain.</p>	<p>Neck pain provoked by neck postures, neck movement or palpation</p>	<p>IG (mean): 45.1 ± 12.5 CG (mean): 44.1 ± 14.2</p>	<p>n=36 F: %80.55</p>	<p>n=36 F: %72.2</p>	<p>IG: Y-strip shaped tape was applied over the cervical extensor muscles with 15%-25% tension. It was applied from the dorsal region (T1-T2) to the upper cervical region (C1-C2). The second tape was applied perpendicular to the Y-strip on the mid-cervical region (C3-C6).^d CG: The application was made after the location of hyperalgesia was determined by palpation. Needling was performed 6-8 times by moving the needle back and forth to the posterior cervical spinal muscles. The application was applied once a week for 4 weeks.^d</p>	<p>NPRS, ROM, NDI, SF-36 and BDI at baseline and 4 weeks</p>	

Ünlü Özkın et al. (2020) ⁸	Double-blinded, randomized, placebocontrolled study	To evaluate the efficacy of kinesiotape in patients with chronic nonspecific neck pain	Chronic neck pain	18-40	n=22 F: %72.6	n=23 F: %82.6	IG: The first taping was applied to the posterior cervical extensor muscles (longissimus cervicis) in a "Y" shape. I strip tape was placed over the mid-cervical region. ^e CG: Sham taping consisted of two I-strips applied tension-free to the 7th cervical spinous process while the patient was sitting in the neutral position. ^e	Lateral cervical radiography at baseline and 1 month. VAS, NDI and ROM at baseline, 2 weeks and 1 month	There was a statistically significant decrease in VAS scores in the IG group (p<0.05). However, there was NS decrease in pain scores in the CG group (p>0.05). NDI scores were significantly decreased in both the IG and CG groups (p<0.001 and p=0.006, respectively) at the end of treatment and also at 1 month from baseline. Patients in the IG group experienced a significant increase in all ROM degrees after treatment. In the CG group, only the degrees of cervical extension, right lateral flexion and left rotation were significantly increased. Although the increase in the rate of patients with effective cervical lordosis was higher in the IG group, there was NS difference between the two groups.
Arias-Burria et al. (2020) ¹⁵	Randomized, parallel-group, controlled trial	To evaluate the effect of dry needling and kinesio taping applied to the upper trapezius muscle	Mechanical neck pain	IG (mean): 25 ±4 CG (mean): 25 ± 5	n=18 F: %47.05	n=18 F: %41.17	IG: The tape was applied with 15-25% tension. Tension-free "Y" shaped taping was applied to the upper trapezius muscle. ^f CG: No tape was applied to the control group. Only received dry needling application. ^f	NPRS at baseline, 5 minutes later, 24 hours, 48 hours and 72 hours. NDI and SPADI at baseline and 72 hours. Algometer at baseline, immediately after taping and 72 hours.	NS difference was found for pain induction after post dry needling (p=0.26). Cervical disability (p=0.62) and shoulder-related disability (p=0.41) also did not reveal a statistically significant group x time interaction. There was NS group x time interaction on pressure pain sensitivity after dry needling (p=0.52), but it did show a significant time effect in both groups (p<0.001).
Zeeshan et al. (2020) ²¹	Randomized controlled trial	To investigate the effects of kinesiotape on improving sensorimotor function and neck disability in patients with chronic neck pain	Neck pain	30-50	n=15 F: %0	n=15 F: %0	IG: Taping was applied to the upper trapezius and serratus anterior. Kinesiotape was applied to the upper trapezius in the form of "T". While the upper trapezius was applied from the insertion to the origin, the serratus was applied anteriorly from the origin to the insertio. ^g CG: Serratus anterior and upper trapezius were applied. Sham tape was applied without direction of application. ^g	Cervical joint position sense with inclinometer, NDI and ROM at baseline and 1 week later.	There was a significant difference in favor of IG in proprioception (p=0.0001) and NDI (p=0.001) scores between the groups. However, NS difference was found in terms of ROM.

<p>Alahmari et al. (2020)¹⁶</p>	<p>Randomized, placebo-controlled trial</p>	<p>To compare the effects of kinesiotape administration versus placebo administration on cervical proprioception in athletes with mechanical neck pain</p>	<p>Mechanical neck pain</p>	<p>>18</p>	<p>n=33 F: N/A</p>	<p>n=33 F: N/A</p>	<p>IG: First, the "Y" shaped tape was applied to the cervical muscles (from T1-T2 to C1-C2). Second, an I-strip placed perpendicular to the Y-strip covering the posterior cervical muscles at maximum tension to the mid-cervical region (C3-C6).^b CG: Kinesiotape application was performed with Y – and I-strips, similar to the real application, without applying any tension to the cervical muscles.^b</p>	<p>Cervical proprioception, VAS and NDI at baseline, 3 days and 7 days after.</p>	<p>Day 3 results for joint position errors showed statistically significant group-time interactions favoring IG for flexion ($p=0.046$), extension ($p=0.010$), and right rotation ($p=0.034$). On the 7th day, it showed a statistically significant group-time interaction in favor of IG for flexion ($p<0.001$), extension ($p<0.001$), left rotation ($p<0.001$) and right rotation ($p<0.001$). The IG group showed significant improvement in decreased joint position errors in flexion, extension, left rotation, and right rotation, significantly more than CG at the end of 7 days. VAS score; group interaction ($p<0.001$) over time of 7-day patching was statistically significant, but there was NS interaction after 3-day patching ($p=0.567$). Participants in the kinesiotape group experienced a more significant reduction in pain intensity after 7 days of tape application, and a similar improvement in both groups after 3 days. NS group interactions over time were observed for NDI at 3 days ($p=0.756$) and 7 days ($p=0.977$) after patch application.</p>
<p>Sanchez-Jorge et al. (2021)¹⁷</p>	<p>Randomized double-blinded clinical trial</p>	<p>To determine the acute effects of neuromuscular taping on outcome measures in individuals with neck pain</p>	<p>Mechanical idiopathic chronic neck pain</p>	<p>18-45</p>	<p>n=30 F: %60</p>	<p>n=30 F: %60</p>	<p>IG: "Y" shaped taping was applied to the upper trapezius muscle from insertion to origo with 15% tension. Both upper trapezius muscles were taped. CG: Sham taping consisted of a Y-strip applied without tension. For placebo taping, the participants' cervical spine was placed in a neutral position.</p>	<p>VAS, ROM and head position with craniocervical angle at baseline and immediately after taping.</p>	<p>Group interaction over time was statistically significant for reducing the VAS score ($p=0.00$), showing a 3.5/10 point reduction in pain immediately after administration in the IG group. In terms of pain, IG achieved a similar improvement (3.7/10 points) to CG ($p=0.00$). There was NS group interaction over time for head position measured using the craniocervical angle while patients were sitting ($p=0.83$) and standing ($p=0.21$). Cervical ROM values in flexion ($p=0.65$), extension ($p=0.01$), left lateral flexion ($p=0.85$), right rotation ($p=0.08$), and left rotation ($p=0.9$), according to time NS group interactions were found. Group interaction over time was statistically significant for right lateral flexion ($p=0.03$) ROM.</p>

<p>Celenay et al. (2021)¹⁹ Prospective randomized clinical trial</p>	<p>To compare the effects of kinesiotape and classical massage in addition to cervical stabilization exercise in patients with chronic neck pain</p>	<p>Chronic neck pain 18-65 F: %59.10</p>	<p>n=21 F: %52.38</p>	<p>IG: KT was applied 3 days a week for 4 weeks. A Y-shaped tape was adhered on the posterior cervical extensor muscles from T1-T2 to C1-C2 with 10-15% tension using muscle technique. An I-shaped band was placed perpendicular to the Y-shaped band in the mid-cervical region (C3-C6) using the ligament technique (75-100% tension). The other two I-shaped bands were placed over the upper trapezius muscles using the muscle technique with 10-15% tension.¹ CG: Classical massage was applied 3 days a week for 4 weeks. The Swedish technique was applied to the upper trapezius, erector spinae and levator scapula muscles for approximately 20 minutes.¹</p>	<p>NDI, VAS, ROM and SF-36 at baseline and 4 weeks later</p>	<p>There was a significant difference between the groups in favor of IG in NDI (p=0.006) and physical component summary scores (p<0.001). Right rotation (p=0.047) and left (p=0.006) rotation movements were significant in favor of the CG group.</p>
				<p>Pain intensity at rest (p=0.091), night (p=0.122), and activity (p=0.207), ROM (flexion (p=0.484), extension (p=0.623), right lateral flexion (p=0.174), and left lateral flexion (p=0.052)) and mental component summary scores (p=0.301) were NS different.</p> <p>After 4 weeks of treatment, NDI (p<0.001) and VAS (pain intensity at rest (p<0.001), during activity (p<0.001), at night (p<0.001)) scores decreased and ROM (flexion (p<0.0011), extension (p=0.003), right lateral flexion (p=0.005) and left (p=0.020) lateral flexion, right rotation (p=0.001) and left (p=0.006) rotation), and physical component summary (p<0.001) and mental component summary (p=0.023) scores increased in the IG group. In the CG group, NDI (p=0.001) and VAS (rest (p=0.012), activity (p=0.003), nighttime (p=0.003)) scores decreased and ROM (flexion (p=0.001), extension (p=0.014) scores were decreased, right lateral flexion (p=0.001) and left (p=0.002) lateral flexion, right rotation (p=0.001) and left (p<0.001) rotation) and physical component summary score (p=0.018) increased, but mental component summary score (p=0.072) did not change significantly after 4 weeks of treatment.</p>		

CG: Control group; **IG:** Intervention group; **n:** Number of Cases; **F:** Female; **NPRS:** Numeric Pain Rating Scale; **NDI:** Neck Disability Index; **ROM:** Range of Motion; **VAS:** Visual Analogue Scale; **BDI:** Beck Depression Inventory; **NS:** Not significant; **PG:** Placebo group; **CR:** Conventional rehabilitation; **SF-36:** Short Form-36; **SPADI:** Shoulder Pain and Disability Index; **N/A:** Not Available

^aThe treatment lasted 4 weeks. All participants received an active static and dynamic physiotherapy program with resistance exercises 3 times a week.

^bWritten material about bad posture and movements was given. The neutral position of the spine was taught. Supervised simple exercises to be done 4 days a week were taught and written material was also given. Manual therapy sessions were applied.

^cThe intervention was applied 3 days a week for 6 weeks.

^dPatients in both groups were taught a standard home-based exercise program consisting of stretching and strengthening of the neck and upper back muscles, reeducation of neutral stance, and reeducation of the scapular muscles, 5 sessions per week for 4 weeks, with 10 repetitions of each exercise.

^ePatients received treatment 3 times a week for a total of 2 weeks. All patients in both groups were given the same exercise program consisting of cervical range of motion, stretching and isometric neck exercises.

^fDry needling was applied to active trigger points of all participants. After the first local twitch response was obtained, the needle was moved up and down until no more local twitch responses appeared.

^gKinesiotape was applied to the intervention group for 1 week, and sham tape was applied to the control group for 1 week.

^hThe tapings were reapplied every other day for a week.

ⁱCervical stabilization exercises were applied to both groups 3 days a week for 4 weeks (12 sessions). Its main purpose is to activate the deep cervical muscles. Correct postural alignment was taught to the participants and information was given about the deep cervical muscles and their functions. Then, postural alignment, cervical bracing technique and activation of deep cervical muscles were taught. The exercises were performed with 8-12 repetitions while holding the contraction for 10 seconds in each position.

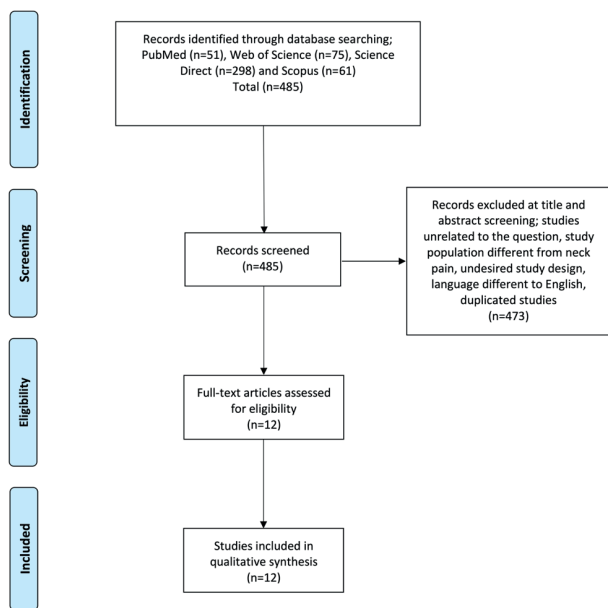


Figure 1. PRISMA flow diagram of the study

RESULTS

A PRISMA flowchart summarizing the scanning process is given in Figure 1. In the electronic database search, 485 records were detected. After scanning titles, abstracts, and, where appropriate, full texts, a total of 12 studies met inclusion criteria. Figure 1 and Appendix 1 were presented detailed information on search strategy, databases' numeric data, and inclusion criteria. The summary of the studies is presented in Table 1. The enrolled studies aimed to compare; KT applications and massage, mobilization techniques, conventional rehabilitation, exercise interventions, sham KT, dry needling, and cervical stabilization exercises.

The diseases of the samples were mostly (58.3% of studies) stated as mechanical neck pain (15-21). Among the remaining studies, two studies specified chronic neck pain (22, 23), one study neck posture-motion-palpation-induced neck pain (24), one study total thyroidectomy (25) and one study neck pain (26) diseases as samples. Considering the age ranges of the studies and the total number of samples included, the starting value was 18 years old, and the total number ranged from 6 to 72 participants, respectively. In terms of gender, more than half of the sample size was selected as female in eight studies (15, 17, 18, 21-25). In one study, less than half of the gender distribution was

female (19). In one study, none of the participants were women (26). In two studies, the gender distribution of the participants was not specified (16, 20).

KT applications were left adhered to for 2 to 7 days. The intervention approaches in the studies are in the intervention groups; conventional physiotherapy program, Y-shaped taping to paravertebral, cervical extensor, upper trapezius muscles, I-shaped tape adhered perpendicular to Y tape, taping for upper trapezius, sternocleidomastoideus, levator scapulae, serratus anterior muscles, taping using mechanical correction technique, mobilization techniques, ischemic compression, dry needling, cervical stabilization exercises. The intervention approaches in the studies were in the control groups; conventional physiotherapy program, massage maneuvers, passive mobilizations, mobilization techniques, ischemic compression, sham KT, infrared, stretching, isometric contraction, strengthening exercises, dry needling, cervical stabilization exercises.

Outcome measures: Range of Motion (ROM) (15, 17, 18, 21-26) and Neck Disability Index (NDI) (15, 18-20, 22-26) are the most widely used (75%) measurement methods in this regard. Again, the highly preferred (66.6%) measurement method is the Visual Analog Scale (VAS) (16-18, 20-23, 25). Numeric Pain Rating Scale (NPRS) (15, 19, 24) and Short Form-36 (SF-36) (17, 23, 24) measurement methods were used in three studies each. Beck Depression Inventory (BDI) (16, 24) and cervical proprioception (20, 26) measurement methods were applied in two studies each. Measurement methods, each of which is used in one study, are Shoulder Pain and Disability Index (SPADI) (19), algometer (19), head position with craniocervical angle (21), craniocervical flexion test (16), diary of medications taken (17), lateral cervical radiography (22).

Therapy effects: Mariana&Carmen-Oana (15) found a difference in favor of IG with a decrease of 3.34 points between the two groups in the NPRS score. In the comparison between the groups, the IG showed a better difference with a 12.81% decrease in the NDI score. Various angle differences in the "ROM degrees of flexion, extension, right lateral flexion, left lateral flexion, right rotation, and left rotation directions" showed better improvement in the IG group between the groups. Kılınc et al. (16) showed no significant difference between the groups in Craniocervical Flexion Test scores ($p=0.322$), the severity of headache ($p=0.728$) neck painless time ($p=0.857$) in their studies. Puerma-Castillo et al. (17) did not report significant differences between groups in any of the outcome measures

of their studies. El-Gendy et al. (18) found no significant difference in pain scores at 1 week and 6 weeks follow-up, respectively ($p=0.016$, $p=0.892$).

The IG group showed better reductions in NDI after 1 week and similar improvement in both groups after 6 weeks. In terms of ROM, after 6 weeks of treatment, flexion ($p=0.021$), left lateral flexion ($p=0.007$) and right rotation ($p=0.024$) were statistically significant in favor of IG. Genç et al. (25) presented significantly better results in IG in pain scores between groups ($p=0.006$). There was no significant difference between the groups in ROM degrees and NDI scores ($p=0.486$). The mean needs for analgesic use showed significantly greater improvement in IG between the two groups ($p=0.011$). Onat et al. (24) reported significantly better results in IG between groups in ROM and NDI scores, which are outcome measures ($p<0.05$).

There was no significant difference between the groups in the remaining outcome measures of NPRS, SF-36 (except for one subgroup score) and BDI scores ($p>0.05$). In addition, there was a significant difference between the groups in favor of IG in the SF-36 physical role difficulties subgroup score ($p=0.047$). Ünlü Özkan et al. (22) reported a significant difference in IG in terms of VAS score ($p<0.05$), but not in CG ($p>0.05$). NDI scores improved significantly in both IG and CG groups ($p<0.001$ and $p=0.006$, respectively). Significant increases were observed in all

degrees of ROM in IG. In CG, significant increases were observed in the directions of cervical extension, right lateral flexion and left rotation.

There was no significant difference between the groups in terms of effective cervical lordosis. Arias-Buria et al. (19) did not report a significant difference in pain after dry needling. There was no significant difference between the groups in the cervical disability ($p=0.62$) and shoulder-related disability ($p=0.41$) scores. Pressure pain sensitivity did not show a significant difference in group x time ($p=0.52$). However, in terms of time effect, a significant difference was found in both groups ($p<0.001$). Zeeshan et al. (26) reported better results in IG between groups in proprioception measurement ($p=0.0001$) and NDI scores ($p=0.001$). No significant difference was reported in ROM values. Alahmari et al. (20) reported significantly better results in flexion ($p=0.046$), extension ($p=0.010$) and right rotation ($p=0.034$) directions in IG for group x time on the third day of proprioception measurement. On the seventh day, significantly more improvement in IG was reported in flexion ($p<0.001$), extension ($p<0.001$), left rotation ($p<0.001$) and right rotation ($p<0.001$) directions. There was no significant difference between the groups in VAS scores on the third day ($p=0.567$), but significantly better results were obtained in the IG on the seventh day ($p<0.001$).

Table 2. PEDro scores

Article	Q-1 ^a	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Total
Mariana&Carmen-Oana (2014) ¹¹	Y	Y	N	N	N	N	N	Y	N	Y	Y	4
Kılınc et al. (2015) ¹²	Y	Y	N	Y	N	Y	N	N	N	Y	Y	5
Puerma-Castillo et al. (2018) ¹³	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	8
El-Gendy et al. (2018) ¹⁴	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	8
Genç et al. (2019) ²¹	Y	Y	N	Y	N	Y	N	Y	N	Y	Y	6
Onat et al. (2019) ²⁰	Y	Y	N	Y	N	N	N	Y	N	Y	Y	5
Ünlü Özkan et al. (2020) ¹⁸	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	7
Arias-Buria et al. (2020) ¹⁵	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	8
Zeeshan et al. (2020) ²²	Y	Y	N	Y	N	N	N	Y	N	Y	Y	5
Alahmari et al. (2020) ¹⁶	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	8
Sanchez-Jorge et al. (2021) ¹⁷	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	9
Celenay et al. (2021) ¹⁹	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	6
Total	12	12	6	11	1	8	4	11	2	12	12	

Q-1: Eligibility criteria; Q-2: Random allocation; Q-3: Concealed allocation; Q-4: Baseline comparability; Q-5: Blind subjects; Q-6: Blind therapists; Q-7: Blind assessors; Q-8: Adequate follow-up; Q-9: Intention-to-treat analysis; Q-10: Between-group comparisons; Q-11: Point estimates and variability

^aThis item relates to external validity and therefore does not contribute to the total score.

There was no significant difference in NDI scores both on the third day ($p=0.756$) and on the seventh day ($p=0.977$). Sanchez-Jorge et al. (21) in terms of VAS, both groups reported significant improvement in immediate outcomes. There was no significant difference in the measurement of head position with craniocervical angle while the patient was standing ($p=0.21$) and sitting ($p=0.83$). There was no significant difference in ROM degrees in flexion, extension, left lateral flexion, right rotation, and left rotation directions. Significant improvement in IG has been reported in right lateral flexion ($p=0.03$). Celenay et al. (23) reported significantly better results in NDI ($p=0.006$) and physical component summary scores ($p<0.001$) in IG.

Results of methodological quality assessment: Four articles were “moderate” (15, 16, 24, 26), seven articles were “good” (Table 2) (17-20, 22, 23, 25) and last one study was “excellent” (21) level of evidence. “More than half of the included studies (58.3%) had a PEDro scoring score ranging from 6 to 8”. The median and mode PEDro scores of the studies were 6.5 and 8, respectively (min:4, max:9).

DISCUSSION

The present systematic review was purposed to demonstrate the effectiveness of KT application in patients with cervical pain. Also, it was aimed to reveal the clinical results of the KT application in these patients. KT applications may provide additional advantages in terms of pain, ROM and function in the short term. On the other hand, it was deduced that KT applications could contribute to proprioception, psychosocial status and quality of life in the medium term. Further study should evaluate the effect of KT on separate parameters (e.g., kinesiophobia, pain catastrophizing, fear-avoidance).

It was noticed that the studies were in the “good” class in terms of the level of evidence. KT was compared with many applications (massage, mobilization techniques, conventional rehabilitation, exercise interventions, sham KT, dry needling, and cervical stabilization) (13, 15-20, 22-26). Short-term efficacy of KT has been reported in many systematic reviews (28-30). It is estimated that KT provides an advantage in addition to conventional applications in musculoskeletal diseases, primarily through its pain-reducing or awareness effect (31). Better result might be obtained with different designed studies in neck pain such as on the effect of proprioception and kinesiophobia.

The majority of cases in the studies were mechanical neck pain (15-21). Mechanical conditions, which are already the leading causes of neck pain, can cause to short and medium-term pain (32). Providing mechanical alignment may be effective in increasing the neck pain of these patients (33). It was considered that KT could lead to satisfactory results in this case group, owing to this awareness feature and additionally its ability to help release the pain-spasm cycle. It is seen that there is a wide range of individuals between the ages of 18-and 72 with chronic neck pain (13, 15-20, 22-26). This situation suggested that the clinical conditions of individuals may vary due to different comorbid conditions. In this respect, a sole focus on musculoskeletal pain in elderly individuals can provide effectual output, especially for meta-analysis studies.

In the studies, it was observed that the KT application was applied for 2 to 7 days (13, 15-20, 22-26). It has been determined that different techniques (e.g., I shaped, Y shaped) are used for different purposes, and thus various symptoms are tried to be improved. Applications lasting less than one week also attract attention. Observing the longer-term effects of KT application for as long as 1 month may provide additional clues to emphasize the sustainability of the improvement in symptoms. In particular, the difficulty of reaching the therapist who will perform KT may have prevented the long-term application of KT in studies.

It was noticed that VAS (16-18, 20-23, 25) and NDI (15, 18-20, 22-26) were used most frequently in studies. It is comprehended that VAS is the most commonly used assessment tool in assessing pain in musculoskeletal diseases. On the other hand, NDI is a questionnaire accepted as the gold standard in the evaluation of disability in chronic neck pain. It can be supposed that ROM evaluation is the most important of the objective evaluations of the disease (15, 17, 18, 21-26). Recent surveys that include pain assessment in different joint ranges of motion reveal the importance of combined pain assessment with a range of motion (34). Therefore, it was an output that was expected to be one of the most frequently used evaluation tools in this corpus. Proprioception, quality of life, and psychosocial status were also addressed in 2-3 studies. It was significant to prefer SF-36 significantly since functional losses due to pain affect the quality of life in individuals. Improvement in kinesiophobia through the effect of awareness can also improve psychosocial status. It can also be qualified as an additional indicator of awareness in proprioception (35).

Mariana & Carmen-Oana reported that KT provides an additional advantage in terms of pain, function and ROM in patients with mechanical neck pain over 1-4 weeks compared to conventional physical therapy applications. The short-term pain-reducing effect was reflected in the ROM and function results (15). This study revealed that KT provides more favorable results in these three parameters than massage and mobilization applications. Further studies may focus on the short-term efficacy of KT in neck patients by focusing on the comparison of CT after physiotherapy with sham LT. In another study conducted with mechanical low back pain cases, Kılınç et al. did not observe any difference between manipulation and mobilization and KT applications in terms of short-term pain, psychosocial status, and Craniocervical flexion test (16). It was a natural situation that no difference was observed in terms of psychosocial status in a short period of 4 days. In addition, the lack of difference in terms of pain may be due to the fact that the patients did not have an excellent effect to reflect the physiological effect of KT on the subjective evaluation results. On the other hand, Puerma-Castillo et al. showed that CT did not contribute to sham application in terms of short and medium-term (1 month) VAS, ROM and quality of life in patients with mechanical low back pain (17). This situation thought us to comment that it is also necessary to focus on the psychological effect of KT rather than its physiological effect.

In individuals with mechanical low back pain (El-Gendy et al.), in short (1 week) and medium-term (6 weeks) follow-up, KT, in addition to conventional physiotherapy, was not effective in terms of pain but showed positive results in terms of disability. KT offered more effective clinical outcomes, specifically flexion, lateral flexion, and rotation (18). It assembled us to consider that this situation increased the awareness of individuals independent of pain and prompted individuals to act in painless ROM. However, contrary to these results, Genç and colleagues reported that KT positively affected short-term pain in total thyroidectomy patients. It was reported that this positive effect was not valid for disability and ROM (25). We believe it may be essential to deal with the pain reduction effect of KT with more objective methods.

Onat et al. reported that KT was influential in the mid-term (4 weeks) in terms of pain and stability (24). However, it should be emphasized that the results based on pain and function in terms of quality of life and psychological state may not yet be reflected in the psychosocial state and

quality of life. In another study conducted with individuals with chronic low back pain, Ünlü Özkan et al. emphasized that KT is more effective in terms of pain than sham taping (22). However, additional evidence is needed on how long it can reduce pain. Arias-Buria et al. compared KT with dry needling in mechanical neck pain (19). In terms of short-term outcomes, no difference was observed between the groups in terms of pain and disability. Since the 72-hour effect did not result in the patient's clinical condition, it made us think that more studies should be focused on longer-term KT applications. Zeeshan et al. reported that KT had a positive effect on proprioception and function in a 1-week period, but there was no difference in ROM compared to sham application (26). This situation made us think again about the additional effectiveness of KT in terms of the painless range of motion and increasing awareness.

Alahmari et al. discussed tension and tensionless KT applications. It was observed that better results were obtained in the tension technique in terms of ROM, disability and pain. Since it is known that the most critical functions of KT can be achieved with the tension technique, it was reported that the physiological effect of KT should be considered more than sham applications (20). Sanchez-Jorge et al. According to the sham application, a positive effect of KT in terms of pain in the short term was reported (21). Finally, Celenay et al. showed that KT is effective in the mid-term (4 weeks) in terms of ROM, disability, pain, and psychosocial status (23). The heterogeneity of the methodologies of the studies and the variation in the follow-up processes of the results may have led to different results.

Some limitations of the review should be acknowledged. First, it was impossible to create a homogeneous data pool in the compilation due to the methodology of the studies. Some databases were not available to the authors in terms of access. We could not perform a sub-analysis of the KT type due to the heterogenous choice of methodologies. Further studies should evaluate the effect of KT on separate parameters (e.g., kinesiophobia, pain catastrophizing, fear-avoidance).

KT applications may provide additional advantages in terms of pain, ROM and function in the short term. On the other hand, it was deduced that KT applications could contribute to proprioception, psychosocial status and quality of life in the medium term. With further studies, the effect of Kinesio Taping on different parameters such as kinesiophobia, catastrophizing pain, and avoidance of fear should be evaluated.

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