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The clinical efficacy of kinesio taping in shoulder disorders: a systematic review and meta analysis

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Abstract

Objective: To evaluate the effects of kinesio taping on shoulder disorders, as a single treatment modality or as conjunction to other treatments.

Data sources: MEDLINE, PEDro (Physiotherapy Evidence Database), The Cochrane Library, Web of Science, Embase and OpenGrey databases were searched for trials published before 5 February 2020.

Methods: This study was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline statement. Randomized controlled trials published in English or Turkish were included. The methodological quality of the studies was assessed with the Physiotherapy Evidence Database scale. For analysis of continuous data, mean differences (MDs) or standardized mean differences (SMDs) with 95% confidence intervals (CIs) were used. The I^2 statistics was used to measure the heterogeneity.

Results: Fourteen studies were included with 680 participants. Kinesio taping did not produce better results on pain compared to sham (MD by –0.77 (95% CI = –1.77, 0.22), $P=0.13$), exercises (MD by –0.51 (95% CI = –1.41, 0.39), $P=0.27$), or passive treatments (MD by –0.29 (95% CI = –0.77, 0.19), $P=0.24$). Similarly, kinesio taping did not found superior to sham kinesio taping (SMD by –0.01 (95% CI = –0.31, 0.29), $P=0.94$), exercises (SMD by 0.41 (95% CI = –0.25, 1.07), $P=0.22$), or passive treatments on function (SMD by –0.02 (95% CI = –0.19, 0.15), $P=0.82$). There was no significant SMD on range of motion (ROM) by –0.07 (95% CI = –0.47, 0.33, $P=0.74$) compared to sham kinesio taping and –0.06 (95% CI = –0.20, 0.09, $P=0.46$) compared to passive treatment. Overall, effect size was found small to moderate.

Conclusion: Despite reported positive effects in some studies, there is no firm evidence of any benefit of kinesio taping on shoulder disorders.

Keywords

Kinesio tape, taping, shoulder pathologies, shoulder pain, physiotherapy

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Introduction

Kinesio taping has become one of the popular non-surgical treatment methods for many musculoskeletal disorders.[1,2] There are several proposed action mechanisms of kinesio taping, including proprioceptive neuromuscular facilitation,[3,4] reducing muscle fatigue and soreness,[5,6] pain inhibition,[7,8] and improving healing through reduced swelling and increased blood flow.[9] Despite insufficient evidence supporting these mechanisms, kinesio taping is a widely used therapeutic intervention that has been the topic of many clinical trials.

Several systematic reviews or meta-analysis were published evaluating the effects of kinesio taping on musculoskeletal disorders.[10–14] Majority of these studies revolved around many different pathologies under the name of musculoskeletal disorders or sport injuries.[11–13] Kinesio taping is most commonly used for shoulder disorders such as impingement syndrome, rotator cuff pathologies and calcific tendinopathy. However, there is no current and high-quality systematic or meta-analysis is available supporting the beneficial effects on shoulder pathologies. Only three of all published systematic reviews on this topic were related to shoulder disorders; which did not directly address the effects of kinesio taping specifically on shoulder disorders.[10,14,15] Desjardins-Charbonneau et al.[10] reported the effectiveness of different taping methods such as kinesio taping or nonelastic taping which were applied with different purposes to treat rotator cuff tendinopathy. The authors reviewed literature until 2014 and ruled out other shoulder disorders. Saracoglu et al.[14] aimed to evaluate the effects of taping in addition to physiotherapy in subacromial impingement syndrome. The authors applied a narrative synthesis based on only four studies. The most recent systematic review conducted by Ghozy et al.[15] included a wide range of diagnoses such as shoulder disability after mastectomy, hemiplegic shoulder pain or asymptomatic overhead athletes, published until 2017.

All these limitations mentioned above emerged a need for an updated systematic review and meta-analysis specific to shoulder pathologies. Therefore, in this meta-analysis, we have aimed to systematically review the evidence provided by literature and analyse the clinical efficacy of kinesio taping specifically focused on shoulder disorders.

Methods

The protocol for this systematic literature review was registered with the International Prospective Register of Systematic Reviews (registration number CRD442015024874). This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[16] The following electronic databases were searched up to 5 February 2020: MEDLINE (PubMed), Physiotherapy Evidence Database, The Cochrane Library, Embase and Web of Science. We have expanded the literature search via the OpenGrey database for unpublished studies in the grey literature and hand-searching of reference lists of the core articles. The search was conducted by two independent reviewers (O.C, S.K.A) and limited to peer-reviewed studies on adult populations which were published in English or Turkish. Medical Subject Headings terms and selected key words used in the search strategy are provided in Supplemental Appendix I.

Studies were included if the study design was only full-text articles of randomized controlled trials, and at least one treatment group was treated by kinesio taping. Manuscripts published only in English and Turkish languages were included. We did not include studies that use kinesio taping for scapular correction, since the effect mechanism is different from the glenohumeral joint–related kinesio taping. Studies which included healthy participants, patients who have neurological disorders, interventions other than kinesio taping (Mulligan taping, static taping etc.) were excluded from the systematic review. No exclusion was applied specifically on diagnosis, and all orthopaedic shoulder disorders were included. This review focuses on outcomes related to clinical efficacy, such as pain, range of motion, and function. Studies on participants below 18 years of age were excluded.

After the duplicate articles retrieved from the different databases were removed, two independent

authors (O.C, S.K.A) screened titles and abstracts to identify which studies met the inclusion and exclusion criteria. Studies that fulfilled the inclusion criteria and studies in which eligibility could not be identified from the title/abstract screening were retrieved for full-text review by two independent authors (O.C, S.K.A). Disagreements between authors were resolved by consulting to a third author (D.C) who was blind to other authors' decisions on inclusion. The third author compiled the following information from each of the selected studies: author names, year of publication, demographics of the study population (number of participants and age, sex, and duration of symptoms), description of the interventions, outcome variables, follow-up duration and statistical results.

The methodological quality of the studies was assessed with the Physiotherapy Evidence Database scale, a critical appraisal instrument for experimental physiotherapy studies. The Physiotherapy Evidence Database scale, developed by Verhagen et al.,[17] consists of 11 items that were based on the Delphi list, over a total score of 10, as the first question was not included in calculation. A score of 9 or 10 points was considered to be of excellent quality, 6 to 8 points was considered good, and 4 or 5 points fair. Studies that score below 4 points were considered to be of poor quality.[18,19] All included articles were analysed by two independent reviewers (O.C, S.K.A). Inter-rater agreement between the reviewers who screened the included studies was assessed using kappa statistics.[20] Disagreements between the reviewers were resolved by consulting to the third reviewer (D.C) who was blind to previous assessment scores. No cut off Physiotherapy Evidence Database score was determined as an exclusion criterion in this review. The score of each study was used as an indicator of the quality of evidence, to be used for comparing the results and conclusions of the studies.

Meta-analysis of study outcomes was performed using RevMan 5.3 (The Nordic Cochrane Centre, Copenhagen, Denmark). For analysis of continuous data, mean differences or standardized mean differences with 95% confidence intervals (CIs) were used. The random-effects model was used to account for variability between studies and its effect on the intervention. The I^2 statistic was used to measure the heterogeneity between included studies, and the I^2 value of 25% indicates a small, 50% a moderate and 75% a high degree of heterogeneity.[21] Cohen's criteria were pooled for estimations, and effect size of 0.2 was considered as small, 0.5 as moderate, and 0.8 as large.[22]

The minimum clinically important difference refers the smallest improvement that is clinically relevant to the patient. It requires to be calculated specifically to the patient population. Therefore, there is a wide range of minimal clinical important difference values reported for same patient-reported outcome. We have accepted a minimal clinical important difference value of 2 for Visual Analogue Scale,[23] 11.2 for the Penn Score,[24] and 13.2 points for the Shoulder Pain and Disability Index.[25]

Results

After the identification and the screening process, 16 trials[26–41] met eligibility for qualitative synthesis (Figure 1). The alphabetical list of the included studies were shown in Appendix II. Fourteen studies were included in quantitative synthesis; two studies were not included due to the unclear reported data.[40,41] The absolute percentage of inter-rater agreement for Physiotherapy Evidence Database scale scoring was 86%, and the chance-corrected degree of agreement was very good ($\kappa = 0.81$; 95% CI = 0.62, 0.94). The Physiotherapy Evidence Database Scores of included studies ranged from 4 to 9 (of a maximum score of 10), with a mean score of 5.8 (Table 1). In 12 studies,[26,28–35,37–39] Kinesio taping was utilized for treatment of shoulder impingement syndrome, and the remaining studies were on treatment of shoulder pain[36] and calcific tendinitis.[27] The characteristics of the 14 trials are included in Table 2. The trials in this analysis included a total of 680 participants. Five of the included studies investigated kinesio taping versus sham kinesio taping,[29,32,34,36,37] where three studies[30,31,33] investigated kinesio taping combined exercise versus exercise alone, five studies kinesio taping versus passive treatments,[27,28,35,38,39] and one study compared kinesio taping to sham taping or nonsteroidal anti-inflammatory drug[26] (Table 2).

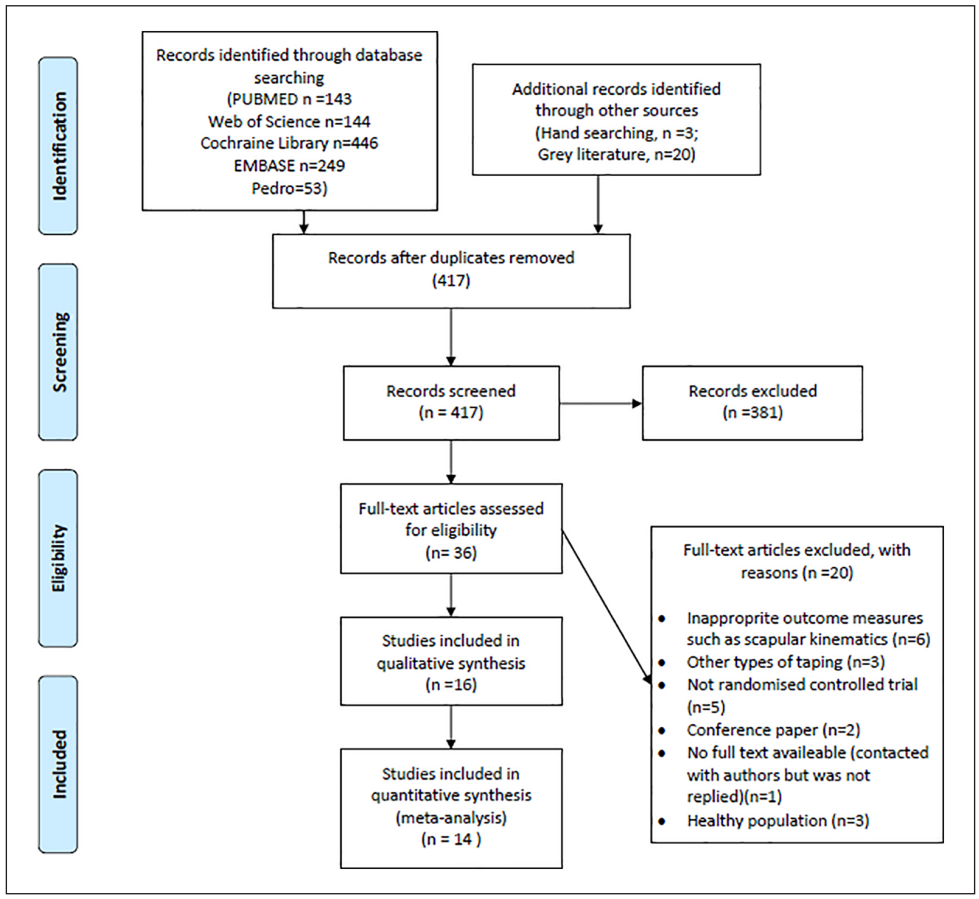

Figure 1. Flowchart of the study.

Table 1. The PEDro scale scores for included studies.

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Pedro score
Devereaux et al.[26]	Y	Y	N	Y	N	N	Y	N	N	Y	Y	5
Frassanito et al.[27]	Y	Y	Y	Y	U	N	U	N	N	Y	Y	5
Goksu et al.[28]	N	Y	Y	Y	N	N	Y	Y	N	Y	Y	7
Kaya et al.[30]	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	7
Kocyigit et al.[37]	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	7
Kul and Ugur[38]	N	Y	N	Y	N	N	N	Y	N	Y	Y	5
Mohamed and Alatawi[39]	Y	Y	N	Y	N	N	N	Y	N	Y	Y	5
Pekyavas and Baltaci[31]	Y	Y	N	Y	N	N	Y	Y	N	Y	Y	6
Shakeri et al.[32]	N	Y	N	Y	N	N	Y	Y	N	Y	Y	6
Shakeri et al.[29]	N	Y	N	Y	N	N	N	Y	Y	Y	Y	6
Sikha et al.[33]	Y	Y	U	N	U	U	U	Y	Y	Y	N	4
Simsek et al.[34]	N	Y	N	N	N	N	Y	Y	N	Y	Y	5
Subasi et al.[35]	Y	Y	Y	Y	N	N	N	N	N	Y	Y	5
Thelen et al.[36]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9

PEDro: Physiotherapy Evidence Database; Q: question; Y: yes; N: no; U: unavailable.

Table 2. Characteristics of included studies.

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Devereaux et al.[26] PEDro score: 5	*n* = 100 Subacromial impingement 50.0 ± 11.9 years 44.0 ± 10.5 years 50.0 ± 13.3 years	1. Kinesio taping + Exercise (*n* = 33) 2. NSAID + Exercise (*n* = 29) 3. Exercise (*n* = 38)	– Baseline – Second week	NPRS Simple Shoulder Test Constant Murley Score	Not statistically significant Not statistically significant Not statistically significant
Frassanito et al.[27] PEDro score: 5	*n* = 42 Calcific tendinopathy 54.1 ± 10.3 years 48.7 ± 11.9 years	1. Kinesio taping + ESWT (*n* = 21) 2. ESWT (*n* = 21)	– Baseline – First week – Fourth week – 12th week	VAS DASH Subjective Shoulder Rating Questionnaire Oxford Shoulder Score	ESWT + Kinesio taping > ESWT; • Baseline to first week: –4.3 ± 1.4; –3.0 ± 1.6, *P* = 0.007 • First week: –0.7 ± 1.0; –1.1 ± 1.3, *P* = 0.005 • 12th week: –0.4 ± 0.9; –0.2 ± 1.2, *P* = 0.02 ESWT + Kinesio taping > ESWT; • Baseline to first week: –19.2 ± 7.0; –8.4 ± 5.9, *P* < 0.0001 • First week: –3.9 ± 5.8; –6.9 ± 9.1, *P* = 0.03 ESWT + Kinesio taping > ESWT; • Baseline to first week: 25.4 ± 10.1; 14.0 ± 6.8, *P* < 0.0001 • First week: 9.9 ± 9.6; 9.2 ± 8.2, *P* = 0.04 12th week: 2.5 ± 3.5; 2.7 ± 7.2, *P* = 0.038 Not statistically significant

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Goksu et al.[28] PEDro score: 7	*n* = 61 Subacromial Impingement 42.63 ± 6.88 years 43.45 ± 6.39 years	1. Kinesio taping (*n* = 30) 2. Injection (*n* = 31)	– Baseline – First week – Fourth week	VAS (at rest)	Injection > Kinesio taping; • First week: 19.67 ± 13.03; 22.33 ± 15.24, *P* = 0.025 • Fourth week: 15.48 ± 12.06; 21.00 ± 12.68, *P* = 0.010
				VAS (activity)	Not statistically significant
				ROM	Only for abduction, Injection > Kinesio taping: • First week: 125.00 ± 21.0; 136.94 ± 15.74, *P* = 0.028 • Fourth week: 132.30 ± 21.08; 142.90 ± 16.11, *P* = 0.043
				SPADI	Injection > Kinesio taping; Fi1.25 ± 13.69; 23.60 ± 14.36, *P* = 0.031
Kaya et al.[30] PEDro score: 7	*n* = 54 Subacromial Impingement 47.15 ± 9.44 years 50.85 ± 5.17 years	1. Manual Therapy + Exercise (*n* = 26) 2. Kinesio taping + Exercise (*n* = 28)	– Baseline – Sixth week	VAS	Kinesio taping + Exercise > Manual Therapy + Exercise; Only for VAS at night: • 1.28 ± 1.88; 3.19 ± 3.28, *P* = 0.001
				DASH	Not statistically significant
				Tendon thickness	Not statistically significant

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Kul and Ugur[38] PEDro score: 5	*n* = 40 Subacromial impingement 54.8 ± 8.2 49.6 ± 10.1	1. Kinesio taping + Exercise (*n* = 20) 2. Physical therapy modalities + Exercise (*n* = 20)	– Baseline – Day 15 – 1-month follow-up	VAS	Physical therapy modalities + Exercise > Kinesio taping + Exercise; For VAS at rest: • 15th day: 0.85 ± 0.8; 0.25 ± 0.63, $P < 0.05$ • 1 month: 0.20 ± 0.52; 0.25 ± 0.63, $P < 0.05$ For VAS at activity: • 15th day: 3 ± 1.89; 1.95 ± 2.03, $P < 0.05$ For VAS at night: • 15th day: 2.85 ± 2.25; 1.4 ± 1.63, $P < 0.01$ • 1 month: 2.85 ± 2.25; 0.85 ± 1.30, $P < 0.05$
				ROM	Not statistically significant
				ASES	Physical Therapy + Exercise > Kinesio taping + Exercise • 15th day: 74.0 ± 18.6; 85.9 ± 15.5, $P < 0.01$ • 1 month: 86.5 ± 14.2; 89.0 ± 15.0, $P < 0.05$
				Constant Murley Score	Not statistically significant
				WORC-index	Physical Therapy + Exercise > Kinesio taping + • 15th day: 618 ± 31; 392 ± 334, p < 0.01

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Kocyigit et al.[37] PEDro score: 7	*n* = 41 Subacromial impingement 50.6 ± 10.1 years 49.2 ± 8.8 years	1. Kinesio taping (*n* = 21) 2. Sham taping (*n* = 20)	– Baseline – Day 12 – One month	ROM VAS Constant Murley Score Nottingham Health Profile	Not statistically significant Not statistically significant Not statistically significant Kinesio taping > Sham taping; For Nottingham Health Profile – pain; • 1 month: 19.2 ± 23.3; 29.6 ± 37.2, *P* = 0.007 For Nottingham Health Profile–physical activity • 12th day: 23.17 ± 21.35; 23.1 ± 24.1, *P* = 0.09 • 1 month: 25.0 ± 27.6; 19.3 ± 19.7, *P* = 0.026 Not statistically significant
Mohamed and Alatawi[39] PEDro score: 5	*n* = 32 Subacromial impingement 44.5 ± 10.1 47.1 ± 11.3	1. Kinesio taping + Exercise (*n* = 20) 2. Manual Therapy + Exercise (*n* = 20)	– Baseline – Third week – Sixth week	NPRS SPADI	Kinesio taping + Exercise > Manual Therapy + Exercise: • Third week: 3.69 ± 1.45; 5.13 ± 1.02, *P* = 0.001 Kinesio taping + Exercise > Manual Therapy + Exercise • Third week: 24.60 ± 4.68; 41.88 ± 8.38, *P* = 0.001

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Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
				ROM	Kinesio taping + Exercise > Manual Therapy + Exercise For flexion: • Third week: 173.38 ± 2.33; 168.56 ± 5.47, $P = 0.001$ For abduction: • Third week: 172.81 ± 4.37; 169.94 ± 5.79, $P = 0.02$ For external rotation: • Third week: 83.00 ± 4.56; 78.50 ± 7.54, $P = 0.008$ Not statistically significant
Pekyavas and Baltaci[31] PEDro score: 6	*n* = 70 Subacromial impingement 47.1 ± 13.8 years	1. Exercise (*n* = 15) 2. Kinesio taping + Exercise (*n* = 20) 3. Manual Therapy + Kinesio taping + Exercise (*n* = 16) 4. Manual Therapy + Kinesio taping + HILT + Exercise (*n* = 19)	– Baseline – Day 15	VAS ROM SPADI	Not reported Not statistically significant Not statistically significant

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Shakeri et al.[32] PEDro score: 6	*n* = 30 Subacromial impingement 46.53 ± 13.31 years 46.6 ± 14.24 years	1. Kinesio taping (*n* = 15) 2. Sham taping (*n* = 15)	– Baseline – Immediately after taping – Day 3 – First week	VAS	Kinesio taping > Sham taping For activity VAS: • Immediately after taping: 0.40 ± 0.71; 2.13 ± 0.10, *P* = 0.009 For night VAS: • Immediately after taping: 1.06 ± 1.51; 3.07 ± 0.55, *P* = 0.04
				Painless ROM	Not statistically significant
Shakeri et al.[29] PEDro score: 6	*n* = 30 Subacromial impingement 46.53 ± 13.31 years 46.6 ± 14.24 years	1. Kinesio taping (*n* = 15) 2. Sham taping (*n* = 15)	– Baseline – First week	DASH	Kinesio taping > Sham taping; • First week: 22.81 ± 9.16; 32.47 ± 14.17, *P* = 0.01
Sikha et al.[33] PEDro score: 5	*n* = 30 Subacromial impingement 43.40 ± 7.55 years 44.33 ± 7.22 years	1. Kinesio taping + Exercise (*n* = 15) 2. Exercise (*n* = 15)	– Baseline – Fourth week	ROM	Kinesio taping + PT > PT; For flexion: • 125.71 ± 10.66; 115.96 ± 13.35, *P* = 0.03 For abduction: • 137.10 ± 9.24; 125.57 ± 9.28, *P* = 0.002 For external rotation: • 34.35 ± 5.94; 27.47 ± 5.7, *P* = 0.003
				PENN Score	Kinesio taping + PT > PT; • 46.88 ± 2.86; 38.12 ± 4.45, *P* = 0.001
				SF-12	Kinesio taping + PT > PT; • 50.50 ± 5.14; 39.68 ± 5.22, *P* = 0.001

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
Simsek et al.[34] PEDro score: 5	*n* = 38 Subacromial impingement 51 (18–69) years	1. Kinesio taping + Exercise (*n* = 19) 2. Sham taping + Exercise (*n* = 19)	– Baseline – Day 5 – Day 12	VAS	Kinesio taping + Exercise > Sham taping + Exercise; For VAS at activity: • Day 5: 4.87 ± 2.29; 6.71 ± 1.68, *P* = 0.01 • Day 12: 4.32 ± 2.64; 6.28 ± 1.93, *P* = 0.009 For VAS at night: • Day 12: 2.37 ± 3.19; 4.82 ± 2.95, *P* = 0.001
				Painless ROM	Kinesio taping + Exercise > Sham taping + Exercise Only for abduction: • Day 12: 128.53 ± 30.94; 103.42 ± 21.67, *P* = 0.004 Not statistically significant
				ROM	Kinesio taping + Exercise > Sham taping + Exercise; Only for flexion • Day 5: 157.63 ± 22.01;171.58 ± 15.88, *P* = 0.002 • Day 12: 165.68 ± 19.45; 172.89 ± 12.72, *P* = 0.04 Not statistically significant
				DASH	Kinesio taping + Exercise > Sham taping + Exercise • Day 5: 30.14 ± 17.77; 48.05 ± 18.59, *P* = 0.004 • Day 12: 25.14 ± 17.35; 47.10 ± 17.87, *P* = 0.001

(Continued)

Table 2. (Continued)

Studies	Population *-Sample size* *-Disease* *-Mean age*	Intervention group/s (*n*)	Time points for assessments	Outcome measures	Results *-Mean ± SD values for group 1 and group 2, respectively* *-Between group P values*
				Constant Murley Score	Not statistically significant
				Muscle strength	Kinesio taping + Exercise > Sham taping + Exercise; For flexion: • Day 12: 11.21 ± 3.37; 8.42 ± 3.15, *P* = 0.005 For external rotation: • Day 12: 8.16 ± 3.35; 5.95 ± 2.30, *P* = 0.03
Subasi et al.[35] PEDro score: 5	*n* = 70 Subacromial Impingement 53.46 ± 10.7 years 54.29 ± 10.4 years	1. Kinesio taping + Exercise (*n* = 35) 2. Injection + Exercise (*n* = 35)	– Baseline – First month – Third month	VAS ROM	Not statistically significant Injection > Kinesio taping; Only for extension: • First month: 45.1 ± 7.1; 48.5 ± 7.8, *P* = 0.004 Not statistically significant
				SPADI	Not statistically significant
Thelen et al.[36] PEDro score: 9	*n* = 42 Shoulder pain 19.8 ± 1.5 years 21.3 ± 1.7 years	1. Kinesio taping (*n* = 21) 2. Sham taping (*n* = 21)	– Day 1 – Day 3 – Day 6	VAS ROM	Not statistically significant Kinesio taping > Sham taping; Only for abduction: • Day 1: 16.9 ± 23.2; 2.2 ± 18.3, *P* = 0.005[a] Not statistically significant
				SPADI	Not statistically significant

PEDro: Physiotherapy Evidence Database; NSAID: Non-Steroid Anti-Inflammatory Drug; NPRS: Numeric Pain Rating Scale; ESWT: Extracorporeal Shock Wave Therapy; VAS: Visual Analog Scale; ROM: range of motion; DASH: Disabilities of the Arm, Shoulder and Hand Questionnaire; SPADI: Shoulder Pain and Disability Index; ASES: American Shoulder and Elbow Surgeon Standardized Shoulder Assessment Form; HILT: High Intensity Laser Therapy; SF-12: Short Form 12 Health-Related Quality of Life Score.

[a]Mean change ± SD were presented table when mean values were not reported.

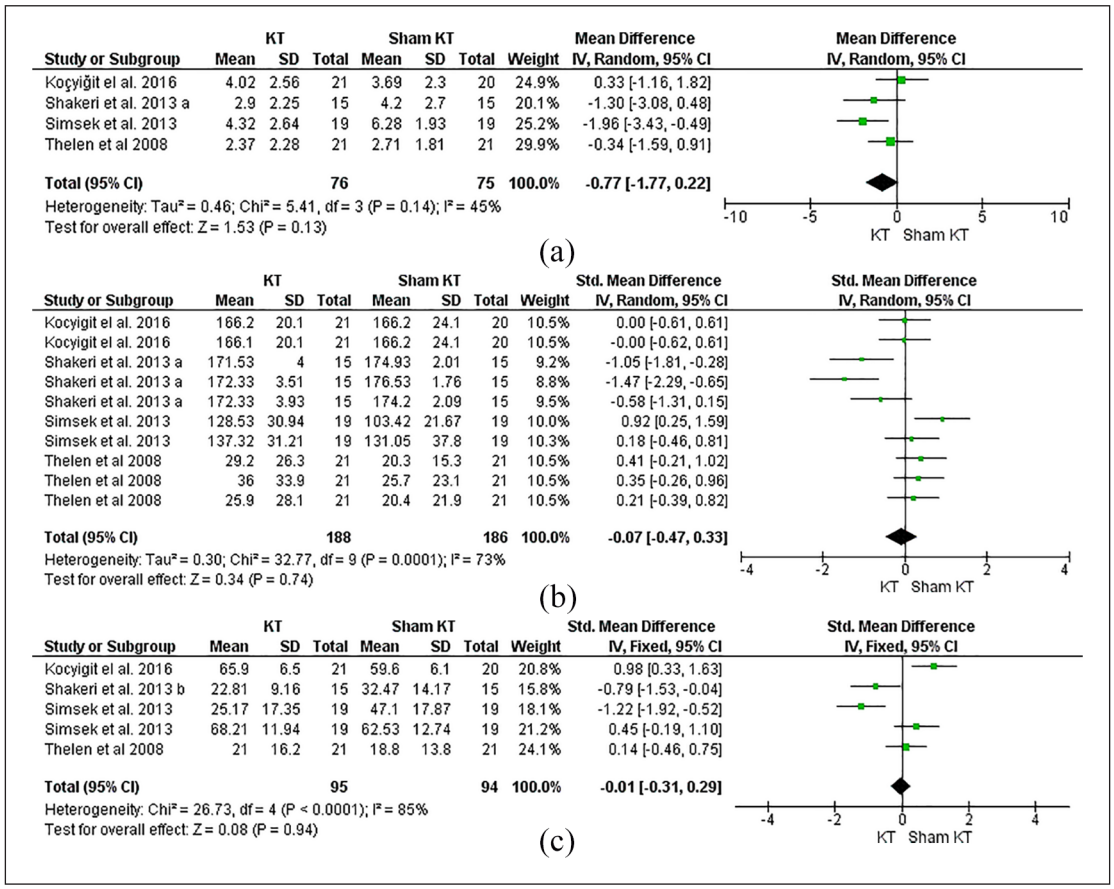

Figure 2. Forest plots: kinesio taping versus sham kinesio taping on (a) pain, (b) range of motion, and (c) function.

Figure 2 demonstrated the effects of kinesio taping compared with sham kinesio taping on pain, range of motion, and function. Four studies[32,34,36,37] examined the effects of kinesio taping on pain and range of motion. Based on the random-effects model, it was suggested that there is no significant mean difference on pain intensity by –0.77 cm (95% CI = –1.77, 0.22, $P = 0.13$) with small heterogeneity ($I^2 = 45\%$). In addition, kinesio taping was not found to improve range of motion compared to sham kinesio taping with standard mean difference on range of motion by –0.07 (95% CI = –0.47, 0.33, $P = 0.74$) with moderate heterogeneity ($I^2 = 73\%$). Four studies[32,34,36,37] evaluated the effects of kinesio taping on function. There was no significant standard mean difference on function by –0.01 (95% CI = –0.31, 0.29, $P = 0.94$) with high heterogeneity ($I^2 = 85\%$).

Four studies[26,30,31,33] compared kinesio taping combined with exercise versus only exercise, as presented in Figure 3. Three studies[26,30,31] assessed pain but in study by Pekyavas et al.; despite of their declaration, pain results were not reported. Based on the random-effects model, it was suggested that there was no significant mean difference on pain intensity by –0.51 cm (95% CI = –1.41, 0.39, $P = 0.27$) with moderate heterogeneity ($I^2 = 63\%$). Two studies[31,33] evaluated range of motion but we could not performed meta-analysis on range of motion, since the range of motion data of one study[31] was not proper. Four studies[26,30,31,33] demonstrated the effects of kinesio taping on function. When kinesio taping

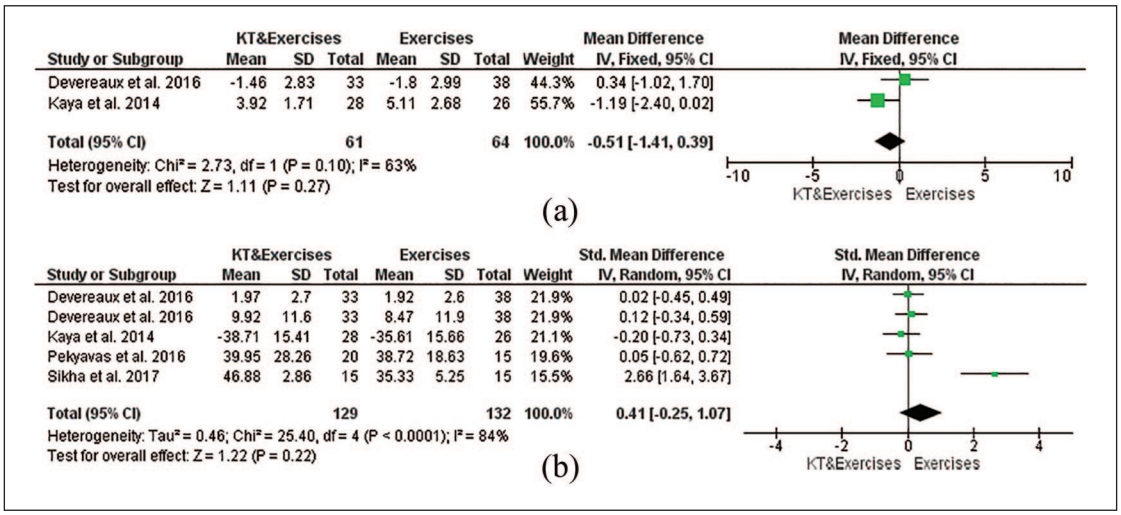

Figure 3. Forest plots: kinesio taping combined exercise versus only exercise on (a) pain and (b) function.

combined with exercise, significant standard mean difference on function by 0.41 (95% CI = –0.25, 1.07, $P=0.22$) was observed. However, the heterogeneity was very high ($I^2=84\%$).

The effects of kinesio taping on pain, range of motion, and function are presented in Figure 4. Six studies investigated the effectiveness of kinesio taping versus passive treatments, including nonsteroidal anti-inflammatory drugs,[26] extracorporeal shock wave therapy,[27] electrotherapy modalities (TENS, hot pack, US),[38] injection,[28,35] and manual therapy.[39] It was observed that there are no significant mean differences on pain intensity by 0.29 cm (95% CI = –0.19, 0.77, $P=0.24$) with moderate heterogeneity ($I^2=73\%$). When exploring the effects on range of motion, only four studies[28,35,38,39] were allowed us to conduct quantitative analysis. Two studies[28,35] compared kinesio taping with injection and a nonsignificant standard mean difference by 0.06 (95% CI = –0.09, 0.20, $P=0.46$) with low heterogeneity ($I^2=49\%$) was reported. In addition, it was estimated a nonsignificant standard mean difference with value of –0.29 (95% CI=–0.29, –0.19, $P=0.69$) with high heterogeneity ($I^2=85\%$) for function.

In this systematic review and meta-analysis, only randomized controlled trials were included, regardless of quality. Seven studies[28–32,37,41] were considered to be of good quality (6–8 points on Physiotherapy Evidence Database Score) and one study[36] was excellent (9 point on Physiotherapy Evidence Database Score).[42]

Discussion

This systematic review and meta-analysis included 14 randomized controlled trials involving 680 patients, evaluating the effectiveness of kinesio taping in patients with shoulder pathologies. Based on this meta-analysis, we have concluded that kinesio taping has no clinical or statistical superiority on pain, range of motion, and function when compared with sham kinesio taping, exercises, or passive treatments.

This meta-analysis has found no significant difference in pain intensity between kinesio taping and sham kinesio taping with moderate effect and small heterogeneity. Although two included studies reported that kinesio taping was superior to sham kinesio taping on pain relief, visual analogue scale between groups did not reach 2 cm, which was defined as the minimal clinical important difference for visual analogue scale by Portney and Watkins.[23] Similarly, kinesio taping was not superior to sham kinesio taping in terms of improving range of motion and function. The overall small effects should be

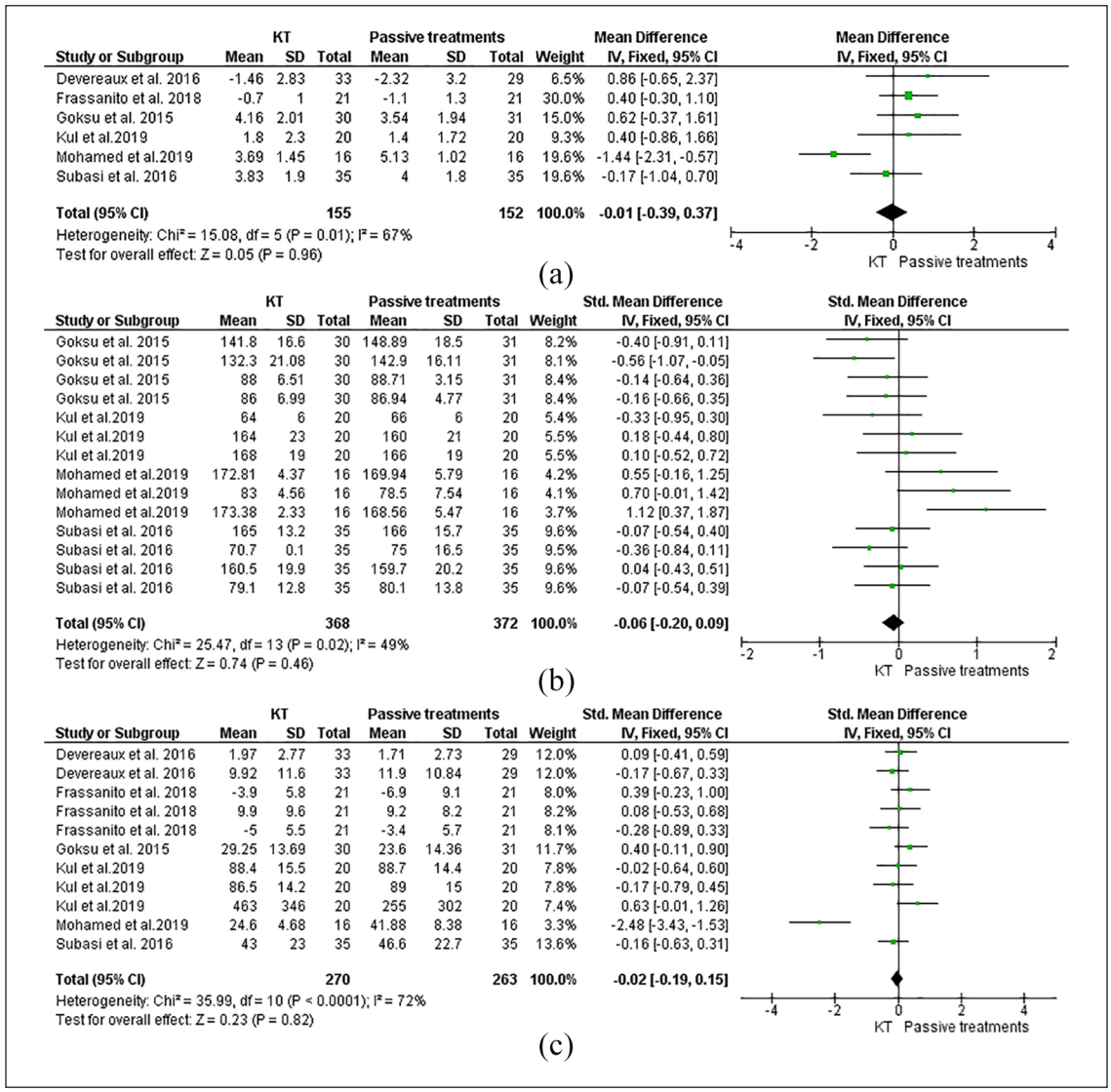

Figure 4. Forest plots: kinesio taping versus passive treatments on (a) pain, (b) range of motion, and (c) function.

interpreted carefully due to high heterogeneity. Results of the study by Simsek et al.[34] were confusing due to three different range-of-motion assessments, including active, passive and painless conditions. In order to make comparison with other studies, which included quantitative analysis, we only included active range-of-motion assessment. Considering these results, it was not possible to conclude that kinesio taping is superior to sham kinesio taping. Only two studies by Shakeri et al.[29] and Simsek et al.[34] suggested that kinesio taping was significantly superior for function; however, group mean differences were below the defined minimal clinical important difference for disabilities of the arm, shoulder and hand questionnaire.[29,34,43,44]

Kinesio taping combined with exercises was not found to be efficient regarding pain and function when compared to exercises alone with moderate

to high heterogeneity. Kaya et al.[30] reported that kinesio taping combined with exercise group was superior in night pain; however, the difference was below minimal clinical important difference (2 cm).[23] Only the study by Sikha et al.[33] reported that function assessed by Penn Score was better in kinesio taping–combined physiotherapy group, yet the mean difference did not reach minimal clinical important difference values as well.[44]

Kinesio taping was similar to passive treatments (injection, nonsteroidal anti-inflammatory drugs, manual therapy, and electrotherapy modalities such as extracorporeal shock wave therapy, ultrasound etc.) in terms of pain and function with small effect size. Similarly, Frassanito et al.[27] reported that kinesio taping was superior to extracorporeal shock wave therapy for pain and function. Mohamed and Alatawi[39] found that kinesio taping was better than manual therapy for pain. However, differences between groups did not reach minimal clinical important difference values for pain and function in both studies.[27,39] Two studies investigated the effectiveness of kinesio taping and injection on range of motion.[28,35] Injection was superior to kinesio taping in range of motion, but standard mean difference was very small. Mohamed and Alatawi[39] reported that kinesio taping was better than manual therapy but differences between groups on range of motion were at maximum of 5 . We interpreted that this difference was not clinically meaningful. It appears that kinesio taping can be used as a noninvasive treatment option. However, these findings should be interpreted cautiously, due to small effect sizes and meaningless clinical differences.

This meta-analysis has some limitations. First, analyses that we were able to perform were limited due to the number of eligible randomized controlled trials. Second, most studies reported the short-term results; therefore, we have only performed the meta-analysis in short-term effects of kinesio taping. Third, only English and Turkish papers were included. Besides, the high heterogeneity could have possibly altered results of the studies. Even though quality of included studies was moderate to high, Physiotherapy Evidence Database score did not evaluate the important aspects such as sample sizes and power of studies. Many of the included studies in this meta-analysis had small sample sizes, since the results should be interpreted attentively. Furthermore, reported data in some studies[31,40,41] had possible faults such as missing data or inappropriate standard deviations.

In conclusion, although kinesio taping is widely used due to its practicality and safety, direct scientific evidence on its efficacy is lacking. When planning in future studies, authors should intend to reach adequate sample size, proper statistical analysis and study design, and present clear and precise results to improve quality of the studies. Concordantly, the clinicians should consider these limitations when using kinesio taping for their patients.

Clinical messages

- Evidence is lacking to support the use of kinesio taping for the reduction of symptoms in shoulder disorders.
- Further high-quality trials showing benefit are required before the use kinesio taping in shoulder disorders can be recommended or justified in clinical practice.

Author contributions

D.C conceived of the presented idea. S.K.A and O.C searched the relevant literature. D.C performed data analysis. All authors wrote the article and contributed to revision.

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Supplemental material

Supplemental material for this article is available online.

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