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REVIEW ARTICLE

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Evidence for taping in overhead athlete shoulders: a systematic review

Elif Turgut[a], Ezgi Nur Can[a], Cigdem Demir[a] and Annelies Maenhout[b]

[a]Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey; [b]Ghent University, Rehabilitation Sciences Department, Ghent Belgium

ABSTRACT

Taping is a popular approach and is often used as part of a multifactorial injury prevention programme for athletes. The aim of this study was to evaluate the current literature regarding the effects of shoulder taping in overhead athletes. Literature search was performed related to rotational range of motion (RoM), posterior shoulder tightness (PST), kinematics, muscular activity, acromiohumeral distance (AHD), proprioception, strength, and performance. Twenty studies were eligible. The majority of the applied taping methods were scapular and humeral head repositioning taping. Across all studies, there was limited to moderate evidence in favour of taping in overhead athletes with regard to rotational RoM, AHD, proprioception, and altering scapular kinematics, while taping did not enhance PST, muscular activity, shoulder strength, and performance. Therefore, the current evidence showed taping can alter some of the investigated factors that may have a therapeutic or preventive role. However, in the management of the athlete shoulder, taping-only approaches should not be focused on, and taping can be integrated in a more comprehensive approach for the overhead athletes.

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KEYWORDS
Shoulder; taping; scapula; athlete

Introduction

Shoulder pain and shoulder-related injuries are common in the general population with a prevalence of 20%, (Pope et al., 1997) and the prevalence increases up to 75% in physically active populations (McMaster & Troup, 1993). In particular, athletes involved in overhead sports such as swimming, baseball, and tennis require the repetitive overhead use of the shoulder in high velocity and in extreme ranges. Such conditions cause the shoulder to experience a more stress and fatigue, which result in some adaptations, such as laxity of static stabilizers, muscular imbalances of shoulder dynamic stabilizers, decreased shoulder range of motion (RoM), flexibility deficits, and scapular dyskinesis (Borsa et al., 2008). These physical adaptations may

CONTACT Elif Turgut elifcamci@hacettepe.edu.tr Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100 Samanpazari, Ankara, Turkey
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result in altered mechanical functioning of the shoulder, and thus, they predispose the shoulder to injury or alter athletic performance. In a recent systematic review (Tooth, Gofflot et al., 2020), these factors have been demonstrated to be risk factors for injury in overhead sports. Therefore, there is a delicate balance between performance, improving adaptations, and eliminating risk factors in overhead athletes.

Overhead athletes were reported to have 28% of weekly prevalence of shoulder problems (Mohseni-Bandpei et al., 2012). These athletes commonly require medical attention, and they miss trainings and competitions due to their current or previous shoulder injury. Myklebust et al. (2013) reported that 36% of the handball players with pain had missed matches and 68% to 76% of these athletes reported changes in their performance, including reduced shooting velocity.

Taping is a popular approach and is often used as part of a multifactorial injury prevention program in athletes. There are different kinds of tapes, taping materials, and tape application methods. In general, taping is frequently used in clinical practice because it is easy to apply, it is low cost and portable, it does not have a harmful effect, and requires no time cost. Taping can be applied in several ways and its theorized physiological effects include re-education of the neuromuscular system, reducing inflammation, promoting circulation and healing while assisting the body in returning to homoeostasis. Although taping is widely used as an intervention, there is little or limited evidence about its benefits. Previous systematic reviews have evaluated the effect of taping on several outcomes in the prevention and treatment of sports injuries (Williams et al., 2012) and in people with musculoskeletal conditions (Ellis, 1980; Ghozy et al., 2020; Kalron & Bar-Sela, 2013; Lim & Tay, 2015; Mostafavifar et al., 2012; Parreira et al., 2014; Saracoglu et al., 2018). Currently, there is no strong evidence for its therapeutic effect on pain in the treatment of musculoskeletal and sporting injuries. Recently, Yildiz et al. (2020) reviewed the immediate effects of taping and reported that scapular corrective taping might alter scapular kinematics and muscle activity in general population. However, there is an uncertainty on the effect of taping on biomechanical factors playing a role in shoulder mobility and stability adaptations in overhead athletes. It is important to explore how overhead athlete shoulders respond to taping since these insights could support the decision whether taping is useful in this population for other reasons besides pain relief.

Therefore, the aim of this study was to investigate the effects of shoulder taping on kinematics, muscular activity, glenohumeral rotational RoM, acromiohumeral distance (AHD), proprioception, strength, posterior shoulder tightness/flexibility (PST), and performance in overhead athletes. Thus, this review will provide evidence regarding the effect of taping on physical characteristic and performance of overhead athletes to guide researchers for future studies and professionals working with overhead athletes.

Materials and methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) guideline (Moher et al., 2010). The review protocol was registered in PROSPERO.

Eligibility criteria, information sources and search strategy

The PICO method was used for the literature search and data extraction: P (population) = overhead athletes with/without shoulder pain/disorders; I (intervention) = taping, including rigid taping (RT) and/or elastic taping (ET); C (comparison) = compared the results with the baseline measurements (taped vs. non-taped conditions), with/or without sham taping (ST)/placebo taping (PT); O (outcome) = glenohumeral rotational RoM, PST, strength, kinematics, muscular activity, AHD, proprioception, and performance.

Studies were included in this review if they evaluated the immediate effects of singular application of shoulder taping on (1) glenohumeral rotational RoM, (2) PST (3) strength, (4) scapular or shoulder kinematics, (5) electromyography (EMG) activity of shoulder muscles, (6) AHD, (7) proprioception, and (8) athletic performance, including overhead athletes with symptomatic or asymptomatic shoulders, and published in English. Overhead sports in the present study included volleyball, handball, basketball, swimming, water polo, baseball, javelin, cricket, lacrosse, hammer throw, badminton, softball, and tennis (racquet sports). Studies were excluded if they involved participants with neurological, connective tissue/systemic disorders, paralympic athletes, and investigated the effect of taping applied to any joint other than the shoulder joint. Narrative reviews, systematic reviews, animal or cadaveric studies, or simulated studies were also excluded. A detailed description of inclusion and exclusion criteria is presented in the supplementary file (Supplementary file 1).

The literature was initially scanned for a systematic review of the effects of shoulder taping on the selected outcome in overhead athletes, and no review was found. A comprehensive literature search was conducted on the PubMed (1966 to 2021) and Web of Science (1945 to 2021) databases with a combination of Medical Subject Headings (MeSH) terms and keywords (Supplementary file 2). A manual search on the reference lists of all eligible articles was conducted in an attempt to find any further relevant references. Two authors conducted the literature search separately. All articles searched were inserted into Rayyan, an online tool available at https://rayyan.qcri.org. The first screening was based on the title and then the abstract of the articles. Afterwards, the full texts of the articles selected were further screened to decide which one met the selection criteria and could therefore be included in the review.

Study selection

Two researchers independently assessed the titles and abstracts of the potential suitable studies found during the initial search based on inclusion/exclusion criteria. Two researchers separately applied all criteria to the full text of the articles that passed the initial screening. Any disagreement between researchers was resolved by discussion, and a third researcher was consulted if disagreements regarding the study's eligibility could not be resolved by consensus.

Data extraction

Data were extracted from the studies selected for inclusion, and the same data extraction form was used by all the authors. The following information was extracted from each study: (1) name of first author and year of publication, (2) journal title, (3) the country

where the study was conducted, (4) study design, (5) type of sport, (6) sample size and characteristics, (7) pathology, if present, (8) taped and tested extremity, (9) time of test after taping, (10) taping characteristics, (11) comparators, (12) outcome measures, (13) assessment methods, and (14) the results including mean difference (MD) with 95% confidence intervals (CI) and effect size (ES).

Risk of bias and quality assessment

Two independent reviewers evaluated the methodological quality of the studies using the Cochrane Effective Practice and Organization of Care tool (Effective Practice and Organization of Care (EPOC) Resources for Review Authors, 2021) (Table 1). Depending on the design of the study and methodological quality, the level of evidence was assessed according to the classification reported by Wright et al. (2003) When there was disagreement between the two authors, a third author was consulted, and a consensus was reached.

Strategy for evidence synthesis

Due to the heterogeneity of the included studies and the scarcity of relevant literature, a meta-analysis was not appropriate. A qualitative synthesis of the available information was achieved by the scale used by Van Tulder et al. (2003).

Table 1. The risk of bias and quality assessment of individual studies.

Study	1	2	3	4	5	6	7	8	9	Level of Evidence
McConnell & McIntosh, 2009	NA	NA	-	+	+	+	NA	NA	+	4
Smith et al., 2009	NA	NA	-	-	+	+	NA	NA	+	4
Bradley et al., 2009	NA	NA	-	+	+	+	NA	NA	+	3
Hsu et al., 2009	NA	NA	-	-	+	+	NA	NA	+	4
McConnell et al., 2011	NA	NA	-	-	+	+	NA	NA	+	4
McConnell et al., 2012	NA	NA	-	-	+	+	NA	NA	+	4
Van Herzeele et al., 2013	NA	NA	-	-	+	+	NA	NA	+	4
Müller & Brandes, 2015	NA	NA	-	-	+	+	NA	NA	+	3
Intelangelo et al., 2016	NA	NA	-	?	+	+	NA	NA	+	4
Tanoori et al., 2016	+	-	+	+	-	+	+	?	+	2
Harput et al., 2016	NA	NA	-	-	+	+	NA	NA	+	4
Leong et al., 2017	NA	NA	-	+	+	+	NA	NA	+	3
Fong et al., 2018	NA	NA	-	-	+	+	NA	NA	+	4
Shih et al., 2018	+	?	-	-	+	+	-	+	+	2
Ozer et al., 2018	+	?	-	+	+	+	+	+	+	2
Gulpinar et al., 2019	+	+	-	+	-	+	+	+	+	2
Leong & Fu, 2019	NA	NA	-	-	+	+	NA	NA	+	4
Tooth, Schwartz, Fransolet, 2020	NA	NA	-	-	+	+	NA	NA	+	4
Tooth, Schwartz, Colman, 2020	NA	NA	-	?	+	+	NA	NA	+	4
Yun et al., 2020	NA	NA	-	+	+	+	NA	NA	+	3

(1) Random assignment of participants, (2) allocation concealment, (3) blinding of participants, (4) blinding of outcome assessors, (5) incomplete outcome data, (6) selective outcome reporting, (7) similar baseline measurements between study and control group, (8) similar baseline characteristics of the participants between groups, and (9) protection of the data from contamination.

NA = nonapplicable; + = low risk; – = high risk; ? = unclear risk.

Results

Study selection

As shown in PRISMA flow-diagram (Figure 1), a total of 2023 records were identified from the databases. After the duplicates were removed, 1535 studies remained. Of these, 1486 articles were excluded for not fulfiling the eligibility criteria (first screening). Thereafter, the full texts of the remaining 49 articles were evaluated. Twenty articles met the inclusion criteria for the review. During the full-text screening, the reviewers had 90% agreement. The conflict on the remaining 10% difference (2 articles) was resolved after a meeting.

Risk of bias within studies and methodological quality

Table 1 shows the results of the risk of bias and methodological assessment. In the first assessment, the assessors had 93.3% agreement (168 out of 180 items). After further discussion, they reached 100% consensus. For the level of evidence analysis, there was 100% agreement between the two reviewers. On a general note, only few studies were classified as Level II (4 out of 20) (Gulpinar et al., 2019; Ozer et al., 2018; Shih et al., 2018; Tanoori et al., 2016) or Level III (4 out of 20) (Bradley et al., 2009; Leong & Fu, 2019; Müller &

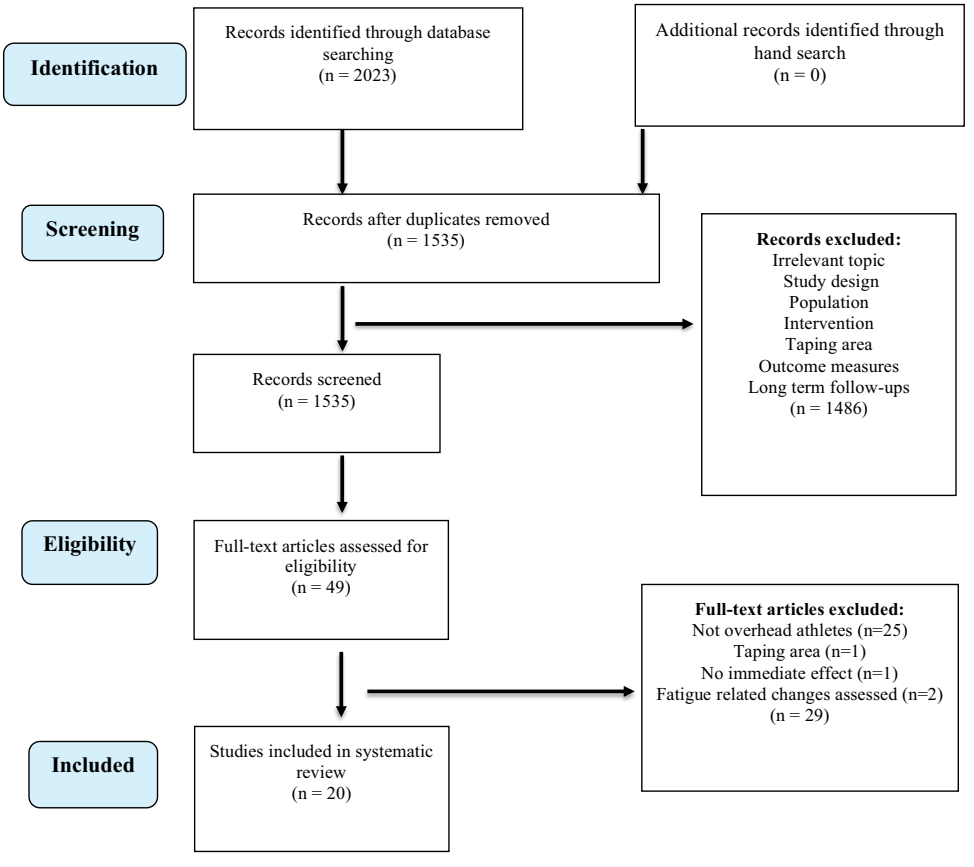


Figure 1. PRISMA flow diagram.

Brandes, 2015; Yun et al., 2020) and the majority were Level IV (12 out of 20) (Fong et al., 2018; Harput et al., 2016; Hsu et al., 2009; Intelangelo et al., 2016; Leong et al., 2017; McConnell et al., 2011, 2012; McConnell & McIntosh, 2009; Smith et al., 2009; Tooth, Schwartz, Colman et al., 2020; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013). Of the 20 studies, four studies (Gulpinar et al., 2019; Ozer et al., 2018; Shih et al., 2018; Tanoori et al., 2016) were randomized controlled trial, four (Bradley et al., 2009; Hsu et al., 2009; Müller & Brandes, 2015; Yun et al., 2020) were cross-over design, and twelve (Fong et al., 2018; Harput et al., 2016; Intelangelo et al., 2016; Leong & Fu, 2019; Leong et al., 2017; McConnell et al., 2011, 2012; McConnell & McIntosh, 2009; Smith et al., 2009; Tooth, Schwartz, Colman et al., 2020; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013) were repeated measures design.

Population

The characteristics of the studies included are summarized in Table 2. The sample size of the studies varied from 9 to 81 participants. Thirteen studies recruited asymptomatic overhead athletes (Bradley et al., 2009; Gulpinar et al., 2019; Harput et al., 2016; McConnell et al., 2011, 2012; McConnell & McIntosh, 2009; Müller & Brandes, 2015; Ozer et al., 2018; Tanoori et al., 2016; Tooth, Schwartz, Colman et al., 2020; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013; Yun et al., 2020), six studies recruited symptomatic overhead athletes (shoulder impingement syndrome (SIS), rotator cuff tendinopathy, or non-specific shoulder pain) (Fong et al., 2018; Hsu et al., 2009; Intelangelo et al., 2016; Leong et al., 2017; Shih et al., 2018; Smith et al., 2009), and one study (Leong & Fu, 2019) recruited both asymptomatic and symptomatic (rotator cuff tendinopathy) athletes and analysed them separately. The studies reviewed included samples involving different types of overhead athletes. The majority of the participants were volleyball, handball, and tennis players.

Taping

Eight studies used RT (Bradley et al., 2009; Intelangelo et al., 2016; Leong & Fu, 2019; Leong et al., 2017; McConnell et al., 2011, 2012; McConnell & McIntosh, 2009; Smith et al., 2009), nine studies used ET (Fong et al., 2018; Harput et al., 2016; Hsu et al., 2009; Müller & Brandes, 2015; Shih et al., 2018; Tooth, Schwartz, Colman et al., 2020; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013; Yun et al., 2020), and three studies investigated and compared both taping methods (Gulpinar et al., 2019; Ozer et al., 2018; Tanoori et al., 2016). Majority of the taping methods were scapular taping (Harput et al., 2016; Intelangelo et al., 2016; Leong & Fu, 2019; Leong et al., 2017; Shih et al., 2018; Smith et al., 2009; Tooth, Schwartz, Colman et al., 2020; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013; Yun et al., 2020) and humeral head repositioning taping (Gulpinar et al., 2019; McConnell et al., 2011, 2012; McConnell & McIntosh, 2009; Ozer et al., 2018). Five studies (Gulpinar et al., 2019; Leong & Fu, 2019; Leong et al., 2017; McConnell & McIntosh, 2009; Ozer et al., 2018) compared RT application with ST or PT, and five studies (Gulpinar et al., 2019; Hsu et al., 2009; Ozer et al., 2018; Shih et al., 2018; Yun et al., 2020) compared ET application with ST or PT. A description of the taping methods used in the studies can be found in Table 3.

Table 2. Characteristics of included studies.

Study (Country of origin, published journal)	Design	Sample size, type of sport and characteristics	Age (Mean, SD)	Gender (n Male/n Female)	Taped and tested extremity	Time of tests after taping
McConnell & McIntosh, 2009 (Australia, Clin J Sport Med)	Sham-controlled repeated measures design	21 asymptomatic tennis players	M: 16.8 ± 1.3 yrs F: 14.9 ± 0.8 yrs	11 M, 10 F	Dominant shoulder	Immediate
Smith et al., 2009 (United Kingdom, Phys Ther Sport)	Cross-sectional study with nested within-subject intervention	16 swimmers with SIS	29.8 ± 8.3 yrs	7 M, 9 F	Symptomatic shoulder	Immediate
Bradley et al., 2009 (Australia, Br J Sports Med)	Crossover design	33 asymptomatic Australian football players	22 ± 3.6 yrs	33 M	Dominant shoulder	Immediate
Hsu et al., 2009 (Taiwan, J Electromyogr Kinesiol)	Crossover design	17 baseball players with SIS	23 ± 2.8 yrs	17 M	Dominant shoulder	Immediate
McConnell et al., 2011 (United States, J Orthop Res)	Repeated measures design	26 asymptomatic volleyball, baseball, and tennis players (n = 9, injured; n = 17, non-injured participants)	20.2 ± 2.6 yrs	15 M, 11 F	Throwing shoulder	Immediate
McConnell et al., 2012 (United States, PM & R)	Repeated measures design	26 asymptomatic volleyball, baseball, and tennis players (n = 9, injured; n = 17, non-injured participants)	20.2 ± 2.6 yrs	15 M, 11 F	Throwing shoulder	Immediate
Van Herzeele et al., 2013 (Belgium, Int J Sports Med)	Repeated measures design	25 asymptomatic handball players	18 ± 1.5 yrs	25 F	Dominant shoulder	Immediate
Müller & Brandes, 2015 (Germany, J Hum Kinet)	Cross-over study	32 asymptomatic handball players	27.3 ± 8.5 yrs	32 M	Dominant shoulder	Immediate
Intelangelo et al., 2016 (Brazil, J Bodyw Mov Ther)	Repeated measures design	10 basketball, volleyball, hockey, and gymnastics players with shoulder pain during arm elevation and scapular dyskinesis	26.3 yrs*	6 F, 4 M	Symptomatic shoulder	Immediate

(*Continued*)

Table 2. (Continued).

Study (Country of origin, published journal)	Design	Sample size, type of sport and characteristics	Age (Mean, SD)	Gender (n Male/n Female)	Taped and tested extremity	Time of tests after taping
Tanoori et al., 2016 (Malasia, Int J Appl Exerc Physiol)	Double blinded RCT	45 asymptomatic tennis players	24 ± 6 yrs	45 M	Dominant shoulder	After 30 minutes
Harput et al., 2016 (Turkey, J Phys Fit Sports Med)	Repeated measures design	41 asymptomatic volleyball players	16.1 ± 1.5 yrs	17 F, 24 M	Dominant shoulder	After 5 minutes
Leong et al., 2017 (Kong, J Sci Med Sport)	Placebo-controlled repeated measures design	26 volleyball players with rotator cuff tendinopathy	23.6 ± 3.3 yrs	26 M	Throwing shoulder	Immediate
Fong et al., 2018 (China, J Sports Med Phys Fitness)	Repeated measures design	25 badminton players with painful shoulder	20.56 ± 1.75 yrs	8 F, 17 M	Dominant shoulder	Immediate
Shih et al., 2018 (Taiwan, J Sport Rehabil)	Placebo-controlled RCT	30 volleyball, swimming, and badminton players with SIS	ET group, 24.3 ± 2.8 yrs PT group, 23.3 ± 3.3 yrs	14 M, 16 F	Dominant shoulder	Immediate
Ozer et al., 2018 (Turkey, J Athl Train)	Placebo-controlled RCT	72 asymptomatic basketball, handball, and volleyball players	17 ± 4.09 yrs	31 M, 41 F	Dominant shoulder	After 30 minutes
Gulpinar et al., 2019 (Turkey, J Sport Rehabil)	Placebo-controlled RCT	81 asymptomatic overhead sports players (n = 21, ET group; n = 20, RT group; n = 20, PT group; n = 20, NT group)	ET group, 15.37 (13–36) yrs** RT group, 16 (13–32) yrs** PT group, 15.50 (13–31) yrs** NT group, 15 (14–36) yrs**	43 F, 38 M	Dominant shoulder	Immediate
Leong & Fu, 2019 (China, J Sport Rehabil)	Sham-controlled repeated measures study	43 volleyball players (n = 17, asymptomatic participants; n = , 26 participants with rotator cuff tendinopathy)	22.9 ± 3.5 yrs	43 M	Dominant shoulder	Immediate
Tooth, Schwartz, Fransolet, 2020 (Belgium, Int J Perform Anal Sport)	Repeated measures study	15 asymptomatic tennis players with scapular dyskinesis	22.8 ± 3.45 yrs	NA	Dominant shoulder	Immediate
Tooth, Schwartz, Colman, 2020 (Belgium, J Electromyogr Kinesiol)	Repeated measures study	20 asymptomatic tennis, volleyball, CrossFit, football, swimming, basketball, and boxing players with scapular dyskinesis	21.9 ± 1.8 yrs	20 M	Dyskinetic shoulder	Immediate

(*Continued*)

Table 2. (Continued).

Study (Country of origin, published journal)	Design	Sample size, type of sport and characteristics	Age (Mean, SD)	Gender (n Male/n Female)	Taped and tested extremity	Time of tests after taping
Yun et al., 2020 (Korea, Life)	Sham-controlled cross-over study	19 asymptomatic baseball players with rounded shoulder posture	17.42 ± 1.46 yrs	19 M	Dominant shoulder	Immediate

Abbreviations: Yrs, years; m, males; f, females; SIS, shoulder impingement syndrome; RCT, Randomized controlled study; ET, Elastic taping; RT, rigid taping; PT, Placebo taping; NT, no-tape.
*SD was not reported in the original study. ** Mean and SD were not reported in the original study therefore age presented as median (min-max).

Glenohumeral rotational RoM

Four studies (Gulpinar et al., 2019; Harput et al., 2016; McConnell et al., 2012; McConnell & McIntosh, 2009) reported the effect of taping on glenohumeral rotational RoM in asymptomatic overhead athletes. One (Gulpinar et al., 2019) of the four studies reported about active RoM and the other three studies reported about passive RoM (Table 4). In three studies (Gulpinar et al., 2019; McConnell et al., 2012; McConnell & McIntosh, 2009) RT, a humeral head repositioning taping technique, was applied, and in two studies (Gulpinar et al., 2019; Harput et al., 2016), scapular or shoulder ET was applied (Table 3). All of these studies have reported alterations in at least one of the shoulder rotational RoM measurements after tape application; however, overall, the evidence to support the use of taping for improving glenohumeral RoM depends on the movement direction. RoM improvement with taping was found in two studies (Harput et al., 2016; McConnell & McIntosh, 2009) for glenohumeral internal rotation (IR) RoM, in one study (McConnell & McIntosh, 2009) for glenohumeral external rotation (ER) RoM, and in three studies (Harput et al., 2016; McConnell et al., 2012; McConnell & McIntosh, 2009) for total rotational RoM. In contrast, two studies (Gulpinar et al., 2019; Harput et al., 2016) found no significant effect of taping on ER RoM. Additionally, Gulpinar et al. (2019) showed an increased IR and total rotational RoM with ET, while decreased IR and total rotational RoM with RT.

*It was concluded that the evidence to support increased **glenohumeral IR RoM** and **total rotational RoM** is moderate, and it is conflicting for **glenohumeral ER RoM** in overhead athletes with taping.*

Posterior shoulder tightness/flexibility

Gulpinar et al. (2019) studied the effect of taping on PST in asymptomatic overhead athletes and reported increased PST with RT, while they reported no effect of ET. In this RCT, the RT group received a humeral head repositioning taping and the ET group received a combination of supraspinatus facilitation, humeral head mechanical correction, and lower trapezius taping (Table 3).

Table 3. Description of the taping methods used in the included studies based on template for intervention description and replication (TIDieR) recommendations.

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
McConnell & McIntosh, 2009	Humeral head repositioning tape	- Underwrap (Fixomull stretch, Germany) and RT (Endura tape, Switzerland)	- The first piece of RT was applied from the anterior aspect of the humeral head, just lateral to the acromion process, to finish at the inferior angle of the scapula. The second piece of tape commenced on the anterior aspect of the humeral head over the acromion. The opposite hand lifted the humeral head up and back during the application of the tape. - ST were placed in identical positions, with no tension applied.	NA	Training room at the tennis centre	No
Smith et al., 2009	Scapular taping	- Underwrap (Fixomull stretch, Germany) and RT (Leukotape combi pack, Germany)	- Underwrap was applied anteriorly at the mid third of the clavicle and placed posteriorly over the main belly of the UT and continued in the direction of T12 down to the belly of the LT. RT was then secured on the underwrap supero-anteriorly.	Investigator	University research laboratory	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Bradley et al., 2009	Shoulder taping	– 5 cm fabric RT (Leukoplast, Germany) and 7.5 cm elastic overwrap (Elastoplast, Germany)	- Taping consisted of three anchors; (1) from 3 cm above the nipple over the top of the clavicle and to the same level on the back, (2) from the ends of the first anchor around the torso below the axilla, (3) around the upper arm at the lateral edge of the deltoid insertion. Three support strips were placed; (1) placed from the over-the-shoulder anchor out to the arm anchor halfway between the top of the shoulder, (2) placed over the ACJ following the anterior edge of the trapezius from the over-the-shoulder anchor to the same point as the first at the lateral insertion of the deltoid, (3) started one-third of the distance between the second support strip and the second anchor out to the same point at the lateral insertion of the deltoid approximately along the spine of the scapula. The arm was held in 30 degrees of abduction of the shoulder. None of the strips were placed under tension. Two final anchoring strips were placed over the first anchor and the around-the-arm anchor to lock the tape in place. Elastic overwrap was placed over the three straps and then over the three anchor straps to finish the taping.	Physiotherapist	NA	No
Hsu et al., 2009	LT muscle taping	- ET, 5 cm x 28 cm ET (Kinesio Tex, Japan) - PT, 5 cm x 28 cm ET (3 M Micropore, USA)	- Y-shaped ET was applied to envelope the LT with minimal tension. - Y-shaped tape was applied over the same position without any stretch force.	NA	NA	No
McConnell et al., 2011	Humeral head repositioning tape	- Underwrap (Fixomull stretch, Germany) and RT (Endura tape, Switzerland)	- The same taping protocol of McConnell & McIntosh, 2009.	NA	NA	No
McConnell et al., 2012	Humeral head repositioning tape	- Underwrap (Fixomull stretch, Germany) and RT (Endura tape, Switzerland)	- The same taping protocol of McConnell & McIntosh, 2009.	NA	Academic institution sports medicine	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Van Herzeele et al., 2013	Scapular position correction	- ET (K-active tape, Japan)	- A strip of ET was applied over the muscle belly of the UT, starting anterior at the processus coracoideus. The tape was pulled over the belly of the UT towards the thoracic spine, following the muscle fibres of the LT.	Physiotherapist	NA	No
Müller & Brandes, 2015	PM muscle tone taping with IR support	- ET (Towatek, South Korea)	- For PM, ET was applied with a stretch of 20–30% of its original length from the anatomical origin to the insertion of the muscle. For IR support, the base was attached to the coracoid process. The athlete then externally rotated the shoulder, before the tape ran out on the back of the scapula.	Physiotherapist and sports scientist	NA	No
Intelangelo et al., 2016	Scapular taping	– 5 cm underwrap (Hypafix, Germany) and 4 cm RT (BSN Medical, Germany)	- The strip of endurafix was applied without tension, extended from the level of the coracoid process across the fibres of the UT until reaching the paraspinal muscles, immediately below the superior-internal angle of the scapula. Next, a tape strip was applied on the endurafix with tension, passively keeping the scapula in the depression. and retraction positions	Physiotherapist	NA	No
Tanoori et al., 2016	PM and IS taping	- ET (Kinesio Tex, Japan) - RT (Mueller Athletic tape, USA)	-ET: For the PM, a Y-shaped strip of tape was measured and cut. An anchor was attached with no tension at the cartilage surface in the shoulder's neutral position, after which the muscle was stretched. The tape was stretched 25%, and again, the end was placed with no tension at the greater tubercle of humerus. For the IS, a single strip of ET was measured and cut. The anchor was attached with no tension 2 cm lateral to the scapula's medial border just below the scapular spine in neutral shoulder position. The muscle was then placed in a stretched position, and the tapes were stretched by 25%. Again, the arm was positioned with no tension at the tubercle of the humerus. -RT: Tape was applied to enhance the force production of the scapular muscles. The tape was applied by holding the muscle in a shortened position and applying the tape along the muscle length.	Certified Kinesiotape trainer	NA	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Harput et al., 2016	Scapular taping	- ET (Kinesio Tex, Japan)	- First, I shape tape was applied on the medial border of the scapula vertically with 75% of tension while the participant was retracting the scapula. The second I shape tape was applied from anterior aspect of the humeral head to the inferior border of the scapula diagonally with the same tension while the participants were posteriorly tilting the scapula.	Physiotherapist	NA	No
Leong et al., 2017	Scapular taping	– 3.8 cm RT (Leukotape, Germany)	- Participants were asked to fully extend their thoracic spine, with the scapula positioned in the full retraction and depression position. I-shaped RT was applied starting from the inferior margin of the medial 1/3 of the clavicle, then firmly on the UT muscle with full stretching of the tape to the T12. -PT was applied in the same way but without any tension.	Researcher	NA	No
Fong et al., 2018	Rotator cuff tendinitis taping	- ET (Support Guards, Australia)	- The first Y-shaped strip, with 15% to 25% tension, ran from 5 cm below the greater tuberosity of the humerus to the SS fossa and spinous process of the scapula. The second Y-shaped strip, with 15% to 25% tension, originated from 5 cm below the deltoid tuberosity of the humerus and followed the curvature of the anterior and posterior deltoid muscle. The I-shaped strip, with 50% to 75% tension, ran from the anterior shoulder to the posterior shoulder region.	Physiotherapist	NA	No
Shih et al., 2018	Scapular taping	-ET (Kinesiology Tape, Japan) - PT (3 M Micropore, USA)	- Y-tape ET was applied to encircle the LT from origin to insertion, while the participant held the arm at 90° flexion with maximum scapular protraction. A fully stretched I-shaped tape was applied perpendicular to the muscle belly of the UT when the scapula was held in maximum retraction and depression. - Surgical tape without any stretch tension was applied when the participant was in the relaxed sitting position as the PT.	NA	Musculoskeletal laboratory	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Ozer et al., 2018	Standardize taping to improve shoulder and scapular biomechanics	- Hypoallergenic tape (Hypafix, Germany) -RT (Protape, Norway) - ET (KinesioTex, Japan)	-RT: First, hypoallergenic tape was applied with no tension. Next, the first RT was applied from the anterior aspect of the shoulder to the T6 area with a pull in to retraction and the second RT from just below the coracoid in the anterior aspect of the shoulder to the T10 area with an initial pull up and then back. -ET: First, a Y-strip spanned the origin to the insertion of the SS using paper-off tension while participants reached behind their backs with their upper extremities and flexed their necks to the contralateral side. Second, an I-strip was applied from the coracoid process around the posterior deltoid using downward pressure and approximately 50% to 75% stretch. Initially, the shoulder was externally rotated with no elevation and then it was moved into slight horizontal adduction and forward elevation as the end of the tape was applied with no stretch. This I-strip had a Y shape at the end of the tape. Finally, a Y-strip was applied from the T10–T12 area to the medial border of the scapula using paper-off tension to facilitate the LT. For this technique, the lateral tail of the Y-tape was applied with the shoulder horizontally adducted, and the medial tail was applied with the hands crossed over the chest. -PT: 2 elastic tape strips with no tension were applied to the ACJ and LT separately.	Primary author, who is certified by Kinesio Taping Association International	Athletic training field	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Gulpinar et al., 2019	Shoulder taping	- Underwrap (Hypafix, Germany) and RT (Protape, Norway) - ET (Kinesio Tex, Japan) -PT (Kinesio Tex, Japan)	- RT: First, the hypoallergenic tape was applied with no tension. Then the first RT was applied from the anterior aspect of the shoulder to around deltoid muscle just below the acromial level to the T6 area with pull into retraction. The second RT was applied from the anterior shoulder just below the coracoid to the T10 area with an initial pull up and then back when the tape was at the midline. -ET: (1) Y-strip was applied from its origin to insertion with paper-off tension for facilitation of the supraspinatus. This strip was applied with the subject in a position of combining contralateral cervical side bending and the arm reaching behind the back. (2) I-strip with Y was applied from the coracoid process around the posterior deltoid with approximately 50% to 75% tension and downward pressure applied for a mechanical correction. For this technique, the shoulder was externally rotated while at the side and then moved into flexion and slight horizontal adduction as the end of the tape was applied with no stretch. (3) Y-strip was applied to the LT from the T10-12 area to the medial border of the scapula with paper-off tension. The medial tail of Y-tape was applied with the hands crossed on the chest and the lateral tail was applied with the shoulder horizontally adducted. - PT: First strip was applied over the ACJ and second on the LT, both with no tension.	Physiotherapist	Local sports club	No
Leong & Fu, 2019	Scapular taping	- RT (Leukotape, Germany)	- Participants were asked to fully extend their thoracic spine, with the scapula in full retraction and depression position. RT was applied from the infero-medial 1/3 of the clavicle, then firmly across the fibres of the UT with full stretching of the tape to the T12. - ST was applied in the same way but without any tension applied.	Researcher	NA	No

(*Continued*)

Table 3. (Continued).

	TIDieR feature					
Study	Brief name and Why	What (Materials)	What (Procedure)	Who	Where	Tailoring/ Modification
Tooth, Schwartz, Fransolet, 2020	Scapular stabilization taping	ET (Cure Tape, South Korea)	- Two-trips of ET were applied. The first strip was applied from the coracoid process, then on the UT and finally applied on the inferior border of the scapula. A maximal tension was applied from the spine to the inferior border of the scapula. The second strip was applied between the thoracic spine and the inferior border of the scapula. For people with an increase in scapular downward rotation at rest, a maximal tension was exerted from the inferior border of the scapula till the side to facilitate scapular upward rotation. For people with an increase in scapular upward rotation at rest, the strip was applied in the opposite direction, from the side till the inferior border of the scapula.	Investigator	Tennis court in the laboratory	Yes
Tooth, Schwartz, Colman, 2020	Scapular dyskinesis taping	ET (Cure Tape, South Korea)	-ET was applied in two different ways. (ET 1) The volunteer sat on a stool, shoulder placed at 60° of flexion in a sagittal plane and supported. Taping was applied from the coracoid process, then firmly on the UT and finally on the inferior angle of the scapula. The strip was fully stretched between the spine and the inferior border of the scapula. (ET 2) The first strip was exactly the same as above. The second strip was applied from the thoracic spine and to the inferior border of the scapula. Full tension was applied from the inferior border of the scapula to the lateral side in order to enhance scapular upward rotation.	Investigator	Laboratory of Human Motion Analysis	No
Yun et al., 2020	Rounded shoulder taping	-ET (BB tape, Korea)	- ET was applied from the anterior of the scapular acromion up to the spinous process of the 10th thoracic vertebra with 30–40% stretch while the subject was standing upright in a posture with the scapula retracted. Second strip was applied once again to the same area of the previous application, but with a 50% overlap and 30–40% stretch. - ST was applied with the same technique but without any stretch with elastic tape.	Physiotherapist	NA	No

NOTE: why" (theoretical framework), "what" (intervention type, intervention materials and procedures, control description), "who" (intervention provider), "how" (use of technology, individual or groups), "where" (location of intervention), "when and how much" (du- ration, number of sessions), "tailoring," and "how well" (attrition, compliance).

Abbreviations: ET, elastic taping; RT, rigid taping; PT, placebo taping; ST, sham taping, UT, upper trapezius; LT, lower trapezius; T, thoracic spine; ACJ, acromioclavicular joint; PM, pectoralis major; IR, internal rotation; IS, infraspinatus; SS, supraspinatus.

*It was concluded that there is limited evidence that discourages the use of taping for altering **PST** in overhead athletes.*

Kinematics

Six studies (Hsu et al., 2009; Leong et al., 2017; Ozer et al., 2018; Shih et al., 2018; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013) reported the effect of taping on scapular kinematics while one study (McConnell et al., 2011) reported its effect on glenohumeral kinematics in overhead athletes (Table 4). Five of the six studies (Hsu et al., 2009; Leong et al., 2017; Shih et al., 2018; Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013) investigated the effect of taping on 3-D kinematics during arm elevation. The effect of RT on scapular kinematics during shoulder abduction was investigated in two studies (Leong et al., 2017; Ozer et al., 2018), while the effect of ET on scapular kinematics was investigated in five studies (Table 3) (Hsu et al., 2009; Ozer et al., 2018; Shih et al., 2018; Tooth, Schwartz, Colman et al., 2020; Van Herzeele et al., 2013). It is worth noting that all studies followed different taping techniques, and recruited asymptomatic (Ozer et al., 2018; LinkManagerBM_REF_76eWXp2JTooth, Schwartz, Colman, et al., 2020; Van Herzeele et al., 2013) or symptomatic (Hsu et al., 2009; Van Herzeele et al., 2013) overhead athletes including SIS (Hsu et al., 2009; Shih et al., 2018). In general, there is an agreement among studies that taping may alter scapular kinematics in both asymptomatic (Tooth, Schwartz, Fransolet et al., 2020; Van Herzeele et al., 2013) and symptomatic (Hsu et al., 2009; Leong et al., 2017; Shih et al., 2018) overhead athletes.

With respect to scapular upward rotation, four studies (Leong et al., 2017; Shih et al., 2018; Tooth, Schwartz, Colman et al., 2020; Van Herzeele et al., 2013) reported increased scapular upward rotation after taping, while Ozer et al. (2018) reported no change. For scapular internal rotation, Tooth et al. (2020) reported increased scapular internal rotation after taping and three studies (Leong et al., 2017; Shih et al., 2018; Van Herzeele et al., 2013) reported no change. Additionally, regarding scapular posterior tilt, three studies (Shih et al., 2018; Tooth, Schwartz, Colman et al., 2020; Van Herzeele et al., 2013) reported increased posterior tilt after taping, and Leong et al. (2017) reported no change. On the other hand, two studies (Hsu et al., 2009; Shih et al., 2018) compared the effect of ET with PT. Shih et al. (2018) reported an increased scapular upward rotation and both studies reported an increased scapular posterior tilt difference in favour of ET. Hsu et al. (2009) reported no difference in scapular upward rotation and internal rotation when they compared ET and PT. Lastly, McConnell et al. (2011) investigated the effect of humeral head repositioning RT on glenohumeral kinematics and reported different results for previously injured and un-injured athletes. They reported increased maximum ER, IR, and total rotational motion for un-injured athletes, while decreased maximum ER, IR, and total rotational motion for injured athletes, whereas RT was reported to have no effect on shoulder abduction.

*It was concluded that there is moderate evidence to support the effectiveness of taping in increasing **scapular upward rotation** and **scapular posterior tilt**, while the evidence to support not to use taping to alter **scapular IR** among overhead athletes is also moderate.*

Table 4. Results of the included studies.

Study (Comparators)	Outcome Measures	Conclusions
McConnell & McIntosh, 2009 (NT vs. RT vs. ST)	• Glenohumeral rotational RoM -Passive ER and IR of GHJ measured with a universal goniometer in supine position while the arm abducted to 90° and the elbow flexed to 90°.	- RT resulted in increased ER (MD, 6.4°; 95% CI, [−2.4–15.2]; ES, 0.64 for males; MD, 7°; 95% CI, [−2.8–16.8]; ES, 0.66 for females), IR (MD, 8°; 95% CI, [1.1–14.8]; ES, 1.04 for males; MD, 7.9°; 95% CI, [1.08–14.7]; ES, 1.08 for females), and total rotational RoM (MD, 14.4°; 95% CI, [5.4–23.3]; ES, 1.42 for males; MD, 15°; 95% CI, [2.6–27.3]; ES, 1.1 for females) when compared to NT. - No difference between NT and. ST. - No difference between ST and. RT.
Smith et al., 2009 (NT vs. RT)	• Muscular Activity -Muscular activity of the UT and LT measured with surface EMG during scapular plane elevation.	- RT resulted in decreased UT activity (MD, −13.4%; 95% CI, [5.8 – −25]; ES, 2.1) in symptomatic athletes. -Taping has no effect on LT activation.
Bradley et al., 2009 (NT vs. RT)	• Proprioception -Shoulder joint reposition sense measured with the aid of an optical tracking system in sitting during (1) 30° shoulder flexion, (2) shoulder abducted to 90°, elbow flexed to 90°, 30° IR at shoulder, (3) same as position (2), but with 90° ER at the shoulder. • Performance -Handballing accuracy measured with an "Auskick Handball Target" (distance from target).	-Taping has no effect on accuracy of repositioning the arm. -Taping has no effect on handballing accuracy.
Hsu et al., 2009 (NT vs. ET vs. PT)	• Strength - Isometric muscle strength of the LT measured with a handle-hand dynamometer in prone position while the arm abducted to 145°. • Kinematics - 3-D scapular kinematics (orientation and displacement) measured with an electromagnetic system during scaption (30°, 60°, 90°, 120° elevation and 120°, 90°, 60°, 30° lowering) with 2-kg-weight. • Muscular Activity - Muscular activity of SA, UT, LT measured with surface EMG during dynamic scaption (30°-120°).	- No significant difference in LT strength changes between PT and ET. - ET resulted in increased scapular posterior tilt at 30° (MD, 0.39°; 95% CI, [−0.06–0.84]; ES, 0.91) and 60° (MD, 0.44°; 95% CI, [−0.17–1.05]; ES, 0.77) humeral elevation when compared to PT. -No difference in scapular upward rotation, IR, and scapular displacement between PT and ET. - PT resulted in increased UT activation (MD, 23%RVC; 95% CI, [41.9 – −4.01]; ES, 0.84) in 90–120° of shoulder elevation when compared to ET. - ET resulted in increased LT activity (MD, 14.2%RVC; 95% CI, [29.13–0.7]; ES, 0.66) in 60–30° shoulder lowering phase of shoulder elevation when compared to PT. -No difference in SA activity between PT and ET.
McConnell et al., 2011 (NT vs. RT)	• Kinematics -3-D shoulder kinematics measured with motion capture system during throwing handball into a net. • Performance -Ball velocity measured with a motion capture system during throwing a handball into a net.	- RT resulted in increased maximum ER (MD, 3.7°; 95% CI, [−9.1–16.4]; ES, 0.2) and increased IR at zero elbow velocity (MD, 3°; 95% CI, [−11.01–17.01]; ES, 0.14) in the uninjured athletes. - RT resulted in decreased maximum ER (MD, 5.2°; 95% CI, [−29.3–18.9]; ES, 0.2) and decreased IR at zero elbow velocity (MD, 2.9°; 95% CI, [−15.6–9.8]; ES, 0.2) in the injured athletes. - Total rotational RoM increased with RT in the uninjured athletes (MD, 4°; 95% CI, [−14.4–22.4]; ES, 0.15) and decreased in the injured athletes (MD, 8.7°; 95% CI, [−33.3–15.9]; ES, 0.35).- Taping has no effect on shoulder abduction just after full cock. - Taping has no effect on ball velocity.

(*Continued*)

Table 4. (Continued).

Study (Comparators)	Outcome Measures	Conclusions
McConnell et al., 2012 (NT vs RT)	• Glenohumeral rotational RoM -Passive total rotational RoM of GHJ measured with a universal goniometer.	- RT increased passive total rotational RoM in the uninjured athletes (MD, 10°) and in the injured athletes (MD, 13°)
Van Herzeele et al., 2013 (NT vs. ET)	• Kinematics -3-D scapular kinematics measured with electromagnetic tracking device during abduction, anteflexion and elevation in the scapular plane (0°-120°).	- ET resulted in increased scapular posterior tilt in all planes of humeral movement and for all angles of elevation (MD, 4.23°, 3.23° and 4.33° respectively for elevation in the sagittal, frontal and scapular plane, ES < 0.7). - ET resulted in increased scapular upward rotation was observed at midrange levels in (MD, 2.36°, 3°, 3.32°, respectively for 30°, 60° and 90°, ES > 0.7).
Müller & Brandes, 2015 (NT vs. ET)	• Performance -Ball velocity measured with a radar device and accuracy analysis (distance from the target) with the help of a video camera during handball goal throwing.	- ET resulted in increased ball speed (MD, 1.1 km/h; 95% CI, [−2.5–4.7]; ES, 0.15). - ET resulted in decreased throwing accuracy (increased distance from the target, MD, 3.5 cm; 95% CI, [0.2–6.7]; ES, 0.68)
Intelangelo et al., 2016 (NT vs. RT)	• Strength -Isometric muscle strength for flexo-abduction and external rotation measured with a handle-hand dynamometer in standing position. For the flexo-abduction (scaption), arms were placed at a 90° scapular plane with shoulder ER. And for the ER, the arm was placed at the side of the body with the elbow flexed at 90°, and the forearm in neutral pronosupination. • Muscular Activity - Muscular activity of SA, UT, LT measured with surface EMG during shoulder flexion.	-Taping has no effect on maximal isometric force of scaption and ER. -Taping has no effect on muscular activity of SA, UT, LT.
Tanoori et al., 2016 (NT vs. ET vs. RT)	• Strength - Isokinetic muscle strength of shoulder IR and ER at the speed of 60°/sec and 180°/sec.	- RT has no effect on peak torque of IR and ER. - ET resulted in increased peak torque of IR at the speed of 60°/sec (MD, 6.3 Nm), 180°/sec (MD, 5.4 Nm), and ER at the speed of 180°/sec (MD, 3.9 Nm) when compared to NT. - ET resulted in increased peak torque of IR at the speed of 60°/sec (MD, 4.9 Nm), 180°/sec (MD, 5.8 Nm), and ER at the speed of 180°/sec (MD, 2.5 Nm) when compared to RT.
Harput et al., 2016 (NT vs. ET)	• Glenohumeral rotational RoM -Passive ER and IR RoM of GHJ measured with a digital inclinometer in supine position while the arm abducted 90° and the elbow flexed to 90°. • Strength -Isometric strength of IR and ER measured with an isokinetic dynamometer in sitting position with the arm abducted 90° and the elbow flexed to 90°. The peak torques were generated from the isokinetic dynamometer. • AHD -Distance between the head of humerus and the inferior edge of acromion was measured with ultrasound in sitting position with the arm abducted to 60° and the elbow flexed to 90°.	- ET resulted in increased glenohumeral IR (MD, 9.26°; 95% CI, [6.54–11.9]; ES, 1.08) and total rotational RoM (MD, 8.07°; 95% CI, [4.5–11.6]; ES, 0.71). - ET has no effect on glenohumeral ER RoM. - ET resulted in increased peak torque of IR (MD, 0.8 Nm; 95% CI, [0.02–0.1]; ES, 0.48) and ER strength (MD, 0.5 Nm; 95% CI, [0.01–0.1]; ES, 0.34). - ET has no effect on ER/IR ratio. - ET resulted in increased AHD (MD, 0.89 mm; 95% CI, [0.4–0.9]; ES, 1.07).

(*Continued*)

Table 4. (Continued).

Study (Comparators)	Outcome Measures	Conclusions
Leong et al., 2017 (NT vs. PT vs. RT)	• Kinematics - 3-D scapular kinematics measured with motion analysis system during shoulder ABD (0° – 90°). • Muscular Activity -Activity onset (recruitment patterns and latencies) of the UT, MT, LT, and SA measured with sEMG and an accelerometer during shoulder ABD.	- RT resulted in increased scapular upward rotation (MD, 0.6° – 1.5°) when compared to NT. - RT resulted in increased scapular upward rotation (MD, 0.2° – 2°) when compared to PT. - Taping has no effect on scapular posterior tilt and ER. - RT resulted in earlier activity onset of the MT (MD, 45.4 ms; 95% CI, [10.8–79.9]; ES, 0.78), LT (MD, 83.1 ms; 95% CI, [43.01–118.3]; ES, 1.31), and SA (MD, 62.5 ms; 95% CI, [37.3–87.6]; ES, 1.38) when compared to NT. - PT resulted in earlier activity onset of the MT (MD, 68.7 ms; 95% CI, [27.1–110.2]; ES, 0.2), LT (MD, 82.2 ms; 95% CI, [49.05–115.1]; ES, 1.38), and SA (MD, 52.5 ms; 95% CI, [- 20.2–84.7]; ES, 0.9) when compared to NT. -Taping has no effect on the activity onset of the UT.
Fong et al., 2018 (NT vs. ET)	• Muscular Activity -Muscular activity of PM, AD, IS and latissimus dorsi measured with surface EMG during badminton strokes. • Performance -Shuttlecock speed measured with 2-D video analysis during badminton strokes.	-ET has no effect on muscular activity. -ET has no effect on shuttlecock speed.
Shih et al., 2018 (NT vs. ET vs. PT)	• Kinematics - 3-D scapular kinematics measured with an electromagnetic tracking system during scaption. • Muscular Activity - Muscular activity of UT, LT and SA measured with surface EMG during scaption. • Proprioception - Scapular reposition error measured as the joint reposition errors (absolute value of the differences between the original target position and the reproduced position) during two movement tasks: the scapular elevation and the protraction task.	- ET resulted in increased scapular posterior tilt (MD, min – max, 1.6° – 3.7°) at all levels of elevation and deceleration when compared to NT which was greater than the change observed with PT. - PT resulted in resulted in increased scapular posterior tilt at 30° elevation (MD, 1.1°; 95% CI, [0.3–1.8]; ES, 0.29) and at 30° deceleration (MD, 2.1°; 95% CI, [1.05–3.2]; ES, 0.5), - ET resulted in increased scapular upward rotation at 120° elevation (MD, 0.8°; 95% CI, [0.2–2.6]; ES, 0.16), at 60° deceleration (MD, 1.5°; 95% CI, [0.5–1.45]; ES, 0.3), and at 30° deceleration (MD, 2.2°; 95% CI, [0.9–3.4]; ES, 0.3) which was significantly more than PT. - PT has no effect on scapular upward rotation. - Taping has no effect on scapular IR. - Increased UT activity in both ET (MD, min – max, 0.64–1.05%) and PT (MD, min – max, 0.59–1.61%) similarly when compared to NT. - Taping has no effect on LT and SA activity. - ET resulted in improved reposition errors for scapular tilt (MD, 1.3°; 95% CI, [0.25–2.8]; ES, 0.62), SUR/SDR (MD, 1.8°; 95% CI, [0.15–3.8]; ES, 0.66), and scapular displacement along the Y axis (MD, 0.25 cm; 95% CI, [0.001–0.5]; ES, 0.47) during the protraction task when compared to NT which was significantly more than PT. - Taping has no effect on reposition errors of the scapular IR, or the scapular displacement along the Z axis. - Taping has no effect on reposition errors during scapular elevation.

(*Continued*)

Table 4. (Continued).

Study (Comparators)	Outcome Measures	Conclusions
Ozer et al., 2018 (NT vs. ET vs. RT vs. PT)	• Kinematics - 2-D SUR measured with a digital inclinometer at 0°, 30°, 60°, 90°, and 120° of scaption.	- No differences in SUR within or between groups.
Gulpinar et al., 2019 (NT vs. ET vs. RT vs. PT)	• Glenohumeral rotational RoM -Active ER and IR of GHJ measured with a bubble inclinometer. IR was measured in a prone position while the arms abducted to 90° and the elbow flexed to 90°. ER was measured in the supine position while the arms abducted to 90° and the elbow flexed to 90°. • Posterior shoulder tightness/flexibility -PST measured by side-lying passive horizontal adduction measurement using a bubble inclinometer.	- ET resulted in increased glenohumeral IR (MD, 2.95°; 95% CI, [−4.4–10.3]; ES, 0.24) and total rotational RoM (MD, 2.34°; 95% CI, [−5.9–10.5]; ES, 0.1) when compared to NT. - RT resulted in decreased glenohumeral IR (MD, 3.2°; 95% CI, [- 2.9–9.4]; ES, 0.3) and total rotational RoM (MD, 4.5°; 95% CI, [- 2.1–11.1]; ES, 0.4) when compared to NT. - PT has no effect on glenohumeral IR and total rotational RoM. - Taping has no effect on glenohumeral ER. - ET resulted in increased total rotational RoM when compared to RT (MD, 7.4°) and PT (MD, 3.25°). - RT resulted in increased PST (MD, 4.7 mm; 95% CI, [0.5–8.9]; ES, 0.7) when compared to NT. - ET and PT have no effect on posterior shoulder tightness.
Leong & Fu, 2019 (NT vs. RT vs. ST)	• AHD -Subacromial space measured with ultrasound scanning system at 0°, 60° shoulder ABD, and the change in subacromial space during 0°-60° shoulder ABD.	- RT resulted in increased AHD (MD, 1.1 mm; 95% CI, [0.4–1.8]; ES, 0.61) at 60° of ABD and (MD, 0.8 mm; 95% CI, [0.1–1.5]; ES, 0.57) at the change in subacromial space during 0°-60° in symptomatic shoulders when compared to NT. - RT resulted in increased AHD (MD, 0.4 mm; 95% CI, [0.1–0.7]; ES, 0.46) at 0° of abduction in asymptomatic shoulders when compared to NT. - No difference between RT and ST. - ST has no effect on AHD.
Tooth, Schwartz, Fransolet, 2020 (NT vs. ET)	• Performance - Racket velocity measured with a 3-D optoelectronic system; tennis serve accuracy measured by a scoring system.	- ET has no effect on racket velocity. - ET resulted in decreased tennis serve accuracy (MD, 23%; ES, 0.18–0.32).

(*Continued*)

Table 4. (Continued).

Study (Comparators)	Outcome Measures	Conclusions
Tooth, Schwartz, Colman, 2020 (NT vs. ET1 vs. ET2)	• Kinematics - 3-D scapular kinematics measured with a motion analysis system in loaded (25% strength) and unloaded flexion and abduction. • Muscular Activity -Muscular activity of UT, LT, and SA measured with surface EMG during unloaded or loaded flexion and abduction.	- Both ET resulted in increased scapular upward rotation at 30°, 60° and 90°of elevation and 90°, 60° and 30° of deceleration during unloaded flexion, and 30° and 60° of elevation and 90°and 60° of deceleration during loaded flexion when compared to NT (MD, min – max, 1.4° – 3.5°). - Both ET resulted in increased scapular upward rotation at 30° and 60° of elevation during unloaded and loaded abduction, 30° and 60° of deceleration during unloaded ABD and all levels of deceleration during loaded abduction when compared to NT (MD, min – max, 1.3° – 2.6°). - Both ET resulted in increased scapular IR at 30° and 60° of elevation, 90° and 30° of deceleration during unloaded and loaded flexion when compared to NT (MD, min – max, 1.3° – 3.9°). - Both ET resulted in decreased scapular ER at 30° and 60° of elevation, 60° of deceleration during unloaded abduction, 30° of elevation, 60° and 30° of deceleration during loaded abduction when compared to NT (MD, min – max, 1.3° – 2.9°). - Both ET resulted in increased scapular posterior tilt at 60° and 90°of elevation and 90°, 60° and 30° of deceleration during unloaded flexion, and 30°, 60° and 90° of elevation and 60° and 30° of deceleration during loaded flexion when compared to NT (MD, min – max, 1.2° – 2.6°). - Both ET resulted in decreased UT activity at 90°, 120° of elevation, and at 120° of deceleration during the unloaded flexion when compared to NT (MD, min – max, 0.3–2.3%). - ET1 resulted in decreased LT activity at 60° of deceleration during unloaded flexion when compared to NT (MD, 1.1%). - ET2 resulted in decreased UT activity at 120° of deceleration during loaded flexion when compared to NT (MD, 1.1%). - Both ET resulted in decreased UT activity at 90° and 120° of elevation during unloaded abduction when compared to NT (MD, min-max 2.06–4.2%). - ET2 resulted in decreased UT activity at 90° (MD, 5.8%) and 120° of elevation (MD, 8.4%) during loaded abduction when compared to NT. - ET1 resulted in increased LT activity at 60° (MD, 1.9%) and 120° of elevation (MD, 0.6%) during unloaded flexion when compared to NT. - ET2 resulted in decreased LT activity at 60° (MD, 0.8%) and 120° of elevation (MD, 3.5%) during unloaded flexion when compared to NT. -ET has no effect on SA activity.

(*Continued*)

Table 4. (Continued).

Study (Comparators)	Outcome Measures	Conclusions
Yun et al., 2020 (NT vs. ET vs. ST)	• Strength -Isokinetic strength of shoulder rotator muscles measured with an isokinetic device in sitting position with the arm at 90° abduction and the elbow flexed to 90°, at the speed of 60°/sec and 180°/sec.	- ET resulted in increased IR peak torque at angular velocity 60° /s (MD, 2.5 Nm; 95% CI, [−4.9–10]; ES, 0.2) and 180° /s (MD, 2.2 Nm; 95% CI, [−4.6–9.1]; ES, 0.2) when compared to NT. - ET resulted in increased ER peak torque at angular velocity 60° /s (MD, 1.5 Nm; 95% CI, [−4.2–7.3]; ES, 0.1) and 180° /s (MD, 1.2 Nm; 95% CI, [−4.1–6.6]; ES, 0.1) when compared to NT. - ST has no effect on shoulder rotator strength. - ET resulted in greater amounts of changes in shoulder peak torque (MD, min – max, 1.3–3.62 Nm) at angular velocity 60° /s and 180° /s when compared to ST.

Abbreviations: RoM, range of motion; ER, external rotation; IR, internal rotation; GHJ, glenohumeral joint; ET, elastic taping; RT, rigid taping; PT, placebo taping; ST, sham taping; MD, mean difference; CI, confidence interval; ES, effect size; UT, upper trapezius; MT, middle trapezius; LT, lower trapezius; SA, serratus anterior; EMG, electromyography; PST, posterior shoulder tightness, AD, anterior deltoid; IS, infraspinatus; RVC, reference voluntary contractions; 3-D, three-dimensional; 2-D, two-dimensional; AHD, acromiohumeral distance.

Muscular activity

Seven studies (Fong et al., 2018; Hsu et al., 2009; Intelangelo et al., 2016; Leong et al., 2017; Shih et al., 2018; Smith et al., 2009; Tooth, Schwartz, Colman et al., 2020) reported the effect of taping on EMG activity (Table 4). The effect of RT on EMG activity was investigated in three studies (Intelangelo et al., 2016; Leong et al., 2017; Smith et al., 2009) in symptomatic overhead athletes. The same approach of scapular taping was applied in all three studies: an I-shaped RT was applied anterior to the posterior direction of the upper trapezius (UT) muscle (Table 3). Additionally, the effects of ET on EMG activity were investigated in four studies (Fong et al., 2018; Hsu et al., 2009; Shih et al., 2018; Tooth, Schwartz, Colman et al., 2020). It should be noted that in these four studies, different ET protocols were followed (Table 4), and they applied the tape to different subgroups of overhead athletes, notably SIS (Hsu et al., 2009; Shih et al., 2018), badminton players with painful shoulder (Fong et al., 2018), and asymptomatic overhead athletes with scapular dyskinesis (Tooth, Schwartz, Colman et al., 2020).

EMG activity alterations with taping were found in five studies (Hsu et al., 2009; Leong et al., 2017; Shih et al., 2018; Smith et al., 2009; Tooth, Schwartz, Colman et al., 2020). With respect to UT activity, both Smith et al. (2009) and Tooth et al. (2020) showed decreased UT activity. Shih et al. (2018) reported increased and Intelangelo et al. (2016) reported no change after taping. Hsu et al. (2009) reported an increased LT activity, while four studies (Fong et al., 2018; Intelangelo et al., 2016; Shih et al., 2018; Smith et al., 2009) reported no change in LT activity after taping. Regarding SA activity, five studies (Fong et al., 2018; Hsu et al., 2009; Intelangelo et al., 2016; Shih et al., 2018; Tooth, Schwartz, Fransolet et al., 2020) reported no effect of taping. Furthermore, Fong et al. (2018) investigated EMG activity of the pectoralis major (PM), anterior deltoid, infraspinatus (IS) and latissimus dorsi during

badminton strokes, and the results indicated that ET has no significant effect on EMG activity. It should be noted that Tooth et al. (2020) assessed the impact of two different ET techniques on LT activity, and they reported increased LT activity when ET was applied over UT (ET1) and reported decreased LT activity when an additional ET was applied over the scapula (ET2).

There is one study (Leong et al., 2017) investigating the effect of taping on muscular activity and reporting the temporal variable after applying the RT. Leong et al. (2017) reported an earlier activity onset of the middle trapezius (MT), LT, and SA with RT, while there were no effects of RT on the onset of UT activity, whereas PT resulted in an earlier activity onset of the MT, LT, and SA.

*It was concluded that there is conflicting evidence to support the effectiveness of taping in altering **UT activity**, while the evidence to support not to use taping to alter **LT and SA activity** is moderate among overhead athletes. Additionally, the limited evidence suggests that ET does not alter **PM, anterior deltoid, IS and latissimus dorsi activity** in overhead athletes.*

Acromiohumeral distance

Two studies (Harput et al., 2016; Leong & Fu, 2019) reported the effect of taping on AHD in asymptomatic overhead athletes and a significant increase in AHD was reported after scapular taping with either RT or ET. Additionally, Leong and Fu (2019) showed an increased AHD with PT (Table 4).

There is moderate evidence to support the effect of taping in increasing AHD for overhead athletes

Proprioception

Two studies (Bradley et al., 2009; Shih et al., 2018) reported the effect of taping on proprioception acuity in overhead athletes (Table 4). Proprioception improvement with taping was found in a study by Shih et al. (2018) in which scapular reposition errors were assessed during the protraction task after applying scapular ET. On the other hand, Bradley et al. (2009) investigated the effect of RT on shoulder joint reposition sense and found no significant improvement in shoulder proprioception in asymptomatic Australian football players.

*It is concluded that the use of taping enhances **scapular proprioception** but not **shoulder proprioception** in overhead athletes (limited evidence).*

Strength

Five studies (Harput et al., 2016; Hsu et al., 2009; Intelangelo et al., 2016; Tanoori et al., 2016; Yun et al., 2020) reported the effect of taping on isokinetic (Harput et al., 2016; Tanoori et al., 2016; Yun et al., 2020) or isometric (Hsu et al., 2009; Intelangelo et al., 2016) shoulder IR and ER strength in overhead athletes (Table 4). Strength improvement with taping was found in three studies (Harput et al., 2016; Tanoori et al., 2016; Yun et al., 2020) in which ET increased shoulder IR and ER peak torque in overhead athletes. Additionally,

the improvements in strength after applying ET were higher than ST (Yun et al., 2020), PT (Hsu et al., 2009), and RT (Tanoori et al., 2016). On the other hand, two studies found no effect of taping on maximal isometric force of scaption and shoulder ER with scapular RT (Intelangelo et al., 2016), on peak torque of shoulder IR and ER with RT on PM and IS (Tanoori et al., 2016), and on shoulder IR/ER ratio with scapular ET (Harput et al., 2016).

It was concluded that there is conflicting evidence to support the effectiveness of taping in improving ***shoulder IR and ER strength*** *for overhead athletes.*

Performance

Five studies (Bradley et al., 2009; Fong et al., 2018; McConnell et al., 2011; Müller & Brandes, 2015; Tooth, Schwartz, Fransolet et al., 2020) reported the effect of taping on performance parameters in overhead athletes (Table 4). Performance enhancement was reported in a study by Müller and Brandes (2015), who reported an increased ball velocity after applying PM tone ET with IR support; however, they also reported decreased accuracy with taping among asymptomatic overhead athletes. Four studies (Bradley et al., 2009; Fong et al., 2018; McConnell et al., 2011; Tooth, Schwartz, Fransolet et al., 2020) reported no significant effect of taping on accuracy or ball velocity among overhead athletes, while by Tooth et al. (2020) reported decreased serving accuracy after taping in asymptomatic tennis players with scapular dyskinesis.

It was concluded that taping is not effective in increasing ***performance*** *among overhead athletes (moderate evidence).*

Discussion

The present systematic review evaluated the existing evidence for the effectiveness of taping in overhead athletes. To our knowledge, this is the first study to review the effectiveness of taping on several biomechanical factors and performance in overhead athletes. In general, this study showed that taping in overhead athletes likely improves glenohumeral rotational RoM, AHD, and proprioception, and alters scapular kinematics. On the other hand, taping probably does not enhance PST, muscular activity, shoulder strength, and performance. This review mostly resulted in conflicting evidence for the effect of taping on some outcomes, such as glenohumeral ER RoM, UT muscular activity, and shoulder strength.

Although we found many studies reporting taping in the overhead athlete shoulder and there is consistency in some of their findings, the design and conduct of the studies had tendencies for high risk of bias, and this may be the reason for the moderate or limited evidence in our results. Frequently, there was a high risk of bias regarding the blinding of the participants or outcome assessors in the studies reviewed. Nevertheless, there are few studies on particular topics that permit strong judgement. Effects of taping on PST, AHD, and proprioception were investigated by a few studies, which may be considered as insufficient for judgement. Furthermore, there is a large variation in taping materials and application techniques across the included studies.

Although several taping methods have been reported in studies included in this review, they would not distinguish results based on ET vs. RT, but in general. However, there are varying effects of the taping used. ET is the most common taping method in

overhead athletes, and there is limited evidence to support its use in improving glenohumeral IR RoM, scapular kinematics during arm elevation, AHD, scapular proprioception, and shoulder rotational strength in overhead athletes. Scapular taping is the most frequent type of ET used in these studies. Studies have reported immediate benefits of ET used as one or two I-shaped tape strings applied from anterior to posterior direction while crossing the scapular medial border or inferior angle. The range of stretching of the taping material has been reported as 30% to 75% stretch by the studies included in this review. RT is another frequently used taping intervention, which was reported in eleven of the studies. Most of these reviewed articles have investigated the effect of scapular RT or humeral head repositioning RT. There is only limited evidence showing the acute benefits of humeral head repositioning RT for passive glenohumeral RoM. Humeral head repositioning taping includes one or two pieces of rigid tapes applied from the anterior aspect of the humeral head, finished at the inferior angle of the scapula, while humeral head is lifted up and back during the application of the tape. Although this method of RT can be advantageous to reposition the scapula and alter scapular kinematics, it results in acute restrictions in active glenohumeral RoM and PST. The potential cause of these results may be related to the nature of non-elastic material attached directly to the skin limiting the mobility.

Implications

Reports have shown the importance of the structural or functional adaptations in overhead athlete shoulders, and they may guide the professionals working with athletes in the management of the biomechanical factors and, therefore, increase performance. This review shows several taping methods utilized in overhead athletes, which is an indication of the efforts put by the professionals in finding effective alternative methods for the management of the athlete shoulder. This review shows that when taping is applied with a specific corrective purpose, such as altering scapular posterior tilt, it can be successful. Overall, the current evidence for taping in overhead athletes is limited in altering glenohumeral rotational RoM, scapular kinematics, AHD, and scapular PPS. Although altering some of the investigated factors may have a therapeutic or preventive role, based on the current evidence of this review, the management of the athlete shoulder should not focus on taping-only approaches. However, some immediate benefits can be obtained, and these changes can lead to function alteration. Therefore, taping can serve as a tool in engaging more active treatment approaches and individualized rehabilitation program when needed for the overhead athletes. Taping is simple to administer, cost-effective, and its role in reducing the burden of shoulder injuries when integrated into a more comprehensive approach in overhead athletes should further be investigated.

Study limitations

The quality of the studies included varied and none of the studies included were having a good methodological quality. The nature of the research question shapes the inclusion criteria for selecting studies with pre-test-post-test repeated measures design, and,

therefore, the reviewed studies were selected mostly from experimental studies. This calls for the need for more high-quality and well-designed trials in the subject area. The findings of this review are only based on the immediate effect of taping in overhead athletes and do not refer to long-term effectiveness of taping in the management of these athletes' shoulders. Furthermore, asymptomatic and symptomatic athletes were not reviewed separately, and also none of the specific taping techniques were followed. No uniform taping protocol was considered across all studies reviewed. However, the description of the reported taping methods was defined in detail. Also, some taping methods were categorized, based on their similarity, which simplifies the presentation of the result, but variations in the interventions may still exist within the same category, which makes the interventions not exactly the same.

Based on our findings, there is moderate to limited evidence to support the effectiveness of taping for acute gains in glenohumeral rotational RoM, AHD, scapular proprioception, and scapular kinematics in overhead athletes, which is mostly supported when ET is applied. Although some evidence exists, in general the effect of taping in overhead athletes on PST, shoulder kinematics, muscle activity, shoulder strength, and performance remains controversial or non-existent.

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ORCID

Elif Turgut http://orcid.org/0000-0002-2006-9617
Ezgi Nur Can http://orcid.org/0000-0002-2181-0796
Cigdem Demir http://orcid.org/0000-0003-2164-3489
Annelies Maenhout http://orcid.org/0000-0002-0610-9512

References

Borsa, P. A., Laudner, K. G., & Sauers, E. L. (2008). Mobility and stability adaptations in the shoulder of the overhead athlete. *Sports Medicine*, *38*(1), 17–36. https://doi.org/10.2165/00007256-200838010-00003

Bradley, T., Baldwick, C., Fischer, D., & Murrell, G. A. (2009). Effect of taping on the shoulders of Australian football players. *British Journal of Sports Medicine*, *43*(10), 735–738. https://doi.org/10.1136/bjsm.2008.049858

Effective Practice and Organization of Care (EPOC) Resources for Review Authors. Oslo: Norwegian Knowledge Centre for the Health Services. (2021). Retrieved June, 6 from https://epoc.cochrane.org/resources/epoc-resources-review-authors

Ellis, R. F. (1980). The use and treatment efficacy of kinaesthetic taping for musculoskeletal conditions: A systematic review. *New Zealand Journal of Physiotherapy*, *38*(2), 56. https://eds.b.ebscohost.com/abstract?site=eds&scope=site&jrnl=03037193&AN=53452064&h=pGb1VKsUQ8ImLOlabiRdSe4gecPISJ4rzJNKvj2GWY0enBrKHvqHzM5PiKe%2f4daPqj9gTnwK69OFGiHdzf%2feNg%3d%3d&crl=c&resultLocal=ErrCrlNoResults&resultNs=Ehost&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d03037193%26AN%3d53452064

Fong, S.-M., Ng, L.-K., Ma, -W.-W., Wang, H.-K., Bae, Y.-H., Yam, -T.-T., Kam, W.-K., & Chung, W.-Y. (2018). Effects of kinesiology taping on shoulder girdle muscle activity and sports performance during badminton forehand overhead strokes in amateur badminton players with shoulder impingement syndrome. *The Journal of Sports Medicine and Physical Fitness*, *59*(6), 994–1000. https://doi.org/10.23736/S0022-4707.18.09125-9 .

Ghozy, S., Dung, N. M., Morra, M. E., Morsy, S., Elsayed, G. G., Tran, L., Abbas, A. S., Loc, T. T. H., Hieu, T. H., Dung, T. C., Dung, T. C., & Huy, N. T. (2020). Efficacy of kinesio taping in treatment of shoulder pain and disability: A systematic review and meta-analysis of randomised controlled trials. *Physiotherapy*, *107*, 176–188. https://doi.org/10.1016/j.physio.2019.12.001

Gulpinar, D., Ozer, S. T., & Yesilyaprak, S. S. (2019). Effects of rigid and kinesio taping on shoulder rotation motions, posterior shoulder tightness, and posture in overhead athletes: A randomized controlled trial. *Journal of Sport Rehabilitation*, *28*(3), 256–265. https://doi.org/10.1123/jsr.2017-0047

Harput, G., Guney, H., Toprak, U., Colakoglu, F., & Baltaci, G. (2016). Acute effects of scapular Kinesio Taping® on shoulder rotator strength, ROM and acromiohumeral distance in asymptomatic overhead athletes. *The Journal of Sports Medicine and Physical Fitness*, *57*(11), 1479–1485. https://doi.org/10.23736/S0022-4707.16.06583-X

Hsu, Y.-H., Chen, W.-Y., Lin, H.-C., Wang, W. T., & Shih, Y.-F. (2009). The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome. *Journal of Electromyography and Kinesiology*, *19*(6), 1092–1099. https://doi.org/10.1016/j.jelekin.2008.11.003

Intelangelo, L., Bordachar, D., & Barbosa, A. W. C. (2016). Effects of scapular taping in young adults with shoulder pain and scapular dyskinesis. *Journal of Bodywork and Movement Therapies*, *20*(3), 525–532. https://doi.org/10.1016/j.jbmt.2015.11.014

Kalron, A., & Bar-Sela, S. (2013). A systematic review of the effectiveness of Kinesio Taping–fact or fashion. *European Journal of Physical Rehabiliyayion and Medicine*, *49*(5), 699–709. https://www.minervamedica.it/en/journals/europa-medicophysica/article.php?cod=R33Y2013N05A0699

Leong, H. T., & Fu, S. N. (2019). The effects of rigid scapular taping on the subacromial space in athletes with and without rotator cuff tendinopathy: A randomized controlled study. *Journal of Sport Rehabilitation*, *28*(3), 250–255. https://doi.org/10.1123/jsr.2017-0287

Leong, H. T., Ng, G. Y.-F., & Fu, S. N. (2017). Effects of scapular taping on the activity onset of scapular muscles and the scapular kinematics in volleyball players with rotator cuff tendinopathy. *Journal of Science and Medicine in Sport*, *20*(6), 555–560. https://doi.org/10.1016/j.jsams.2016.10.013

Lim, E. C. W., & Tay, M. G. X. (2015). Kinesio taping in musculoskeletal pain and disability that lasts for more than 4 weeks: Is it time to peel off the tape and throw it out with the sweat? A systematic review with meta-analysis focused on pain and also methods of tape application. *British Journal of Sports Medicine*, *49*(24), 1558–1566. https://doi.org/10.1136/bjsports-2014-094151

McConnell, J., Donnelly, C., Hamner, S., Dunne, J., & Besier, T. (2011). Effect of shoulder taping on maximum shoulder external and internal rotation range in uninjured and previously injured overhead athletes during a seated throw. *Journal of Orthopaedic Research*, *29*(9), 1406–1411. https://doi.org/10.1002/jor.21399

McConnell, J., Donnelly, C., Hamner, S., Dunne, J., & Besier, T. (2012). Passive and dynamic shoulder rotation range in uninjured and previously injured overhead throwing athletes and the effect of shoulder taping. *PM&R*, *4*(2), 111–116. https://doi.org/10.1016/j.pmrj.2011.11.010

McConnell, J., & McIntosh, B. (2009). The effect of tape on glenohumeral rotation range of motion in elite junior tennis players. *Clinical Journal of Sport Medicine*, *19*(2), 90–94. https://doi.org/10.1097/JSM.0b013e31819b9cd1

McMaster, W. C., & Troup, J. (1993). A survey of interfering shoulder pain in United States competitive swimmers. *The American Journal of Sports Medicine*, *21*(1), 67–70. https://doi.org/10.1177/036354659302100112

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery*, *8*(5), 336–341. https://doi.org/10.1016/j.ijsu.2010.02.007

Mohseni-Bandpei, M. A., Keshavarz, R., Minoonejhad, H., Mohsenifar, H., & Shakeri, H. (2012). Shoulder pain in Iranian elite athletes: The prevalence and risk factors. *Journal of Manipulative and Physiological Therapeutics*, *35*(7), 541–548. https://doi.org/10.1016/j.jmpt.2012.07.011

Mostafavifar, M., Wertz, J., & Borchers, J. (2012). A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. *The Physician and Sportsmedicine*, *40*(4), 33–40. https://doi.org/10.3810/psm.2012.11.1986

Müller, C., & Brandes, M. (2015). Effect of kinesiotape applications on ball velocity and accuracy in amateur soccer and handball. *Journal of Human Kinetics*, *49*(1), 119. https://doi.org/10.1515/hukin-2015-0114

Myklebust, G., Hasslan, L., Bahr, R., & Steffen, K. (2013). High prevalence of shoulder pain among elite N orwegian female handball players. *Scandinavian Journal of Medicine and Science in Sports*, *23*(3), 288–294. https://doi.org/10.1111/j.1600-0838.2011.01398.x

Ozer, S. T., Karabay, D., & Yesilyaprak, S. S. (2018). Taping to improve scapular dyskinesis, scapular upward rotation, and pectoralis minor length in overhead athletes. *Journal of Athletic Training*, *53*(11), 1063–1070. https://doi.org/10.4085/1062-6050-342-17

Parreira, P. C. S., Costa, L. D. C. M., Junior, L. C. H., Lopes, A. D., & Costa, L. O. P. (2014). Current evidence does not support the use of kinesio taping in clinical practice: A systematic review. *Journal of Physiotherapy*, *60*(1), 31–39. https://doi.org/10.1016/j.jphys.2013.12.008

Pope, D. P., Croft, P. R., Pritchard, C. M., & Silman, A. J. (1997). Prevalence of shoulder pain in the community: The influence of case definition. *Annals of the Rheumatic Diseases*, *56*(5), 308–312. https://doi.org/10.1136/ard.56.5.308

Saracoglu, I., Emuk, Y., & Taspinar, F. (2018). Does taping in addition to physiotherapy improve the outcomes in subacromial impingement syndrome? A systematic review. *Physiotherapy Theory and Practice*, *34*(4), 251–263. https://doi.org/10.1080/09593985.2017.1400138

Shih, Y.-F., Lee, Y.-F., & Chen, W.-Y. (2018). Effects of kinesiology taping on scapular reposition accuracy, kinematics, and muscle activity in athletes with shoulder impingement syndrome: A randomized controlled study. *Journal of Sport Rehabilitation*, *27*(6), 560–569. https://doi.org/10.1123/jsr.2017-0043

Smith, M., Sparkes, V., Busse, M., & Enright, S. (2009). Upper and lower trapezius muscle activity in subjects with subacromial impingement symptoms: Is there imbalance and can taping change it? *Physical Therapy in Sport*, *10*(2), 45–50. https://doi.org/10.1016/j.ptsp.2008.12.002

Tanoori, P., Mohamed, M. N. A., & Ali, M. R. M. (2016). Effects of kinesio® tape vs rigid tape on shoulder muscle strength in healthy tennis players. *International Journal of Applied Exercise Physiology*, *5*, 1. http://www.ijaep.com/index.php/IJAE/article/view/44

Tooth, C., Gofflot, A., Schwartz, C., Croisier, J.-L., Beaudart, C., Bruyère, O., & Forthomme, B. (2020). Risk factors of overuse shoulder injuries in overhead athletes: A systematic review. *Sports Health*, *12*(5), 478–487. https://doi.org/10.1177/1941738120931764

Tooth, C., Schwartz, C., Colman, D., Croisier, J.-L., Bornheim, S., Brüls, O., Denoël, V., & Forthomme, B. (2020). Kinesiotaping for scapular dyskinesis: The influence on scapular kinematics and on the activity of scapular stabilizing muscles. *Journal of Electromyography and Kinesiology*, *51*, 102400. https://doi.org/10.1016/j.jelekin.2020.102400

Tooth, C., Schwartz, C., Fransolet, C., Tubez, F., Colman, D., Croisier, J.-L., & Forthomme, B. (2020). Influence of scapular dyskinesis, kinesiotaping and fatigue on tennis serve performance. *International Journal of Performance Analysis in Sport*, *20*(3), 456–469. https://doi.org/10.1080/24748668.2020.1761672

Van Herzeele, M., van Cingel, R., Maenhout, A., De Mey, K., & Cools, A. (2013). Does the application of kinesiotape change scapular kinematics in healthy female handball players? *International Journal of Sports Medicine*, *34*(11), 950–955. https://doi.org/10.1055/s-0033-1334911

Van Tulder, M., Furlan, A., Bombardier, C., & Bouter, L., & Group, E. B. o. t. C. C. B. R. (2003). Updated method guidelines for systematic reviews in the Cochrane collaboration back review group. *Spine*, *28*(12), 1290–1299. https://doi.org/10.1097/01.BRS.0000065484.95996.AF

Williams, S., Whatman, C., Hume, P. A., & Sheerin, K. (2012). Kinesio taping in treatment and prevention of sports injuries. *Sports Medicine*, *42*(2), 153–164. https://doi.org/10.2165/11594960-000000000-00000

Wright, J. G., Swiontkowski, M. F., & Heckman, J. D. (2003). *Introducing levels of evidence to the journal*. LWW.

Yildiz, T. I., Castelein, B., Harput, G., Duzgun, I., & Cools, A. (2020). Does scapular corrective taping alter periscapular muscle activity and 3-dimensional scapular kinematics? A systematic review. *Journal of Hand Therapy*, *33*(3), 361–370. https://doi.org/10.1016/j.jht.2019.03.001

Yun, H.-G., Lee, J.-H., & Choi, I.-R. (2020). Effects of kinesiology taping on shoulder posture and peak torque in junior baseball players with rounded shoulder posture: A pilot study. *Life*, *10*(8), 139. https://doi.org/10.3390/life10080139