



Original Article

The effect of kinesio taping with exercise compared with exercise alone on pain, range of motion, and disability of the shoulder in postmastectomy females: a randomized control trial

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Abstract. [Purpose] The aim of the study was to investigate the effect of kinesio tape on pain, range of motion, and disability of the shoulder. [Subjects and Methods] Seventy-four female patients who underwent modified radical mastectomy participated in this study. They were randomly divided into two groups, an experimental group that received kinesio tape for the shoulder joint in addition to a conventional physiotherapy program and a control group that received the physiotherapy program only. Outcome measures included the Visual Analogue Scale, shoulder range of motion, and Shoulder Pain and Disability Index. [Results] The experimental group showed significant differences in all outcome measures both within and between groups. The control group only showed a significant within group difference in shoulder flexion. [Conclusion] Clinicians should be able to recognize the benefits achieved through the use of adjunct treatment options such as kinesio tape in comparison with benefits that can be obtained through the use of individual modalities in physical therapy. Kinesio tape can be suggested and recommended for postmastectomy patients, especially for shoulder pain, range of motion, and disability.

Key words: Mastectomy, Shoulder pain, Kinesio tape

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INTRODUCTION

According to the latest report of the International Agency for Research on Cancer (GLOBOCAN 2012), breast cancer (BC) is by far the world's most common cancer among women and the most likely cause that a woman will die from cancer worldwide¹⁾. In Egypt, the highest incidence rates for cancer among men were in the liver (33.6%) and bladder (10.7%), while in females they were in the breast (32.0%) and liver (13.5%). It has been estimated that by 2050, the incidence of cancer will be 3-fold that in 2013²⁾.

The American Society of Clinical Oncology (ASCO) revealed that the majority of women who had undergone BC surgery complained of postsurgical shoulder pain with limited upper arm range of motion (ROM) extending until 1.5 years after surgery³⁾. Likewise, the prevalence of chronic shoulder pain in patients following mastectomy due to BC has previously been reported to be 20% to 68%^{4–10)}. This adversely affects activities of daily living (ADL)¹¹⁾. Co-existing lymphedema often accounts for chronic postsurgical shoulder pain, limited ROM, and decreased muscle strength¹²⁾. Postmastectomy shoulder limitation is greater in patients treated with radiotherapy¹³⁾. In addition, it has been reported that women who underwent

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breast-conserving surgery were less likely to demonstrate shoulder restriction impairment compared with those who had undergone mastectomy¹⁴).

Early physiotherapy intervention for treatment is perceived to improve treatment outcomes. Accordingly, upper ROM exercises lasting 6–12 months after mastectomy have been shown to improve shoulder mobility and reduce pain^{15, 16}).

One of the current techniques being utilized is kinesio taping (KT), which was developed by Dr. Kenzo Kase in 1973. Kinesio tape is thinner and more elastic than conventional tape¹⁷) and can be stretched by approximately 40–60% of its resting length^{18, 19}). The recommended duration for wearing the tape is approximately 3–5 days²⁰). The concept that underlies KT for pain reduction is reduction of the pressure on pain receptors, muscles, and tendons, and this facilitates recovery without limitation of ROM²¹). Additionally, KT provides sensory stimulation, decreases formation of adhesions and contractures, increases skin softening, improves skin pliability, and reduces scar formation²²).

Though some research and studies have demonstrated the effect of KT in the management of different cases^{17, 20, 22–24}), evidence is lacking regarding the effect of KT on postmastectomy shoulder problems. Thus, this study was implemented to determine the effects of KT on pain, ROM, and disability of the shoulder in postmastectomy patients. This may provide valuable evidence supporting the importance of KT in the management of shoulder complaints in such cases.

SUBJECTS AND METHODS

The study employed randomization and selected 74 postmastectomy female patients with postoperative shoulder pain and dysfunction admitted to the National Cancer Institute. The inclusion criteria were as follows: modified radical mastectomy at least 2 weeks previously and currently undergoing chemotherapy and radiation therapy for stage I or II breast cancer, presence of shoulder pain with associated limitation of motion of the shoulder, and good compliance and willingness to participate in KT sessions with written consent. Subjects were excluded from the study due to the following reasons: diagnosed with active BCA at the time of the study; presence of skin hypersensitivity to Kinesio tape material; presence of treatment contraindications including the presence of a pacemaker, heart disease, pregnancy, infectious disease, epilepsy thrombophlebitis, arterial hypertension, or metastatic cancer; and presence of mental disturbances of the sensorium or language problems that could make communication and cooperation problematic.

The Research Ethics Committee (P.T. REC/012/001249) of the Faculty of Physical Therapy, Cairo University, approved this study, which was registered with ClinicalTrials.gov under identifier number NCT02749539, and patients were assessed for eligibility. If a patient met the inclusion criteria, she was provided with a consent form to sign to declare acceptance and was randomly allocated to either the control or experimental group through random assignment. This was done by having a physical therapist randomly pick names from a registry of qualified patients written on paper. Selection of names was conducted in the presence of another physical therapist, and each selected name was assigned to a group by alternating between the two groups. Names of patients assigned to each group were collected and coded using Microsoft Excel 2010 for windows (Microsoft Corp., Redmond, WA, USA). A patient flow diagram is presented in Fig. 1.

Subjects in both groups received routine physical therapy treatment, which consisted of active-assistive range of motion exercises (AAROME), active stretching, and strengthening exercises for the shoulder joint. Likewise, patients also received postural correction exercises. Initially, the patients were given general exercise instructions regarding wearing loose and comfortable clothing. They were also informed that all exercises should be performed slowly and gently within the pain-free range. Furthermore, they were told that they should breathe regularly during the exercises.

Exercises were performed at home as well as in a clinic under a physiotherapist's supervision. Two sets of 15 repetitions of each exercise were performed for AAROME and strengthening exercises. Two sets of 10 repetitions with 15- sec hold and relax times were performed for active stretching exercises. Finally, 3 sets of postural correction were performed with 3–5 repetitions per set.

In the first week, Codman's exercises, finger ladder, overhead pulleys, self-stretching, and postural correction (from crook and supine lying positions) exercises were performed.

In the second week, the same exercises as in the first week were repeated in-addition to self-stretching by pushing against a wall, hand behind the back towel stretching, static strengthening against a wall, and postural correction (from sitting and standing positions) exercises.

The control and experimental groups performed physical therapy exercises 3 times a week during the two-week intervention period. The experimental group additionally received KT as an adjunct treatment, which was reapplied every 3 days interval within the 2 weeks of the intervention by a certified kinesio taping practitioner.

Standard 2-inche Kinesio Tex^R tape was used for taping in the experimental group. General application guidelines consistent with the procedures described by Kase et al.¹⁸) were followed. KT was applied using 4 strips of Kinesio tape, with the first 3 strips comprising the first KT application, which was performed with the inhibition technique with 15–25% tension.

First strip was an I strip applied over the supraspinatus. The anchor was applied just below the greater tuberosity of the humerus without tension. Then, the patient was instructed to adduct, extend, and internally rotate the shoulder in conjunction with contralateral neck flexion. The rest of the tape strip was applied along the spinous process of the scapula and ended with no tension.

Second strip was a Y-strip for the deltoid. The anchor was applied on the deltoid's insertion with the first tail applied to the anterior deltoid as the arm was externally rotated and horizontally abducted. The second tail was applied on the posterior

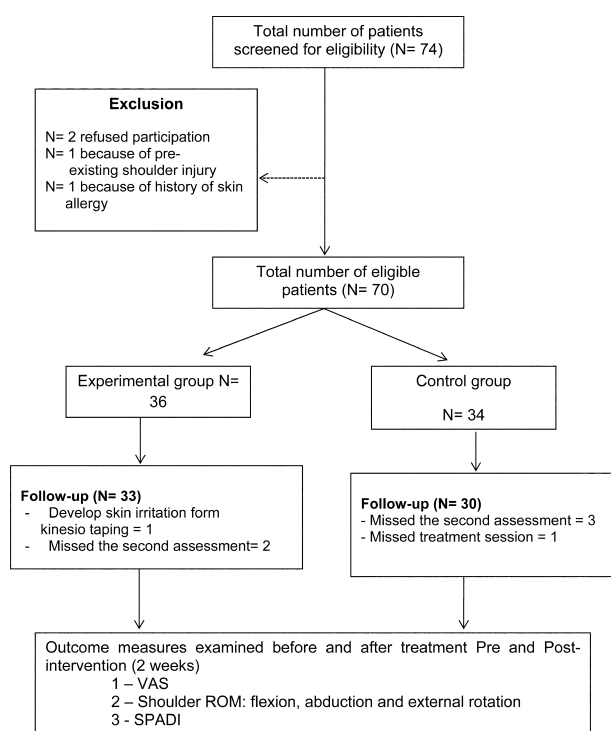


Fig. 1. Flow diagram of the Study

Table 1. Demographic data of the subjects (mean \pm SD)

	Experimental group (n=33)	Control group (n=30)
Age (years)	43.33 \pm 3.78	42.80 \pm 3.88
Marital status		
Married	20	19
Divorced	9	4
Widow	4	7
Affected side		
Dominant	20	18
Nondominant	13	12
Pre-existing shoulder problem	1	0
Postsurgical complications		
None	30	29
Infection	2	1
Bleeding	1	0

deltoid with the arm in horizontal adduction and internal rotation. Both tails ended with no tension.

Third strip was an I-strip KT applied to the teres minor muscle. The anchor was placed over the lower facet of the greater tuberosity with no tension. The patient's arm was in shoulder flexion with horizontal abduction and internal rotation. The end of the tape was applied with no stretch at the inferior angle of the scapula.

The fourth strip, comprising the second KT application, was applied with the mechanical correction technique with 50% to 75% tension. It was I-strip (cut down in middle) and was applied from the coracoid process anteriorly to the posterior deltoid with downward pressure by the tape at the region of perceived tenderness for the shoulder joint.

The outcome measures were shoulder pain intensity measured with the Visual Analogue Scale (VAS); active ROM of shoulder flexion, abduction, and external rotation; and the Shoulder Pain and Disability Index (SPADI). For the VAS, patients were asked to place a perpendicular line on the scale that corresponded to their perceived pain intensity. VAS scores describe the postoperative pain intensity as none, mild, moderate, or severe. The following cutoff were used for the VAS pain scale: 0–4 mm, no pain; 5–44 mm, mild pain; 45–74 mm, moderate pain; and 75–100 mm, severe pain²⁵.

Using a universal goniometer, shoulder ROM of flexion, abduction, and external rotation of the affected side were measured. Shoulder flexion and external rotation were assessed with the patient in a supine lying position, while abduction was investigated in an upright position. In this study, an experienced physiotherapist assessed shoulder ROM before and after intervention. The KT was applied after the initial evaluation and was removed before the final assessment, so the tester was blind with respect to the group assignments.

The SPADI was developed to evaluate the shoulder pain and disability. It consists of 13 items that assess two domains: a 5-item subscale that measures pain and an 8-item subscale that measures disability. The total score is calculated by averaging the pain and disability subscale scores²⁶. The SPADI has reliability coefficients of ICC \geq 0.89 in a variety of patient populations²⁷. Its internal consistency is high, with Cronbach's α typically exceeding 0.90^{27, 28}. The SPADI demonstrates good construct validity, correlating well with other region-specific shoulder questionnaires^{27, 29, 30}. The translated version of the SPADI in the Arabic language showed excellent internal consistency, with a Cronbach's α values of 0.98, and test-retest reliability³¹.

All the collected data were tabulated in the PASW Statistics Version 18 to apply both descriptive and inferential statistics. Both the paired and unpaired t-test were used to indicate inter- and intragroup differences. The p-value was set at 5%.

RESULTS

Seventy-four patients underwent modified radical mastectomy. However, only sixty-three completed the study. Demographic characteristics of the subjects are provided in Table 1.

Table 2. Pre- and posttreatment measurement scores in the experimental and control groups

Outcomes	Experimental group n=33		Control group n=30	
	Pre	Post	Pre	Post
VAS	4.9 ± 1.8	3.3 ± 1.4*	4.8 ± 1.6	4.1 ± 1.5
Flexion (degrees)	94.1 ± 8.7	130.6 ± 8.7*	93.2 ± 8.0	104.3 ± 7.4*
Abduction (degrees)	74.5 ± 8.7	103.3 ± 12.3*	73.3 ± 8.7	76.6 ± 8.1
External rotation (degrees)	64.4 ± 14.6	79.9 ± 8.0*	64.1 ± 12.8	68.2 ± 12.0
SPADI	102.4 ± 3.7	93.6 ± 4.9*	101.0 ± 5.2	99.00 ± 4.5

*Indicates significance change

Baseline characteristics and pre- and posttreatment scores for outcome measures are presented for both the experimental and control groups. No meaningful difference existed between the groups when matched. A summary of the mean scores for each of the outcomes measured, pain, shoulder ROM (shoulder abduction), and SPADI, are presented in Table 2. The decreases in scores recorded for the VAS and SPADI are indicative of improvement. The increases in scores for shoulder ROM indicate improvement.

The control group showed no change in the VAS score ($p=0.071$), indicating that there was no significant difference in pain intensity compared with the pretreatment score. The experimental group showed a mean difference of 1.63 points in VAS score in comparison with the mean difference of 0.72 points in the control group. The experimental group showed significant improvement both within and between groups ($p=0.0001$ and $p=0.025$, respectively). Both groups showed significant within-group improvement ($p=0.0001$) in shoulder flexion ROM after two weeks of treatment. The experimental group improved by 36.50° , while the control group improved by 11.2° .

For the experimental group, a significant difference was noted between groups ($p=0.0001$) in respect to shoulder flexion. Measurement of both shoulder abduction and external rotation in the experimental group showed significant improvement both within and between groups ($p=0.0001$, $p=0.001$), shoulder abduction and external rotation improving by 28.70° and 15.4° respectively. There was no significant difference ($p=0.123$, $p=0.195$) in the control group, with shoulder abduction and external rotation only improving by 3.3° and 4.06° , respectively.

In terms of the SPADI, the experimental group showed significant improvement within and between groups ($p=0.001$), the SPADI score decreasing by 8.8 points between before and after treatment. There was no meaningful difference noted within the control group ($p=0.103$), which showed a decrease of 2 points.

DISCUSSION

Few studies have been performed to evaluate the clinical effects of shoulder KT with physical therapy in patients suffering from shoulder-related problems following mastectomy, but several authors have reported pain reduction following KT application^{17, 20, 23, 32}. Regarding pain intensity, the current study found a greater decrease in the experimental group after KT application compared with the control group. This is consistent with findings that showed a greater pain reduction after applying KT compared with application of physical therapy alone³³. Noticeable clinical improvements were evident by the second week of treatment and similar to statistically significant findings reported for the reduction in pain between before and after treatment with KT^{17, 33, 34}. In contrast, Akbas et al.³⁵ did not report significant pain reduction despite the addition of physical therapy treatment and concluded that KT was not even superior to sham taping/placebo taping.

Generally, the results related to shoulder ROM after KT were significant both within and between groups in the experimental group when baseline and posttreatment values were analyzed. Several authors have previously reported improvement of shoulder ROM accompanied by reduction of pain intensity with KT application^{24, 36-38}. In the present study, the improvement in shoulder ROM after KT application in addition to physical therapy was similar to findings^{20, 39} of earlier studies. Concomitantly, pain reduction resulted in improvement in shoulder abduction, flexion, and external rotation ROM. In contrast, there was only significant improvement in shoulder flexion when both pre- and posttreatment values were compared in the control group.

In contrast, the shoulder flexion results of our control group, a previous study reported that shoulder abduction primarily showed a significant difference after physical therapy and was the only outcome to improve²⁰.

Several reasons may account for pain reduction through the use of KT application. One of these possible reasons is the Gate Control Theory. The tape used for KT is presumed to stimulate the neuromuscular pathway through an increase in afferent feedback²⁰. Under the Gate Control Theory, an increase in the afferent stimulus to large-diameter nerve fibers can lessen the input received by small-diameter nerve fibers conducting pain sensation²⁰. Another possible mechanism is activation of circulatory and neurological systems with movement³⁷. The tape can be used to support muscles, fasciae and joints in addition to allowing unrestricted ROM. Depending on the amount of applied stretch, potential benefits of the application involve the provision of a stimulus through the skin based on the position of the taping, the facilitation of fascial

tissues alignment, and the creation of additional space through the lifting of fasciae and soft tissue above the area affected. This lifting effect increases the amount of the space and reduces localized pressure, which eventually improves circulation and lymphatic drainage⁴⁰). This mechanism is perceived to be the underlying rationale for reduction of swelling and muscle spasm²⁰). In terms of shoulder movement facilitation through its entire ROM, the stretching of the skin over the region caused by KT, guides the shoulder through the arc. An improvement in glenohumeral motion will facilitate the effects of KT. This will decrease the mechanical irritation present in the soft tissues surrounding the shoulder joint²⁰).

The current study showed that KT had a significant effect in terms of improvements in pain intensity, disability scores, and shoulder ROM. Therefore, KT can be used in combination with physical therapy interventions. Furthermore, clinicians should be able to recognize the benefits achieved through the use of adjunct treatment options such as KT in comparison to benefits that can be obtained through the use of individual modalities in physical therapy. KT can be suggested and recommended for postmastectomy patients, especially for pain, ROM, and disability of the shoulder.

The limitations of this study were the short duration of KT application and the small sample size. Therefore, clinical trials should be conducted with a larger sample size for an extended period of time. Further research may produce additional information on the potential benefits of KT as an adjunct treatment with physical therapy in postmastectomy patients. Clinical messages are:

- The use of KT with physical therapy modalities decreases shoulder-related signs and symptoms after mastectomy.
- KT application reduces shoulder pain and its resultant effects on disability with improvement of shoulder range of motion.
- The use of KT in combination with physical therapy can be recommended for pain relief in patients with shoulder limitation of motion.

Conflict of interest

Sayed A. Tantawy and Dalia M. Kamel declare that they have no competing interests.

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REFERENCES

- 1) Ferlay J, Soerjomataram I, Ervik M, et al.: GLOBOCAN 2012 v1.1, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer; 2014. <http://globocan.iarc.fr> (Accessed on Jan. 1, 2015)
- 2) Ibrahim AS, Khaled HM, Mikhail NN, et al.: Cancer incidence in Egypt: results of the national population-based cancer registry program. *J Cancer Epidemiol*, 2014, 2014: 437971. [Medline] [CrossRef]
- 3) Arm/Shoulder Problems Common After Breast Cancer Surgery: 2008. <http://www.breastcancer.org/research-news/20080909>.
- 4) Stevens PE, Dibble SL, Miaskowski C: Prevalence, characteristics, and impact of postmastectomy pain syndrome: an investigation of women's experiences. *Pain*, 1995, 61: 61–68. [Medline] [CrossRef]
- 5) Wallace MS, Wallace AM, Lee J, et al.: Pain after breast surgery: a survey of 282 women. *Pain*, 1996, 66: 195–205. [Medline] [CrossRef]
- 6) Carpenter JS, Andrykowski MA, Sloan P, et al.: Postmastectomy/postlumpectomy pain in breast cancer survivors. *J Clin Epidemiol*, 1998, 51: 1285–1292. [Medline] [CrossRef]
- 7) Smith WC, Bourne D, Squair J, et al.: A retrospective cohort study of post mastectomy pain syndrome. *Pain*, 1999, 83: 91–95. [Medline] [CrossRef]
- 8) Kuehn T, Klauss W, Darsow M, et al.: Long-term morbidity following axillary dissection in breast cancer patients—clinical assessment, significance for life quality and the impact of demographic, oncologic and therapeutic factors. *Breast Cancer Res Treat*, 2000, 64: 275–286. [Medline] [CrossRef]
- 9) Peintinger F, Reitsamer R, Stranzl H, et al.: Comparison of quality of life and arm complaints after axillary lymph node dissection vs. sentinel lymph node biopsy in breast cancer patients. *Br J Cancer*, 2003, 89: 648–652. [Medline] [CrossRef]
- 10) Vilholm OJ, Cold S, Rasmussen L, et al.: The postmastectomy pain syndrome: an epidemiological study on the prevalence of chronic pain after surgery for breast cancer. *Br J Cancer*, 2008, 99: 604–610. [Medline] [CrossRef]
- 11) Voogd AC, Ververs JM, Vingerhoets AJ, et al.: Lymphoedema and reduced shoulder function as indicators of quality of life after axillary lymph node dissection for invasive breast cancer. *Br J Surg*, 2003, 90: 76–81. [Medline] [CrossRef]
- 12) Chiverton SG, Perry PM: Morbidity after surgery for breast cancer. *Br J Surg*, 1987, 74: 1166. [Medline] [CrossRef]
- 13) Højris I, Andersen J, Overgaard M, et al.: Late treatment-related morbidity in breast cancer patients randomized to postmastectomy radiotherapy and systemic treatment versus systemic treatment alone. *Acta Oncol*, 2000, 39: 355–372. [Medline] [CrossRef]
- 14) Chevillat AL, Tchou J: Barriers to rehabilitation following surgery for primary breast cancer. *J Surg Oncol*, 2007, 95: 409–418. [Medline] [CrossRef]
- 15) Anderson RT, Kimmick GG, McCoy TP, et al.: A randomized trial of exercise on well-being and function following breast cancer surgery: the RESTORE trial. *J Cancer Surviv*, 2012, 6: 172–181. [Medline] [CrossRef]
- 16) Box RC, Reul-Hirche HM, Bullock-Saxton JE, et al.: Physiotherapy after breast cancer surgery: results of a randomised controlled study to minimise lymph-

- oedema. *Breast Cancer Res Treat*, 2002, 75: 51–64. [[Medline](#)] [[CrossRef](#)]
- 17) Castro-Sánchez AM, Lara-Palomo IC, Matarán-Peñarocha GA, et al.: Kinesio Taping reduces disability and pain slightly in chronic non-specific low back pain: a randomised trial. *J Physiother*, 2012, 58: 89–95. [[Medline](#)] [[CrossRef](#)]
 - 18) Kase K, Wallis J, Kase T: *Clinical therapeutic applications of the kinesio taping method*. Tokyo: Ken Ikai, 2003.
 - 19) Chang HY, Chou KY, Lin JJ, et al.: Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athletes. *Phys Ther Sport*, 2010, 11: 122–127. [[Medline](#)] [[CrossRef](#)]
 - 20) Thelen MD, Dauber JA, Stoneman PD: The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther*, 2008, 38: 389–395. [[Medline](#)] [[CrossRef](#)]
 - 21) Chen PL, Hong WH, Lin CH, et al.: Biomechanics effects of kinesio taping for persons with patellofemoral pain syndrome during stair climbing. *Biomed*, 2008, 21: 395–397.
 - 22) Pop TB, Karczarek-Borowska B, Tymczak M, et al.: The influence of Kinesiology Taping on the reduction of lymphoedema among women after mastectomy —preliminary study. *Contemp Oncol (Pozn)*, 2014, 18: 124–129. [[Medline](#)]
 - 23) Tantawy SA, Kamel DM: Effect of kinesio taping on pain post laparoscopic abdominal surgery: randomized controlled trial. *IJTRR*, 2015, 4: 250–255. [[Cross-Ref](#)]
 - 24) Jaraczewska E, Long C: Kinesio taping in stroke: improving functional use of the upper extremity in hemiplegia. *Top Stroke Rehabil*, 2006, 13: 31–42. [[Medline](#)] [[CrossRef](#)]
 - 25) Jensen MP, Chen C, Brugger AM: Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. *J Pain*, 2003, 4: 407–414. [[Medline](#)] [[CrossRef](#)]
 - 26) Breckenridge JD, McAuley JH: Shoulder Pain and Disability Index (SPADI). *J Physiother*, 2011, 57: 197. [[Medline](#)] [[CrossRef](#)]
 - 27) Roy JS, MacDermid JC, Woodhouse LJ: Measuring shoulder function: a systematic review of four questionnaires. *Arthritis Rheum*, 2009, 61: 623–632. [[Medline](#)] [[CrossRef](#)]
 - 28) Hill CL, Gill TK, Shanahan EM, et al.: Prevalence and correlates of shoulder pain and stiffness in a population-based study: the North West Adelaide Health Study. *Int J Rheum Dis*, 2010, 13: 215–222. [[Medline](#)] [[CrossRef](#)]
 - 29) Paul A, Lewis M, Shadforth MF, et al.: A comparison of four shoulder-specific questionnaires in primary care. *Ann Rheum Dis*, 2004, 63: 1293–1299. [[Medline](#)] [[CrossRef](#)]
 - 30) Bot SD, Terwee CB, van der Windt DA, et al.: Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. *Ann Rheum Dis*, 2004, 63: 335–341. [[Medline](#)] [[CrossRef](#)]
 - 31) Alsanawi HA, Alghadir A, Anwer S, et al.: Cross-cultural adaptation and psychometric properties of an Arabic version of the Shoulder Pain and Disability Index. *Int J Rehabil Res*, 2015, 38: 270–275. [[Medline](#)] [[CrossRef](#)]
 - 32) González-Iglesias J, Fernández-de-Las-Peñas C, Cleland JA, et al.: Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. *J Orthop Sports Phys Ther*, 2009, 39: 515–521. [[Medline](#)] [[CrossRef](#)]
 - 33) Kaya E, Zinnuroglu M, Tugcu I: Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. *Clin Rheumatol*, 2011, 30: 201–207. [[Medline](#)] [[CrossRef](#)]
 - 34) Llopis GL, Aranda CM: Physiotherapy intervention with kinesio taping in patients suffering chronic neck pain. A pilot study. *Fisioterapia*, 2012, 34: 189–195.
 - 35) Akbaş E, Atay AO, Yüksel I: The effects of additional kinesio taping over exercise in the treatment of patellofemoral pain syndrome. *Acta Orthop Traumatol Turc*, 2011, 45: 335–341. [[Medline](#)]
 - 36) Murray H, Husk LJ: Effect of kinesiotaping on proprioception in the ankle. *J Orthop Sports Phys Ther*, 2001, 31: 37.
 - 37) Osterhues DJ: The use of Kinesio Taping in the management of traumatic patella dislocation: a case study. *Physiother Theory Pract*, 2004, 20: 267–270. [[Cross-Ref](#)]
 - 38) Yoshida A, Kahanov L: The effect of kinesio taping on lower trunk range of motions. *Res Sports Med*, 2007, 15: 103–112. [[Medline](#)] [[CrossRef](#)]
 - 39) Shakeri H, Keshavarz R, Arab AM, et al.: Clinical effectiveness of kinesiological taping on pain and pain-free shoulder range of motion in patients with shoulder impingement syndrome: a randomized, double blinded, placebo-controlled trial. *Int J Sports Phys Ther*, 2013, 8: 800–810. [[Medline](#)]
 - 40) Williams S, Whatman C, Hume PA, et al.: Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. *Sports Med*, 2012, 42: 153–164. [[Medline](#)] [[CrossRef](#)]