Effect of Taping on Spinal Pain and Disability: Systematic Review and Meta-Analysis of Randomized Trials

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Background. Taping is a widely used therapeutic tool for the treatment of musculoskeletal disorders, nevertheless its effectiveness is still uncertain.

Purpose. The purpose of this study was to conduct a current review of randomized controlled trials (RCTs) concerning the effects of elastic and nonelastic taping on spinal pain and disability.

Data Sources. MEDLINE, CINAHL, EMBASE, PEDro, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, ISI Web of Knowledge, and SPORTDiscus databases were searched.

Study Selection. All published RCTs on symptomatic adults with a diagnosis of specific or nonspecific spinal pain, myofascial pain syndrome, or whiplash-associated disorders (WAD) were considered.

Data Extraction. Two reviewers independently selected the studies and extracted the results. The quality of individual studies was assessed using the PEDro scale, and the evidence was assessed using GRADE criteria.

Data Synthesis. Eight RCTs were included. Meta-analysis of 4 RCTs on low back pain demonstrated that elastic taping does not significantly reduce pain or disability immediately posttreatment, with a standardized mean difference of −0.31 (95% confidence interval=−0.64, 0.02) and −0.23 (95% confidence interval=−0.49, 0.03), respectively. Results from single trials indicated that both elastic and nonelastic taping are not better than placebo or no treatment on spinal disability. Positive results were found only for elastic taping and only for short-term pain reduction in WAD or specific neck pain. Generally, the effect sizes were very small or not clinically relevant, and all results were supported by low-quality evidence.

Limitations. The paucity of studies does not permit us to draw any final conclusions.

Conclusion. Although different types of taping were investigated, the results of this systematic review did not show any firm support for their effectiveness.

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Neck pain (NP) and low back pain (LBP) among adults in the United States are common, costly, and, in some instances, chronic.[1] Although the natural history of these conditions appears to be favorable and self-limiting,[2] rates of recurrence[3,4] and risk for chronicity appear high for both of these musculoskeletal disorders.[5,6] Furthermore, NP and LBP are especially frequent during the most productive years of a person's life, causing a large number of lost workdays and lost productivity, and may precipitate permanent disability.[7] In order to decrease this social burden of disability, interventions with demonstrated efficacy for specific outcomes are essential.[8]

Among the conservative therapeutic interventions adopted by physical therapists and other health care providers, taping is one of the most commonly used in the prevention and treatment of sports injuries and a variety of clinical conditions, including spinal pain.[9,10] Several types of tapes are available, each with its own mechanical characteristics as well as theorized aims and techniques of application. Tapes fall into 2 broad categories: the nonelastic or rigid tapes and the elastic nonadhesive and adhesive tapes, among which Kinesio Tex tape (Kinesio Holding Corp, Albuquerque, New Mexico)[11] is likely the most well-known. Rigid taping was the first type of taping used, and it is still adopted as an adjunct for treatment of musculoskeletal injuries. The rationale for its mechanism of action is that it protects muscles and joints by enhancing proprioception and providing support.[12] In contrast, Dr Kenzo Kase, a Japanese chiropractor, invented a new form of tape and technique for therapeutic taping in the 1970s that later developed into a method called "Kinesiotaping" (KT), which required an elastic type of tape (ie, Kinesio Tex tape).[11] This tape was different from traditional rigid tape used mainly in athletics. Its elasticity allows a clinician to stretch it up to 130%–140% of its original length before application, and it can be worn for several days without removal. These properties arguably make it a useful tool following injury and during rehabilitation.[12,13]

Various therapeutic benefits have been proposed for KT, including its ability to support fascia, muscles, and joints and to decrease pain and inflammation by improving lymphatic and blood circulation without restricting the range of motion (ROM) of the affected part, unlike traditional rigid taping techniques, which restrict movement.[10,12,14,15] Murray and Husk[16] have further suggested another mechanism of action (ie, enhanced proprioception through increased stimulation of the cutaneous mechanoreceptors).

In recent years, accompanied by heightened public awareness with its high-profile presence at the London Olympics in 2012 and the European Football Championship,[17] a growing number of research studies have explored KT to evaluate the effects of this conservative therapeutic intervention in the treatment of musculoskeletal pathology. Clinical interest also is growing, as demonstrated by the fact that the education regarding KT has had a marked increase in recent years. Since its inception, 50,000 individuals have been trained in this method, about half of whom are physical therapists (Dorothy Cole; personal communication; June 4, 2013).

Despite the magnitude of KT's current popularity and increasing use in clinical practice, substantial uncertainty continues to exist regarding its true merit, mainly due to insufficient and inconsistent supporting evidence. The limited scientific information available has been obtained mostly from reports, case series studies, and individual anecdotal patient experiences. Even though more clinical trials have been undertaken in recent years to examine the efficacy of KT, systematic reviews and meta-analyses published on this issue so far[10,15,17–23] have reached conclusions that do not align completely with each other. Considering, for example, only those reviews published between 2012 and 2014,[10,15,17,18,21–23] opinions range from no apparent clinical benefit[18,22] to modest impact on outcome,[15,17,23] with some agreement that the evidence is insufficient[10,15] to warrant unequivocal recognition as a therapeutic option on the basis of the evidence.[21,22] Furthermore, other limitations of previous reviews may have influenced their findings and conclusions, such as aggregating results pertaining not only to spinal pain but also to other different conditions,[18] introducing inclusion and exclusion criteria in search strategies that potentially resulted in publication bias (eg, requiring availability of full version in English[10,15,18,19] and restricting publication date[21]), and allowing the methodological quality of randomized controlled trials (RCTs) to serve as a basis for further analysis in the review.[10] It also is

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- eFigure: Flow Diagram of Studies Through the Different Phases of the Review
- eTable 1: PEDro Score
- eTable 2: Minimal Clinically Important Difference Results
- eAppendix 1: Search Strategy for PubMed/MEDLINE
- eAppendix 2: Quality Assessment and Summary of Findings for All Outcomes and Comparisons

important to note that no previous systematic reviews or meta-analyses have evaluated the effects of forms of taping other than KT.

For all of these reasons, we recognized the need for an up-to-date and specific systematic review and meta-analysis to determine a more accurate estimation of the efficacy of elastic and nonelastic taping and their impact on pain and disability in patients with spinal pain. This systematic review expands upon previous studies[10,15,17–23] by considering different types of taping, explicitly targeting a particular population of interest, and focusing on specific characteristics of RCTs as inclusion criteria.

Method

Data Sources and Searches

Our literature search aimed to identify all available studies that evaluated the effect of taping in relieving pain and reducing disability in people with spinal pain. Records were identified by searching multiple literature databases, including MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, Physiotherapy Evidence Database (PEDro), Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, ISI Web of Knowledge, and SPORTDiscus, from their inception to June 2014. The search terms used were "taping," "kinesio," "kinesiotape," and "kinesiotaping." These key words were identified after preliminary literature searches and by cross-checking them against previous relevant systematic reviews.[10,18] The search strategy used for searching the MEDLINE database through PubMed is presented in eAppendix 1 (available at ptjournal.apta.org). This strategy was modified and adapted for each searched database. Additional records were searched through other sources to complement the databases' findings, including manual research of reference lists of relevant literature reviews and indexes of peer-reviewed journals.

Two reviewers (I.G., F.T.) independently applied the predetermined inclusion and exclusion criteria to select potentially relevant trials, initially identified based on title and abstract. Full-text copies of relevant trials were then obtained and independently evaluated by the reviewers. Disagreements were resolved through discussion among the reviewers, with input of 2 other authors (C.V., P.P.).

Study Selection

Types of studies. We included published RCTs without any restrictions on publication date or language. Among RCTs, only trials with a control or comparison group were considered as eligible. These trials included: (1) intervention versus placebo or sham treatment, (2) intervention versus no-taping intervention or comparator (eg, self-care, advice, continuing with ordinary and recreational activities), and (3) intervention versus standard practice (eg, wait list or usual care). A further criterion for designating a study as an eligible "comparison" trial was the comparison of taping plus another intervention versus this same intervention (eg, taping and therapeutic exercise versus therapeutic exercise) in a comparably matched group. Quasi-RCTs and nonrandomized controlled trials were excluded.

Types of participants. The participants in selected studies had to be symptomatic adults (18 years of age or older) with a diagnosis of acute, subacute, or chronic specific or nonspecific spinal pain, myofascial pain syndrome (MPS), or whiplash-associated disorder (WAD). Pain was categorized as "acute" when it was evident from the text that participants experienced it for less than 1 month, as "subacute" between 1 and 3 months, and as "chronic" for more than 3 months.[24,25] In the absence of this explicit description, pain was considered acute, subacute, or chronic when the investigators themselves categorized an individual's pain in those terms.[26] Trials were excluded if any of the participants received a diagnosis such as myelopathy, fracture, infection, dystonia, tumor, inflammatory disease, or osteoporosis.[27]

Types of interventions. Among all of the types of conservative interventions used by physical therapists for the treatment of spinal pain, only elastic or nonelastic taping was considered in our analysis. Studies concerning other interventions or taping used in association with therapeutic exercise or physical therapy procedures without any explicit investigation on the distinct effects of each procedure were excluded. Finally, trials were excluded if the prevention of spinal pain was the main clinical purpose of the study intervention.

Types of outcome measures. To be eligible for inclusion, a study had to assess pain with a visual analog scale (VAS), a numerical pain rating scale, or patient self-report as an outcome measure. Disability was considered an outcome measure if the chosen instrument measured the impact of spinal pain on everyday life beyond work or leisure-time activities. If more than one instrument or measure of an outcome of interest was reported within the same study, only one was considered for the pooled estimate in the meta-analysis. We chose the outcome measure that would most likely provide the most conservative estimate of the effect of taping on the outcome due to the magnitude of the pain or disability. For example, in the case of pain, we selected the measure that most nearly corresponded to "What is your worst pain?" to be used in our analysis. Trials investigating the effect of taping on pres-

sure pain threshold or pressure pain tolerance, electromyographic signals, ROM, proprioception, or strength or endurance of spinal muscles were excluded. Similarly, health-related quality of life, patient satisfaction, global perceived effect, work-related measures, depression, and other psychosocial measures were not considered in our analyses. When possible, we extracted study findings at baseline, after intervention, and at every reported follow-up. Follow-up data were recorded at short-term (defined as less than 3 months following the date of randomization), intermediate-term (between 3 and 12 months), and long-term (12 months or more) time periods.[28] If more than one follow-up set of data was present within the same category of timing of an outcome measure, only one set was considered.

Data Extraction and Quality Assessment

Two authors (I.G., F.T.) independently conducted data extraction. Two other authors (C.V., P.P.) were consulted in the case of persisting disagreement. Reviewers were not blinded to information regarding the authors, journal of origin, or outcomes for each article reviewed. Using a standardized form, data extraction addressed participants, types of intervention, follow-up times, clinical outcome measures, and findings that were reported. These data are detailed in the Table. Methodological quality of studies was assessed using the PEDro scale, which has been shown to be reliable[29] and valid[30] for rating the quality of RCTs. Two independent assessors (G.M., G.C.) obtained or extracted the score for each trial from the PEDro database when available. Trials with a rating of at least 6/10 on the PEDro scale were considered as having high quality, consistent with previous systematic reviews.[31–33] Trials were not excluded on the basis of quality.

Clinical Relevance Assessment

Two expert physical therapists (C.V., P.P.) assessed the clinical relevance of the extracted studies by evaluating whether the patients and interventions were described precisely enough to allow inferences about the clinical applicability of the results and clinical relevance of the measured outcome. The questions used to assess the clinical relevance were: (1) Are the patient characteristics and treatment settings described well enough to decide whether they are comparable to those you see in your own practice? (2) Are all of the interventions described well enough to allow you to provide the same to your own patients? and (3) Were clinically relevant outcomes measured? With regard to this last question, the experts identified the minimal clinically important difference (MCID) for each measurement scale and for each outcome by referencing the literature. Specifically, they selected 30% of change in back pain measured with the VAS,[34] a 10-point change in back disability on the 100-point Oswestry Disability Index (ODI),[35] or a 2-point change in back disability on the 24-point Roland-Morris Disability Questionnaire (RMDQ)[34,35] as the MCID. Moreover, they selected 20% of change in NP as measured with a VAS,[36] 25% of change in NP measured with a numerical rating scale,[37] and a 3.5-point change on the 50-point Neck Disability Index[37,38] as the MCID. A reference for the MCID of the Constant-Murley Scale score, which was used by Lee et al[39] to measure neck disability, could not be located.[40] Using these specific MCID values, the question of whether the evidence was sufficient for clinical recommendations was made.

Data Synthesis and Analysis

Data were synthesized using a meta-analytic method based on a random-effects model because this approach weights studies by the inverse of the variance and incorporates heterogeneity into the model.[41] All effect sizes were computed using Hedges' g statistic because it incorporates a small sample bias correction.[42] ProMeta V.2.0 software[43] (Internovi by Scarpellini Daniele s.a.s. Cesena [FC], Italy) was used for the statistical analyses. Standardized mean differences (SMDs) with 95% confidence intervals (95% CIs) were calculated for continuous data. The SMD was used because different measures were adopted by each study to address the same clinical outcome. To interpret effect size calculated with SMD, we used Cohen[44] as a guide to identify small (0.20), medium (0.50), or large (0.80) effects. Calculation of effect size was based first on the best possible data (ie, final means, standard deviations, and sample sizes of intervention and control groups). Selected studies for which these or other crucial data were not directly reported, or obtainable by contacting authors, were not included in the review.

A qualitative analysis to evaluate the overall quality of the evidence was planned[28] and independently conducted by 2 authors (I.G., L.B.) using the GRADE approach.[45] We used an adapted version of the criteria advocated by the Cochrane Back Review Group.[46] The quality of evidence was downgraded by one level for each of 3 factors we encountered: limitations in the design (eg, >25% of participants from studies with low-quality methods, PEDro score <6 points), inconsistency of results (eg, ≤75% of participants reported findings in the same direction), and imprecision (eg, total number of participants <300 for each outcome). We did not assess publication bias with funnel plots, as too few studies

Table.
Characteristics of Included Studies[a]

Participants[b]	PEDro Score	Intervention[b]	Outcome Measures and Follow-up[b,c]	Reported Results[b]
Parreira et al, 2014[56] 148 patients with chronic nonspecific LBP (>12 wk) Mean age=50.5 y Exp group, n=74* Ctrl group, n=74*	9	**Ctrl group:** sham KT **Exp group:** standardized KT **Taping application modality:** Ctrl group: I-shaped kinesiotape over each erector spinae muscle with no tension (0% tension) and with the treated muscle in a nonstretched position Exp group: I-shaped kinesiotape over each erector spinae muscle with 10%–15% of tension (paper-off tension) with the treated muscles in stretched position **Type of tape used:** Kinesio Tex tape **Renewal of taping**: twice per week (tape maintained in situ for 2 d) **Duration:** 4 wk	(1) **Pain**–NRS (0–10) (2) **Disability**–RMDQ (0–24) - **Follow-up** at 0/2 mo	Pain (between-groups MD=−0.4 points; 95% CI=−1.3, 0.4) and disability (−0.3 points; 95% CI=−1.9, 1.3) did not significantly decrease after the intervention No significant between-group differences were observed at follow-up Authors' conclusion: KT applied with stretch to generate convolutions in the skin was no more effective than simple application of the tape without tension for the outcomes measured
Bae et al, 2013[55] 20 patients with chronic nonspecific LBP (>12 wk) Mean age=52.5 y Exp group, n=10* Ctrl group, n=10*	7	**Ctrl group:** placebo taping **Exp group:** standardized KT **Exp and Ctrl groups:** both groups received ordinary physical therapy with hot pack, ultrasound, and TENS to the L1–2 and L4–5 areas for 40 min each time, 3 times per week **Taping application modality:** Ctrl group=one inelastic I-strip was attached transversely to the lumbar area with the maximum pain Exp group=4 blue I-strips were stretched and overlappingly attached to the lumbar area with the maximum pain in a star shape **Type of tape used:** kinesiotape, width=5 cm, thickness=0.5 mm **Renewal of taping:** at each intervention 3 times per week **Duration:** 12 wk	(1) **Pain**–VAS (0–10) (2) **Disability**–ODI (0–100) - **Follow-up** at 0 mo	Pain significantly decreased ($P<.05$) within both groups after the intervention Disability significantly decreased in Ctrl group ($P<.05$) and more significantly decreased in Exp group ($P<.01$) after the intervention Authors' conclusion: KT applied to patients with chronic LBP reduced their pain and disability
Castro-Sánchez et al, 2012[50] 60 patients with chronic nonspecific LBP (>12 wk) Mean age=48.5 y Exp group, n=30* Ctrl group, n=30, 29*	9	**Ctrl group:** sham KT **Exp group:** standardized KT **Taping application modality:** Ctrl group: single I-strip of the same tape applied transversely immediately above the point of maximum lumbar pain Exp group: 4 blue I-strips placed at 25% tension overlapping in a star shape (the central part adheres before the ends) over the point of maximum pain in the lumbar area **Type of tape used:** Kinesio Tex tape, width=5 cm, thickness=0.5 mm **Renewal of taping:** no one for both groups (tape maintained in situ for 7 d) **Duration:** 1 wk	(1) **Pain**–VAS (0–10) (2) **Disability**–ODI (0–100), RMDQ (0–24) - **Follow-up** at 0/1 mo	Pain (between-groups MD=1.1 cm; 95% CI=0.3, 1.9) and disability (on ODI score: 4 points; 95% CI=2, 6; on RMDQ score: 1.2 points, 95% CI=0.4, 2.0) significantly decreased more in Exp group vs Ctrl group after the intervention Significant between-groups difference maintained only for pain (1.0 cm; 95% CI=0.2, 1.7) at follow-up Authors' conclusion: KT reduced disability and pain in people with chronic nonspecific LBP, but these effects may be too small to be clinically worthwhile

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Participants[b]	PEDro Score	Intervention[b]	Outcome Measures and Follow-up[b,c]	Reported Results[b]
Chen et al, 2012[51] 43 patients with subacute nonspecific LBP (>6 wk) Mean age=43.2 y Exp group, n=21* Ctrl group, n=22*	9	**Ctrl group:** placebo taping **Exp group:** functional fascial taping **Exp and Ctrl groups:** A manual that contained back care and a standardized simple trunk flexion exercise was given to all participants. The trunk flexion exercise was applied to reinforce the stretching effect of the taping. **Taping application modality:** Ctrl group: strips with no tension over the painful area on the lower back Exp group: strips with tension in a direction assessed by the therapist (generally 3 taping directions were applied); the direction of tape application was determined with the skin distraction test that resulted in maximal pain reduction on trunk flexion **Type of tape used:** 3–5 tape layers with rigid strapping tape MK38 **Renewal of taping:** daily for both groups **Duration:** 2 wk	(1) **Pain**–VAS (0–100) average/worst** (2) **Disability**–ODI (0–100) - **Follow-up** at 0/1/2.5 mo	Worst pain significantly decreased more in Exp group vs Ctrl group after the intervention (P=.02) No significant difference between groups in worst pain at any stages of follow-up (P>.05) No significant differences between groups in disability and average pain at all time periods (P>.05) Authors' conclusion: functional fascial taping reduced worst pain in patients with nonacute nonspecific LBP during the treatment phase; no mid-term differences in pain or function were observed
Paoloni et al, 2011[52] 26 patients with chronic LBP (>12 wk) Mean age=62.4 y Exp group, n=13* Ctrl group, n=13*	7	**Ctrl group:** 30 min of therapeutic group exercises 3 times per week (relaxation techniques as well as stretching and active exercises for the abdominal, lumbar, and thoracic back extensor, psoas, ischiotibial, and pelvic muscles) **Exp group:** KT + therapeutic exercise (same as for Ctrl group) **Exp and Ctrl groups:** patients were encouraged to keep practicing at home after the end of the group sessions **Taping application modality:** patients were asked to bend forward during the taping procedure (no tension was used other than that required to cover the back in bending position) Exp group: 3 stripes over the lumbar area between T12 and L5 spinous processes; one stripe was placed over the midline, along a line corresponding to the spinous process, and the other 2 stripes were placed on the right and left erector spinae muscles (4 cm from the first stripe) **Type of tape used:** 20×5 cm Kinesiotape KT545, longitudinal elasticity of 40% **Renewal of taping:** every 3 d for Exp group **Duration:** 4 wk	(1) **Pain**–VAS (0–10) (2) **Disability**–RMDQ (0–24) - **Follow-up** at 0 mo	Pain significantly decreased in both groups after the intervention (P<.0001) Disability decreased in both groups after the intervention, although the difference with baseline values was significant only for the Ctrl group (P=.01) Authors' conclusion: KT is able to reduce pain in patients with chronic LBP shortly after its application; its effects persist over a short follow-up period

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Participants[b]	PEDro Score	Intervention[b]	Outcome Measures and Follow-up[b,c]	Reported Results[b]
Kavlak et al, 2012[53] 40 patients with acute, subacute, or chronic NP (cervical disk herniation, cervical spondylosis, or cervical radiculopathy) Mean age=49.4 y Exp group, n=20* Ctrl group, n=20*	7	**Ctrl group:** Classic therapy that comprised ultrasound, interferential current, hot pack, and massage applied to the neck and midscapular regions. The duration of the neck massage was 10 min, and it consisted of stroking and kneading motions to relax the muscles (erector spinae, levator scapulae, and trapezius). Cervical flexion, extension, lateral flexion, rotation, and strengthening exercises were given to patients as an exercise program. **Exp group:** KT + classic therapy (same as for Ctrl group) **Exp and Ctrl groups:** exercise program to be performed at home **Taping application modality:** Exp group: The origin of the KT shaped Y was placed while the patient's head was in a neutral position and he or she was instructed to perform neck flexion. After the medial tail of the KT was adhered in this position, the patient was instructed to perform rotation in combination with neck flexion, and the lateral tail of KT was adhered in this position. The administration was repeated on the other side. **Type of tape used:** kinesiotape **Renew of taping**: daily for Exp group **Duration:** 3 wk (15 sessions)	(1) **Pain**–VAS (0–100) resting/activity/night (2) **Disability**–NDI (0–50) - **Follow-up** at 0 mo	Pain ($P<.05$) and disability ($P<.001$) significantly decreased within all 3 groups after the intervention No significant differences between groups for pain and disability after the intervention ($P>.05$) Authors' conclusion: KT may be helpful as an alternative treatment for neck pain
Lee et al, 2012[39] 32 patients with MPS (upper trapezius muscle) Mean age=47.6 y Exp group, n=16* Ctrl group, n=16*	6	**Ctrl group:** Stabilization exercises twice per week for the scapular and shoulder girdle muscles. A duty cycle of 1:3 was adopted, and each exercise was performed for 10 s, followed by rest for 30 s. The patients performed 3 sets of 10 repetitions of each exercise and rested for 3 min after each set. The stabilization exercises for the scapular muscles were isometric contractions (scapular elevation, depression, upward and downward rotation, protraction and retraction). The stabilization exercises for the shoulder girdle were performed while the patient extended his or her elbow joints, flexed his or her shoulder joints at 90°, and held a rod with both hands in the supine position together with the therapist while being instructed to maintain the posture against the provided resistance. **Exp group:** nonelastic tape application + stabilization exercises (same as for Ctrl group) **Taping application modality:** Exp group: the taping was applied to the 1/3 point on the medial side of the clavicle with the 12th thoracic vertebra completely extended to maintain retraction and depression of the scapula **Type of tape used:** not reported **Renewal of taping:** taping applied before stabilization exercises and removed immediately after them (twice a week) for Exp group **Duration:** 4 wk	(1) **Pain**–VAS (0–100) (2) **Disability**–CMS, activities of daily living subscale (0–20) - **Follow-up** at 0 mo	Pain significantly decreased in both groups after the intervention ($P<.05$) No significant differences between groups for pain after the intervention ($P>.05$) In the assessment of disability using the CMS, the Ctrl group showed no significant differences on the activities of daily living subscale ($P>.05$), whereas the Exp group showed a statistically significant difference ($P<.05$) Significant differences between groups on the activities of daily living subscale ($P<.05$) Authors' conclusion: applying nonelastic taping before stabilization exercises is more effective at relieving pain in patients with MPS in the upper trapezius muscle than treatment that uses only stabilization exercises

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Participants[b]	PEDro Score	Intervention[b]	Outcome Measures and Follow-up[b,c]	Reported Results[b]
Gonzáles-Iglesias et al, 2009[54] 41 patients with acute WAD (within 40 d after a motor vehicle accident) Mean age=32.5 y Exp group, n=21* Ctrl group, n=20*	8	**Ctrl group:** placebo KT **Exp group:** standardized therapeutic KT **Taping application modality:** Ctrl group: 2 I-strips applied with no tension; the first (blue) strip was placed over the spinous processes of the cervical and thoracic spines, and the second (black) strip was placed perpendicular over the midcervical region. The cervical spine of the participants was placed in a neutral position. Exp group: The first layer was a blue Y-strip placed at approximately 15%–25% tension over the posterior cervical extensor muscles and applied from the insertion to origin (from the dorsal region [T1–T2] to the upper cervical region [C1–C2]). Each tail of the first (blue) strip (Y-strip, 2-tailed) was applied with the patient's neck in a position of cervical contralateral side bending and rotation. The overlying second (black) strip was a space-tape (opening) placed perpendicular to the Y-strip over the midcervical region (C3–C6), with the patient's cervical spine in flexion to apply tension to the posterior neck structures. **Type of tape used:** Kinesio Tex tape, width=5 cm, thickness=0.5 mm **Renewal of taping:** none **Duration:** 1 d (1 session)	(1) **Pain**–NPRS (0–10) - **Follow-up** immediately postintervention (0 mo) and 24 h after the intervention (1 d)	Pain greatly and significantly decreased in Exp group vs Ctrl group immediately postintervention and at 24-h follow-up ($P<.001$) Authors' conclusion: Patients with acute WAD receiving an application of KT, applied with proper tension, exhibited statistically significant improvements in pain levels immediately following application of the kinesiotape and at a 24-h follow-up. However, these improvements were small and may not be clinically meaningful.

[a] LBP=low back pain, Ctrl=control, Exp=experimental, KT=Kinesiotaping, MD=mean difference, CI=confidence interval, NRS=numerical rating scale, NPRS=numerical pain rating scale, RMDQ=Roland-Morris Disability Questionnaire, VAS=visual analog scale, ODI=Oswestry Disability Questionnaire, NDI=Neck Disability Index, MPS=myofascial pain syndrome, NP=neck pain, WAD=whiplash-associated disorder, TENS=transcutaneous electrical nerve stimulation. *Participants whose data were analyzed. **Only pain at worst was considered for data pooling.
[b] Only data of considered sample groups and their respective interventions are reported.
[c] Follow-up time is intended from postintervention onward.

were included in the meta-analysis. We also did not assess indirectness, as this review encompasses specific population, type of intervention, and outcome measures. Two reviewers judged whether these factors were present for each outcome. Single randomized studies (with fewer than 300 participants) were considered inconsistent and imprecise (that is, sparse data) and provided "low-quality evidence." This rating could be further downgraded to "very low-quality evidence" if there were also limitations in design.[47,48] We applied the following definitions of quality of the evidence[49]:

- High quality—further research is unlikely to change our confidence in the estimate of effect. There are no known or suspected reporting biases; all domains fulfilled.
- Moderate quality—further research is likely to have an important impact on our confidence in the estimate of effect and might change the estimate; one of the domains was not fulfilled.
- Low quality—further research is likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; 2 of the domains were not fulfilled.
- Very low quality—we are uncertain about the estimate; 3 of the domains were not fulfilled.

A GRADE profile was completed for each pooled estimate and for single trials comparing KT and placebo intervention.

Results

We identified 5,531 studies through database searching. No additional eligible studies were identified through other sources. After removing duplicates and screening titles and abstracts of all remaining unique articles, 23 full-text articles needed to be assessed to verify their eligibility for inclusion in the present study. Ultimately, 15 of them were excluded for various reasons (eFigure, available at ptjournal.apta.org), resulting in 8 studies selected for this review.[39,50–56] Only one disagreement between assessors occurred, and it was resolved by a meeting held in consultation with 2 other authors (C.V., P.P.). Six studies[50,52–57] concern elastic taping, and the other 2 studies[39,51] concern nonelastic taping. Overall, the 8 included studies, conducted in Europe (Italy, Spain), Australia, South America (Brazil), and Asia (Turkey, Korea), were published from 2009 to 2014, with only 25% of them being published before 2012. The number of patients who were enrolled and completed baseline assessments was 409 (range=20–148), with a mean sample size of 51 participants. The mean age of the study participants was approximately 48 years (range=32.5–62.4). The majority of the participants were female (n=277; 68%).

Five studies concerned LBP, and 3 studies concerned NP. All of the studies on LBP referred to people with chronic and nonspecific LBP. With respect to studies on NP, one of them was related to chronic nonspecific NP,[39] one to acute NP,[54] and the third to specific NP[53] (Table). Four selected trials were judged by the reviewers to be clinically homogeneous,[50,52,55,56] and meta-analysis was performed (Figs. 1 and 2). However, meta-analysis for pain and disability at short term was not executed for the same studies[50,52,55–56] or for the other 4 studies.[39,51,53,54] For these studies, effect sizes and associated 95% CIs for the individual trials were calculated and were presented in a forest plot grouped according to treatment, followed by outcomes and follow-ups (Figs. 3, 4, and 5). The evaluation of evidence quality was made for each comparison outcome using the GRADE results (eAppendix 2, available at ptjournal.apta.org).

Quality and Clinical Relevance Assessment

The methodological quality of the studies was assessed with the PEDro scale. Two evaluators independently rated all of the studies included in the review using the PEDro scale. Then, they compared their evaluation with the published PEDro scores, when available, and reached an agreement in the other cases by a meeting in consultation with 2 other authors (C.V., P.P.). All studies that reached the minimum score (6/10) were considered to have good quality, with a range from 6/10 to 9/10 and an average higher than this threshold (mean score=7.75).

The worst scored criterion of quality was the blinding of physical therapists, as all of the studies failed to obtain a positive score. This finding is not surprising given that clinician blinding is not possible for the type of treatment performed. Similarly, the other criterion receiving a low score was the blinding of the patients regarding the treatment. However, it should be noted that this patient blinding was not scored favorably in most of the studies because this information was omitted. Blinding of assessors and concealed allocation of patients to groups were satisfied in 5 of 8 studies, and data analysis according to the intention-to-treat method achieved positive results in 7 of 8 studies. The best scored criteria on which all studies obtained a favorable score were those related to the statistical analysis of the results, the randomization of participants in the groups, the initial comparability of the most important prognostic factors, and finally the evaluation of at least one outcome measured on at least 85% of patients (eTab. 1, available at ptjournal.apta.org).

Concerning clinical relevance, no differences between experimental and control groups were found.

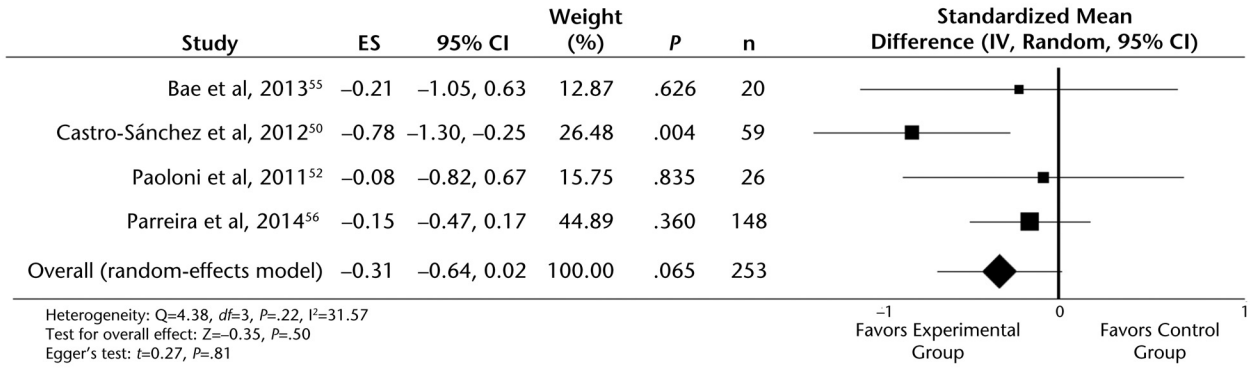

Figure 1.
Forest plot of comparison: elastic taping versus sham/placebo or no treatment for people with low back pain (outcome: pain in the immediate posttreatment period). ES=effect size, 95% CI=95% confidence interval, IV=inverse variance.

Only Chen and colleagues' study[51] on nonelastic taping yielded results in the experimental group that attained the threshold MCID for short-term pain and disability reduction, differently from placebo (eTab. 2, available at ptjournal.apta.org).

Outcomes of Treatment for People With LBP

Figures 1, 2, 3, and 4 present the follow-up study findings for pain and disability with respect to the effect size for 95% CI values of the intervention outcomes. Four studies concern elastic taping,[50,52,55,56] and 1 study concerns nonelastic taping.[51]

Outcomes of elastic taping versus sham/placebo or no treatment for people with LBP. Four high-quality studies[50,52,55,56] on the PEDro scale assessed pain in the immediate posttreatment period; 1 study[50] had a 1-month follow-up, and 1 study[56] had a 2-month follow-up. Meta-analysis was performed (Fig. 1) only for the 4 studies that assessed pain immediately after the intervention.[50,52,55,56] Overall (random-effects model) effect size of elastic taping versus sham/placebo or no treatment was small and not significant (g=−0.31; 95% CI=−0.64, 0.02). In the study that assessed pain at 1 month after the intervention,[50] the effect size of elastic taping was medium and significant (g=−0.78; 95% CI=−1.30, −0.25). In the study that assessed pain 2 months after the intervention,[56] the effect size of taping was small and not significant (g=−0.20; 95% CI=−0.52, 0.12) (Fig. 3). In summary, using GRADE criteria, there is low-quality evidence that elastic taping versus sham/placebo or no treatment provides no significant improvement in pain intensity immediately posttreatment and at 2-month follow-up, and there is a low-quality evidence that elastic taping reduces pain at 1 month follow-up.

Four high-quality studies[50,52,55,56] on the PEDro scale assessed disability in

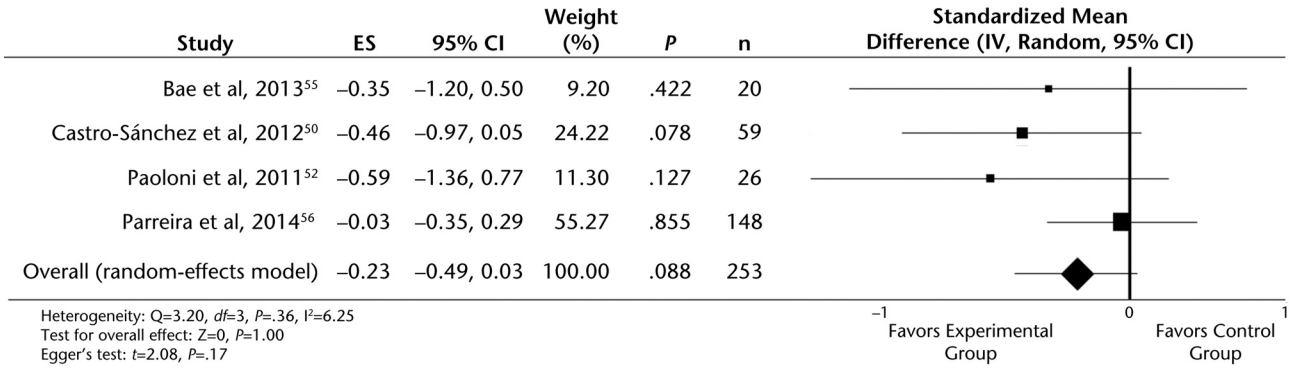

Figure 2.
Forest plot of comparison: elastic taping versus sham/placebo or no treatment for people with low back pain (outcome: disability in the immediate posttreatment period). ES=effect size, 95% CI=95% confidence interval, IV=inverse variance.

Outcomes	n	Experimetal Group Mean (SD)§	Experimetal Group Mean (SD)§	n	Control Group Mean (SD)*	Control Group Mean (SD)*	Forest Plots	ES (95% CI)	P
ST* pain (VAS)[50]	30	5.6 (1.8)	4.7 (1.4)	29	5.4 (1.3)	5.6 (1.4)		**–0.78 (–1.30, –0.25)**	**.00**
ST* disability (ODI)[50]	30	42.0 (6.0)	38.0 (7.0)	29	41.0 (9.0)	40.0 (9.0)		–0.37 (–0.88, 0.14)	.16
ST* disability (RMDQ)[50]	30	10.9 (2.1)	9.8 (2.2)	29	9.8 (2.9)	8.6 (3.0)		–0.04 (–0.54, 0.47)	.89
ST§ pain (NRS)[56]	74	7.0 (2.0)	5.4 (2.4)	74	6.8 (2.0)	5.7 (2.5)		–0.20 (–0.52, 0.12)	.21
ST§ disability (RMDQ)[56]	74	11.5 (6.2)	8.8 (7.5)	74	10.4 (5.3)	7.4 (6.3)		–0.04 (–0.36, 0.28)	.80

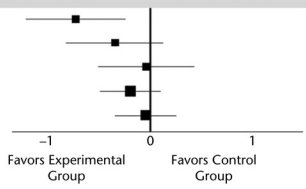

Figure 3.
Results of single included trials on the effects of elastic taping versus sham kinesiotaping at short term in people with low back pain. Treatment effects favoring taping: assigned negative Hedges' g standardized mean difference (SMD) values. Results in bold type represent statistically significant comparisons based on the 95% confidence interval (95% CI) of the SMD. Values presented in forest plots are effect size (ES) of the SMD and 95% CI. Mean (SD)§=mean and standard deviation measured at baseline, mean (SD)*=mean and standard deviation measured posttreatment, ST*=short term (1-month follow-up), ST§=short term (2-month follow-up), NRS=numerical rating scale, VAS=visual analog scale, ODI=Oswestry Disability Questionnaire, RMDQ=Roland-Morris Disability Questionnaire.

the immediate posttreatment period; 1 study[50] had a 1 month follow-up (with 2 different measurement scales), and 1 study[56] had a 2-month follow-up. Meta-analysis (Fig. 2) was performed only for the 4 studies that assessed disability immediately after intervention.[50,52,55,56] Overall (random-effects model) effect size of elastic taping versus sham/placebo or no treatment was small and not significant (g=−0.23; 95% CI=−0.49, 0.03). In the study that assessed disability at 1 month after the intervention (with 2 different measurement scales),[50] the effect size was small (g=−0.37; 95% CI=−0.88, 0.14) when disability was assessed with the ODI and very small (g=−0.04; 95% CI=−0.54, 0.47) when disability was assessed with the RMDQ. In the study that assessed disability at 2 months after the intervention,[56] the effect size of taping was small and not significant (g=−0.20; 95% CI=−0.52, 0.12) (Fig. 3).

In summary, using GRADE criteria, there is low-quality evidence that elastic taping versus sham/placebo or no treatment provides no significant improvement in disability in the immediate posttreatment period and at 1- and 2-month follow-ups.

Outcomes of nonelastic taping versus placebo for people with LBP. One high-quality study[51] on the PEDro scale assessed pain both immediately posttreatment and at 1-month follow-up. The effect size of taping versus placebo was medium and significant (g=−0.72; 95% CI=−1.33, −0.12) in the immediate posttreatment period, and it was small and not significant (g=−0.42; 95% CI=−1.01, 0.18) at 1-month follow-up (Fig. 4). In summary, using GRADE criteria, there is low-quality evidence that nonelastic taping versus placebo reduces pain at posttreatment follow-up and provides no significant improvement at 1-month follow-up.

One high-quality study[51] on the PEDro scale assessed disability both in the immediate posttreatment period and at 1-month follow-up. The effect size of taping versus placebo was medium and not significant (g=−0.59; 95% CI=−1.19, 0.01) immediately posttreatment, and it was small and not significant (g=−0.33; 95% CI=−0.93, 0.26) at 1-month follow-up (Fig. 4). In summary, using GRADE criteria, there is low-quality evidence that nonelastic taping versus placebo provides no

Outcomes	n	Experimental Group Mean (SD)	n	Control Group Mean (SD)	Forest Plots	ES (95% CI)	P
IPT pain (VAS)[51]	21	35.5 (22.9)	22	18.2 (23.9)		**–0.72 (–1.33, –0.12)**	**.019**
ST pain (VAS)[51]	21	33.9 (25.8)	22	22.6 (27.2)		–0.42 (–1.01, 0.18)	.167
IPT disability (ODI)[51]	21	13.6 (8.0)	22	8.1 (10.2)		–0.59 (–1.19, 0.01)	.052
ST disability (ODI)[51]	21	14.6 (10.9)	22	11.2 (9.0)		–0.33 (–0.93, 0.26)	.267

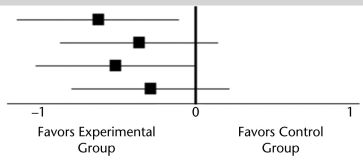

Figure 4.
Results of single included trials on the effects of nonelastic taping versus placebo for people with low back pain. Treatment effects favoring taping: assigned negative Hedges' g standardized mean difference (SMD) values. Results in bold type represent statistically significant comparisons based on the 95% confidence interval (95% CI) of the SMD. Values presented in forest plots are effect size (ES) of the SMD and 95% CI. IPT=immediate posttreatment (0-month follow-up), ST=short term (1-month follow-up), NRS=numerical rating scale, VAS=visual analog scale.

Type of NP	Taping	Outcomes	n	Experimental Group Mean (SD)§	Experimental Group Mean (SD)§	n	Control Group Mean (SD)*	Control Group Mean (SD)*	Forest Plots	ES	P
Acute NP	Elastic	IPT pain (NPRS)[54]	21	4.30 (0.9)	3.30 (0.9)	20	4.20 (0.7)	4.10 (0.8)		**–1.04 (–1.68, –0.39)**	**.002**
Specific NP	taping	IPT pain (VAS)[53]	20	5.38 (2.54)	1.99 (1.76)	20	3.77 (3.29)	1.71 (2.19)		**–0.66 (–1.28, –0.03)**	**.039**
		IPT disability (NDI)[53]	20	34.75 (13.28)	20.30 (11.22)	20	33.80 (12.16)	17.40 (8.46)		–0.19 (–0.80, 0.42)	.536
Nonspecific NP	Nonelastic	IPT pain (VAS)[39]	16	7.31 (0.87)	4.88 (1.36)	16	7.06 (1.12)	4.75 (1.69)		–0.08 (–0.75, 0.60)	.825
	taping	IPT disability (CMS)[39]	16	12.19 (2.48)	13.69 (2.41)	16	12.69 (2.15)	13.19 (2.29)		–0.42 (–1.10, 0.27)	.234

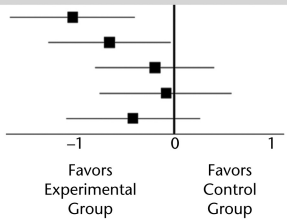

Figure 5.
Results of single included trials on the effects of taping versus placebo or no treatment in people with neck pain (NP). Treatment effects favoring taping assigned negative Hedges' g standardized mean difference (SMD) values. Results in bold type represent statistically significant comparisons based on the 95% confidence interval (95% CI) of the SMD. Values presented in forest plots are effect size (ES) of the SMD and 95% CI. Mean (SD)§=mean and standard deviation measured at baseline. Mean (SD)*=mean and standard deviation measured posttreatment, IPT=immediate posttreatment (0-month follow-up), VAS=visual analog scale, NPRS=numerical pain rating scale, NDI=Neck Disability Index, CMS=Constant-Murley Scale.

significant improvement in disability at posttreatment follow-up and at 1-month follow-up.

Outcomes of Treatment for People With NP

The follow-up study findings for pain and disability with respect to the effect size with 95% CI for intervention outcomes are presented in Figure 5. Three studies analyzed NP[39,53,54]: 1 related to nonspecific chronic NP,[39] 1 related to acute NP,[54] and 1 related to specific NP.[53] Two studies concern elastic taping,[53,54] and 1 study concerns nonelastic taping.[39]

Outcomes of treatment with elastic tape versus placebo for people with NP (WAD). One study[54] assessed pain in the immediate posttreatment period. The effect size of taping versus placebo was large and significant (g=−1.04; 95% CI=−1.68, −0.39) (Fig. 5).

In summary, using GRADE criteria, there is low-quality evidence from one trial that elastic taping versus placebo reduces pain in the immediate posttreatment period.

Outcomes of treatment with elastic tape versus no treatment for people with specific NP (cervical disk herniation, cervical spondylosis, or cervical radiculopathy). One study[53] assessed pain in the immediate posttreatment period. The effect size of taping versus no treatment was medium and significant (g=−0.66; 95% CI=−1.28, −0.03) (Fig. 5).

One study[53] assessed disability in the immediate posttreatment period. The effect size of taping versus no treatment was small and not significant (g=−0.19; 95% CI=−0.80, 0.42) (Fig. 5).

In summary, using GRADE criteria, there is low-quality evidence (from one trial) that elastic taping versus no treatment reduces pain in the immediate posttreatment period. No significant improvement in disability was found at posttreatment follow-up.

Outcomes of treatment with nonelastic taping versus no treatment for people with nonspecific chronic NP. One study[39] assessed pain immediately posttreatment. The effect size of taping versus no treatment was very small and not significant (g=−0.08; 95% CI=−0.75, 0.60) (Fig. 5).

One study[39] assessed disability immediately posttreatment. The effect size of taping versus no treatment was small and not significant (g=−0.42; 95% CI=−1.10, 0.27) (Fig. 5).

In summary, using GRADE criteria, there is very low-quality evidence (from one trial) that nonelastic taping versus no treatment provides no significant reduction in pain or disability in the immediate posttreatment period.

Discussion

We searched the scientific evidence for the effect of elastic and nonelastic taping on the 2 outcomes that are commonly considered as relevant in spinal conditions: pain and disability. Eight RCTs concerned the effect of several types of taping on pain and disability for LBP and NP. Meta-analysis of RCTs on LBP demonstrated that elastic taping did not significantly reduce pain and disability immediately posttreatment compared with sham/placebo or no treatment. Both elastic and nonelastic taping did not provide significant improvement in spinal disability. Conflicting results emerged from sin-

gle trials because nonelastic taping appeared to be effective on lumbar pain versus placebo only immediately posttreatment, but it provided no significant reduction in cervical pain compared with no treatment. Elastic taping appeared to be effective on lumbar pain only at 1-month follow-up, but not immediately posttreatment or at 2-month follow-up. Single trials also indicated that elastic taping may be effective for pain relief in acute NP (WAD) and in specific NP in the immediate posttreatment period.

On the basis of the GRADE assessment results, all of these findings were supported by evidence from very low- to low-quality studies. Although different types of taping were investigated, the results of this systematic review are similar for both types of tape, not showing any firm support for their effectiveness.

The quality of the included RCTs, assessed by PEDro score, was generally high, especially for LBP. Studies on LBP are homogeneous for outcome measures and age of included participants. Nevertheless, only one study[56] had a sample size greater than 50 participants per group, which is the minimum number needed to achieve "golden" and "platinum" evidence.[57] No study was found on acute, specific, or posttraumatic LBP; on nonspecific NP other than myofascial pain syndrome; or on thoracic pain. Mid- and long-term follow-up studies have never been conducted, and we cannot comment about outcome measures other than pain and disability. The conclusion from the few studies on taping we found is comparable to the results of other systematic reviews concerning the effectiveness of KT in musculoskeletal injuries[10,15,19,22,23] and in treatment and prevention of sports injuries.[18] Our results on elastic taping effectiveness are similar to findings of the previous reviews, also considering the low levels of evidence.

In light of our results, the current literature does not support the use of this therapeutic option in spinal conditions, and it does not confirm the hypothesized greater effect of the elastic taping compared with nonelastic taping. Suggestions for future research are to conduct high-quality studies with longer follow-up times and sufficiently large and generalizable samples. The effects of nonsteroidal anti-inflammatory drugs as possible confounding factors also should be considered. Due to associated modifications of position sense and the repositioning strategies used in people with chronic LBP and NP, the study of the effects of taping on additional outcome measures such as proprioception and balance would be of interest. Additionally, the psychological dimensions of taping, including patient preferences, might be investigated. Finally, as the overall quality of the small body of literature on the effects of taping is low, future research may alter current estimates of effect, and stronger evidence could very well change confidence in our conclusions as well as further confirm it.

Ms Vanti, Ms Bertozzi, Mr Gardenghi, Ms Turoni, and Mr Pillastrini provided concept/idea/research design. Ms Vanti, Ms Bertozzi, Mr Gardenghi, Dr Guccione, and Mr Pillastrini provided writing. Mr Gardenghi and Ms Turoni provided data collection. Ms Bertozzi, Mr Gardenghi, Ms Turoni, and Dr Guccione provided data analysis. Ms Vanti, Ms Bertozzi, and Mr Pillastrini provided project management. Ms Vanti, Ms Bertozzi, Dr Guccione, and Mr Pillastrini provided consultation (including review of manuscript before submission). The authors thank Giulia Catoni and Giulia Marcheselli for their assistance with the research.

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