

SYSTEMATIC REVIEW OF MUSCULOSKELETAL TAPING METHODS

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University of Pittsburgh, 2015

Taping is a therapeutic technique used by many rehabilitation clinicians to treat musculoskeletal conditions. Various types of taping methods are in common use, such as Kinesio Tape, Mulligan, and McConnell. However, the literature is inconclusive about the effectiveness of these techniques, and a comprehensive look at all body regions and types of taping has not yet been performed. A systematic search through September 16, 2015 was performed of the following databases: PEDro, CINAHL, Cochrane Database of Systematic Reviews, Cochrane Central Register for Controlled Trials, PubMed, and PROSPERO. This search revealed a number of systematic reviews and individual randomized controlled trials (RCTs) regarding several musculoskeletal conditions and therapeutic taping methods.

The methodological quality of included systematic reviews was assessed using the AMSTAR checklist (1) and compiled into evidence tables. RCT searches were also completed and compiled into evidence tables, organized by type of taping method and musculoskeletal condition. Only trials that compared outcomes of pain and function were used; balance, proprioception, and EMG activity were not included in this systematic review. The methodological quality of these RCTs was measured using the PEDro scale(2). These PEDro ratings are provided in these evidence tables along with a summary description of each individual RCT.

Most trials were focused on Kinesio tape as well as the lower extremity, primarily the knee and ankle. The results demonstrate that taping for the knee can be beneficial in the short-term, but benefits disappear between groups over extended periods of time. Ankle bracing is more beneficial for the prevention of ankle injuries and recovery from ankle injury than ankle taping. Kinesio tape is effective for the improvement in function for patients with chronic low back pain. Taping also

appears effective for patients with plantar fasciitis, and those with shoulder impingement syndrome can benefit in the short term from the addition of tape.

Recommendations from this systematic review for future researchers would include: a greater focus on the upper extremity, the addition of a control group to research designs, teasing out the effectiveness of taping from multiple interventions, and comparing different types of taping on similar body regions or musculoskeletal conditions.

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PREFACE

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1.0 INTRODUCTION

With increases in commercialization of health care products and a global market, more people are familiar with taping as a therapeutic tool than ever before. Patients are now familiar enough with this technique to request it when visiting a physical therapist, athletic trainer, or chiropractor, applying pressure on the clinician to use a treatment without a clear understanding of its effectiveness. Literature on taping is being published at an increasingly fast pace, leaving clinicians with so much information and little time to find, read, and appraise it, and then apply the results to patients. Systematic reviews of the literature are common, but there has yet to be one comprehensive systematic review that can address all body regions and all brands and styles of taping. This wide-ranging systematic review would be incredibly useful to the everyday clinician to learn which techniques can produce the most clinically effective results, and which methods work best for which body region.

1.1 SYSTEMATIC REVIEWS

1.1.1 Basics of a Systematic Review

A systematic review is an ordered collection of literature on a topic that is designed to educate the reader on the existing information, as well as to provide an assessment of the quality of that

literature (3). Systematic reviews use comprehensive methods to identify and include all studies that meet the inclusion and exclusion criteria established by the researcher. These reviews are useful tools as they provide a synthesis of the data as well as an assessment for the usefulness of the data. By combining many studies together into one composite source, systematic reviews seek to reflect the collective research questions that has been examined, as well as to minimize biases from individual studies (3).

To conduct a systematic review, one must first start with a research question of interest and begin to systematically search a collection of databases for information regarding this question. The process of searching must be appropriately recorded so that another individual who is unfamiliar with this project could search the same databases with the same terms and come up with the same results. Each subsequent step of the systematic review must also be carefully recorded so that others can replicate the process. After setting distinct inclusion and exclusion criteria, the search results are examined based on title and abstract to see which are relevant for the question at large. Once the final full-text articles are acquired, they are examined and rated using an assessment scale for judging quality, such as AMSTAR, QUORUM or PEDro, to see if they are well-designed studies with minimal bias(1; 4). If the included studies have homogeneous inclusion/exclusion criteria and use similar outcome measures, the data may be combined and a meta-analysis conducted. However, this is often not possible due to heterogeneity between the individual studies, in which case the results of the searches will be qualitatively described and summarized into evidence tables for the benefit of the reader.(3)

Systematic reviews are useful as tools for combining large amounts of information into one compact summary source and therefore serve as important tools for health care providers and clinicians. Most clinicians spend the majority of their day treating patients, but still need to remain

up to date on the newest research and techniques. Systematic reviews combine these findings into one easy to read combination of information so that more of the clinician's time can be focused on patient-care rather than reading and searching for individual research trials for hours on end. Systematic reviews allow health care providers to find the best evidence that is already appraised and combined into one easy to read source, potentially resulting in improved patient care.

1.1.2 Existing Systematic Reviews on Taping Methods

Our initial literature searches on the subject of taping revealed that numerous systematic reviews on the topic already existed. Although our search revealed that numerous systematic reviews of taping methods were already in the literature, we found that many of them were not comprehensive in their approach. All 21 of the existing systematic reviews that were found to meet our inclusion criteria were focused on only four broad categories: 1) foot, 2) ankle, 3) knee, and 4) Kinesio tape. There were no systematic reviews that compared different taping methods to one another, or looked at multiple regions of the body.

Additionally, we performed searches for individual randomized controlled trials of taping methods and found many trials that were not included in the existing systematic reviews. Some of these trials were focused on different body regions, such as the shoulder or cervical spine; but others were focused on specific types of taping, such as McConnell or Mulligan taping. There was no single systematic review that contained all trials of the numerous taping methods and body regions.

1.1.3 Why This Systematic Review Is Needed

The average clinician has a limited amount of time to search for updated evidence and research that has been newly published. The evidence-based medicine guidelines encourage clinicians to use research findings to assess their own care and develop new ideas of practice(3). Many clinicians rely more on their experience than the most current research literature, mainly because finding clinically relevant research evidence is a time-consuming and difficult task. Clinicians routinely use systematic reviews as an easy way to find all the relevant research on a particular topic in one condensed and pre-appraised source. As previously mentioned, there is currently no single comprehensive systematic review that addresses the vast amount of taping literature that includes several types of taping methods and several musculoskeletal complaints/body regions.

A comprehensive and single systematic review, which summarizes the current evidence about all major types of taping methods and all major musculoskeletal conditions, is therefore necessary. As taping methods have increased in commercialization and popularity with patients, there is a large push by the taping manufacturers to spread the word about the benefits of their particular type of tape. Many physical therapists and athletic trainers use various taping methods on a daily basis without the benefit of having a reference source of evidence for the clinical effectiveness of these methods. This systematic review of taping methods is necessary to provide clinicians with an easy way to gather research information on taping so that educated decisions on the use of specific taping methods for specific musculoskeletal conditions can be made.

1.2 TAPING METHODS

The therapeutic effects of taping on the body have been recorded in the literature from as early as 1969, but have greatly increased in quantity recently(5). There are many categories of taping, including: Kinesio taping, McConnell taping, Mulligan taping, and more traditional sports taping that uses adhesive tape and elastic bandages. Some of the therapeutic effects of these taping methods include: the prevention of injuries, reduction of lymphedema, increased proprioception, increased blood flow, improved patellar tracking, improvement in function, and reduction in pain (6-8). The effects of taping are evidenced primarily in the musculoskeletal system, but observations of improved lymphatic flow have been shown as an important taping target as well (9). Although many practitioners, such as physical therapists, athletic trainers, and chiropractors use taping methods on a daily basis, the literature does not always agree about the effectiveness of these therapeutic treatments. Many systematic reviews and meta-analyses have been conducted to investigate the effectiveness of these taping methods.

1.2.1 Kinesio Taping

Kinesio taping was developed by Dr. Kenzo Kase, a Japanese chiropractor and acupuncturist, as an alternative to traditional rigid taping methods(10). His alternative of Kinesio Taping utilizes an elastic tape that mimics the elasticity of the skin to provide the best therapeutic results. The mechanism of action of Kinesio tape is thought to be a lifting of the skin, which increases blood and lymphatic flow to the injured area while limiting the stimulation of pain receptors(10). Through the increase in blood and lymphatic flow, a decrease in pain and improvement in function may be felt(10). After the dramatic increase in public use of Kinesio tape through the Olympics,

use of Kinesio tape has surged in both sports and daily life through the use of this product by health care practitioners(11). Many trials and systematic reviews have been performed to investigate the authenticity of claims about the effectiveness of Kinesio tape, but the results have been varied to date.

Current research features several systematic reviews on the role of Kinesio tape on strength, pain, and range of motion. Most have found inconclusive results, but some systematic reviews and trials have shown some signs of immediate pain relief with the application of Kinesio tape(6; 9; 12-15). Some of these systematic reviews address the musculoskeletal and lymphatic applications of Kinesio tape, but none compare Kinesio tape to other brands or styles of taping.

1.2.2 McConnell Taping

McConnell taping is a method created by Jenny McConnell, an Australian physiotherapist. This method uses a more rigid type of tape, unlike the previously described flexible Kinesio tape. The McConnell type of tape is primarily advocated to help with alignment of the patella in patients with patellofemoral pain(16). A common concern with individuals with patellofemoral pain is that the pain is due to incorrect tracking of the patella on the femur. This tape purports to fix these problems by realigning the tracking of the knee. This taping method provides mechanical pressure on the patella in one specific direction so that the patella can move freely without hitting other parts of the femur and thus causing pain(16).

Current research on McConnell taping shows that it is an effective method for reducing anterior knee pain and improving the alignment of the knee immediately after application(17). Additionally, several studies have showed that McConnell tape may improve proprioception in

individuals (18). Some research has been done into comparisons of McConnell taping with placebo taping and Kinesio Tex taping(16).

1.2.3 Mulligan Taping

Mulligan mobilization with movement is a therapeutic technique using manual force that is applied and sustained in a specific direction, while a previously painful action is repeatedly and actively performed by the patient (19). Tape can also be applied to the body region in the same direction as the manual force, which is thought to extend the benefit of the mobilization with movement (20). Current research on Mulligan mobilization with movement exists, but the addition of the taping component is not found in all studies, and is particularly absent from the RCTs contained with systematic reviews of this taping method.

1.2.4 Athletic taping

Various types of adhesive athletic taping are the methods used primarily by athletes for prevention of injury. These methods use adhesive tape wrapped around a specific region to provide proprioceptive feedback during activity and to limit excessive movement(21). These types of taping methods are thought to restrict the movement of joints, thus serving to prevent injury by excessive joint motion(21).

Current research into this topic primarily deals with comparisons between various types of athletic tape, orthoses, and braces. Research focuses on the effectiveness of these techniques at preventing injuries, primarily in the ankles, as well as the time required to apply the techniques and the cost differential between techniques. Various types of athletic taping techniques have been

a large tenant of athletic injury prevention for many years and have a perception of being 'established' methods within the sports-related health professions.

1.3 BODY REGIONS

Many different regions of the body can be taped for musculoskeletal conditions. Although Kinesio tape can also be used for lymphatic and neurologic conditions, most of these previously mentioned brands of tape are used primarily for prevention of musculoskeletal injury or after an injury has occurred. Taping methods have been primarily used in the lower extremity, specifically in the knee, ankle, and foot. More recently, we found newer studies that explored the effectiveness of various types of taping for conditions involving the upper extremity and spine.

2.0 METHODS

A systematic review must consist of pre-established steps such as finding research articles, systematically sorting them, and organizing the results(3). The chief differentiation between a systematic review and simpler literature or narrative reviews, is that any individual who reads the systematic review can replicate it, because all of the steps of the process have been elaborately detailed. We made the decision to perform a systematic review using well-established methodology that involved several steps.

The initial step of this process began with a comprehensive search for any existing systematic reviews, which revealed that many systematic reviews had already been published. The goal of this first step of our review strategy was to combine all existing systematic reviews into evidence tables that were organized by body regions and taping method. These evidence tables would include all the systematic reviews and their respective AMSTAR quality ratings(1). AMSTAR ratings were performed by two thesis advisors who have extensive clinical practice experience as well as experience conducting and appraising systematic reviews.

The next step in the systematic review process was to perform our own search for individual RCTs on taping methods, and to compare these results with the RCTs found within the existing systematic reviews. After removing duplications, we created evidence tables that consisted of RCTs categorized first by taping method, and then secondly by musculoskeletal condition/body region. These evidence tables included summaries of the RCTs and their respective PEDro ratings(2). These ratings were found through the PEDro database; and when not available, two thesis advisors performed the ratings using the PEDro methodology.

2.1 REFERENCE LIBRARIAN CONSULTATION

A reference librarian at the Health Sciences Library System who was familiar with systematic reviews was initially consulted at the beginning of this project. The reference librarian's familiarity with search strategies and databases was used to formulate a tentative list of search terms and online databases from which to look for individual trials and existing systematic reviews. Traditionally, a key word search strategy uses a population and intervention combination to look for trials, but as this review was looking at all types of taping in all populations, a more general key word search strategy was advised for the best results.

The reference librarian was helpful in providing instructions about the use of various advanced search strategies, such as the Boolean operators 'AND', 'OR', 'NOT', and '*' that would be useful for upcoming searches. By using a unique combination of words combined with the key use of "AND", these strategies were successful in our ability to find the exact targets of the searches. Use of the asterisk in key word searching was not very helpful, because it brought up results that contained words with all the letters prior to the asterisk. For example, use of the key word 'tap*' brings up results with words such as 'tape', 'tapes', and 'taping'; but also brings up the word 'taper' in regards to a pharmaceutical treatment and 'tap water' involving environmental studies of health. To prevent this wide range of potentially irrelevant results, the choice was made to leave out the asterisk in favor of a large combination of 'ORs'.

2.2 SYSTEMATIC REVIEW OF SYSTEMATIC REVIEWS

2.2.1 Search Strategy

To conduct a broad search, only key words and terms used with the intervention of taping were used. We did not limit our search to specific populations, specific outcomes of strength and function, or specific brands of tape, such as Kinesio Tape. To help inform our search strategy, current systematic reviews of taping were gathered and examined to see what key words were used within their search strategies. Additional use of the Medical Subject Headings (MeSH) were used to examine the key words that were similar to ‘taping’ in PubMed as well as other body regions to see if broadening the search terms with specific body regions would be useful for widening the results. MeSH headings for body regions were not found to make any difference in the search results, nor were the other terms for taping.

The key words used within the search for systematic reviews on taping were: “Tape OR tapes OR taping OR strap OR strapping”. This combination of search terms was found to bring up systematic reviews about all types of ‘tape’, whether McConnell or Kinesio tape, as they were all categorized with the word ‘tape’. This key word string also resulted in finding systematic reviews that were focused on all regions of the body and several musculoskeletal conditions (e.g. knee pain, shoulder impingement, ankle sprains, etc.). ‘Strapping’ is an Australian term and version of taping that is very common in their journals. There is a large amount of literature from Australia on taping protocols and procedures, so by including this variation of the key word ‘tape’, more trials were able to be discovered through the searches.

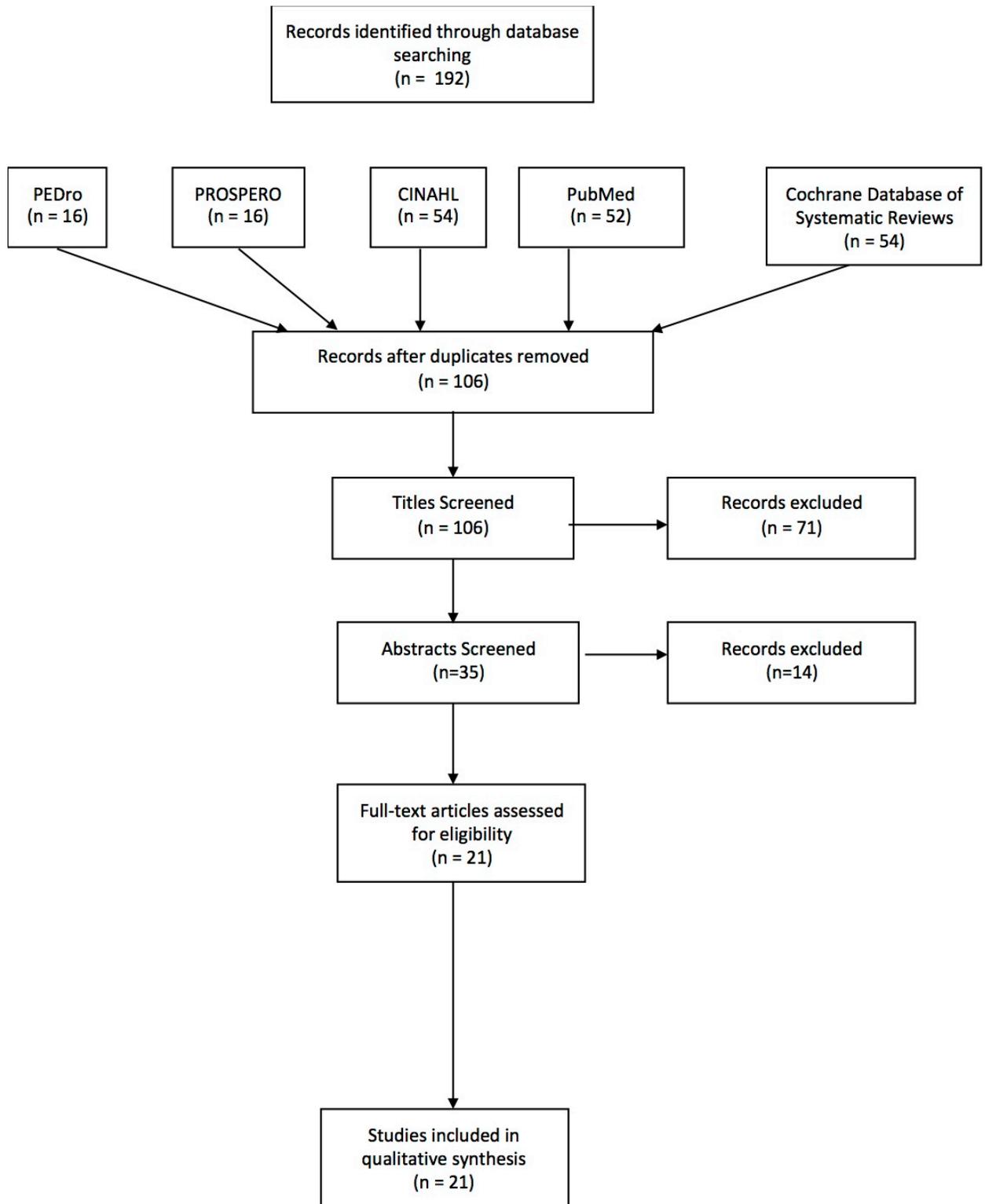
To conduct a comprehensive search of multiple health care databases, the following databases were used for these searches: PEDro, CINAHL, Cochrane Database of Systematic

Reviews, and PubMed. Additional searching was performed in PROSPERO, looking for additional research studies on this topic. To narrow the search strategies to find only systematic reviews, specific search restrictions were used in PEDro, CINAHL, and PubMed. These restrictions were unnecessary in the Cochrane Database of Systematic Reviews, as this database was already restricted to our target findings. Searches were done from inception of all included databases until June 11, 2014. There were 192 systematic reviews found in these databases.

2.2.2 Inclusion/Exclusion Criteria

Many of the existing systematic reviews were focused on one particular body region or type of taping method, and many included trials that reported only the immediate effects of taping. We had only one simple inclusion criterion; a systematic review involving some type of taping method of the human body that had been published within the last ten years. Systematic reviews generally overlap each other, by searching all databases from inception until the current time. As such, we felt that any systematic review over ten years old would have been replicated by more current reviews and would contain redundant information. No exclusion criteria were created. As long as the systematic review involved some type of taping of a body region or an overview of a taping method, and had been published after 2004, it was included for consideration. Language was not a factor in the exclusion criteria as long as a translation of the systematic review could be obtained from a colleague. However, no systematic reviews that were found were published in any languages other than English.

Figure 1: Flowchart of systematic reviews



2.2.3 Duplicates

We searched multiple databases and therefore it was possible that an individual systematic review could potentially be found on more than one database. Therefore we needed to add another step, a de-duplication process. The extra step was necessary to ensure that extra time was not wasted on reviewing multiple versions of the same systematic review. This step resulted in the removal of 86 duplicates; leaving a total of 106 systematic reviews for consideration.

2.2.4 Titles

The titles of the de-duplicated systematic reviews were sent to two independent raters to be evaluated for their potential eligibility into the final systematic review. This stage of the process resulted in the exclusion of 71 systematic reviews from consideration for our comprehensive review. Most of these reviews were excluded because they were focused on edema reduction or wound care, or did not include clinical outcomes. This left us with a total of 35 systematic reviews, which would be considered for inclusion based upon a review of their abstracts.

2.2.5 Abstracts

Abstracts were then collected into one document and read by two independent reviewers who have clinical experience with taping methods. To gain experience in the field of systematic reviews, I also read the abstracts and excluded or included them, based on the previously established criteria. My results were compared to the two expert clinicians and feedback was given to help me in future exclusion and inclusion protocols. This level of the process removed another 14 systematic

reviews, leaving a final total of 21 remaining systematic reviews. The full-text versions of these systematic reviews were gathered for rating and inclusion in our evidence table

2.2.6 Full Text Appraisal

After narrowing down the search results, there were 21 remaining systematic reviews. None of these systematic reviews were removed after an appraisal of their full-texts, leaving the total number of 21 systematic reviews for data extraction and rating.

2.2.7 Rating/AMSTAR

The rating of the systematic reviews was again done by two researchers with clinical and systematic review experience using the AMSTAR scale, a measurement tool to assess the methodological quality of systematic reviews(1). These two researchers performed the ratings independently, and then compared their scores. If these scores differed by more than one point, they discussed their individual ratings and came to consensus on the final rating. The AMSTAR scale has eleven criteria to rate the quality of a systematic review; higher numbers indicating higher quality. Characteristics of a good systematic review include: an a priori design; duplicate study selection and extraction; a comprehensive literature search; grey literature inclusion (literature that hasn't been formally published); characteristics of included studies provided; assessing the quality of included studies; methods to combine the findings appropriately; likelihood of publication bias assessed; and conflict of interest included(1). AMSTAR has been found to be a reliable and valid method through multiple investigations (22; 23).

I also rated the systematic reviews using the AMSTAR scale to gain experience in the process, but my results were not used, as I am an undergraduate student with no clinical experience in the field of taping. The experience was used to provide me with more knowledge and familiarity in the steps of a systematic review, as well as what makes a systematic review high quality. Knowing the aspects of a good systematic review was beneficial to help guide me in writing my own individual systematic review.

2.2.8 Collection of Data

After the systematic reviews were rated for quality, relevant information was extracted from each systematic review and organized into one comprehensive evidence table. This evidence table of systematic reviews will serve as the primary information source for clinicians looking to gain information on the clinical benefits of various taping methods. Data was extracted by me and then double-checked by two independent expert clinicians to assure that the data was extracted correctly. The systematic reviews have been sorted and organized by body region, which will be beneficial for clinicians looking for information about taping each different body area.

2.2.9 Re-running search strategies for existing systematic reviews

We thought that it made sense to update the most current and highest quality systematic reviews, by re-running their search strategies from the end-date of their searches until the present day. The rating of systematic reviews was performed using the AMSTAR system as previously stated. To find the most comprehensive systematic reviews, a spreadsheet was made to see which systematic reviews used which trials and their respective search strategies. There were three body regions

that surfaced as being problematic with respect to simply re-running the search strategies of those systematic reviews: 1) the ankle 2) the upper extremity and 3) the spine.

2.2.9.1 Ankle Systematic Reviews

The knee, foot, and Kinesio tape systematic reviews were all fairly similar in their scope, so the most recent and best quality systematic reviews for each of these topic areas were easily identified. However, the ankle systematic reviews varied greatly in their subject matter. Some of these reviews focused on sprain prevention through external devices (7; 24) whereas others focused on proprioception (25) or sprain prevention in primary care (26). Therefore, we could not find any single systematic review of ankle studies that was comprehensive. By re-running the search strategies of these previous ankle systematic reviews, we would be leaving out many other aspects of ankle taping and would not be finding the most comprehensive taping information regarding the ankle.

2.2.9.2 Upper Extremity and Spine

We were not able to find any systematic reviews focused on taping methods for the upper extremity or spine. By only updating the previously published systematic reviews on other topic areas (knee, ankle, foot, Kinesio Tape), many trials regarding taping of the upper extremity and spine could potentially be completely left out.

2.3 SEARCH FOR RANDOMIZED CONTROLLED TRIALS

To find all potential clinical trials regarding taping methods that were not in the existing systematic reviews, a separate search for individual randomized controlled trials (RCTs) was undertaken. The steps of this process were very similar to the previous search for systematic reviews, but differed with respect to the databases searched and scales used to rate the individual trials.

2.3.1 Search Strategy

The search strategy for randomized trials remained the same as the searches for systematic reviews, but with some differences in the databases that were searched. The key words “Tape OR tapes OR taping OR straps OR strapping” were used again to search the databases that had been selected for their health care orientations. PEDro, CINAHL, and PubMed were again searched, but the Cochrane Database for Systematic Reviews was replaced by the Cochrane Central Register of Controlled Trials to fit the new focus of this research question. PEDro, CINAHL, and PubMed search findings were narrowed down by selecting for randomized controlled trials once the original search numbers were found. By limiting the search strategy to RCTs, there were 490 trials found. This number of trials was gradually narrowed down to the final 47 trials that were included in the systematic review and RCT evidence tables.

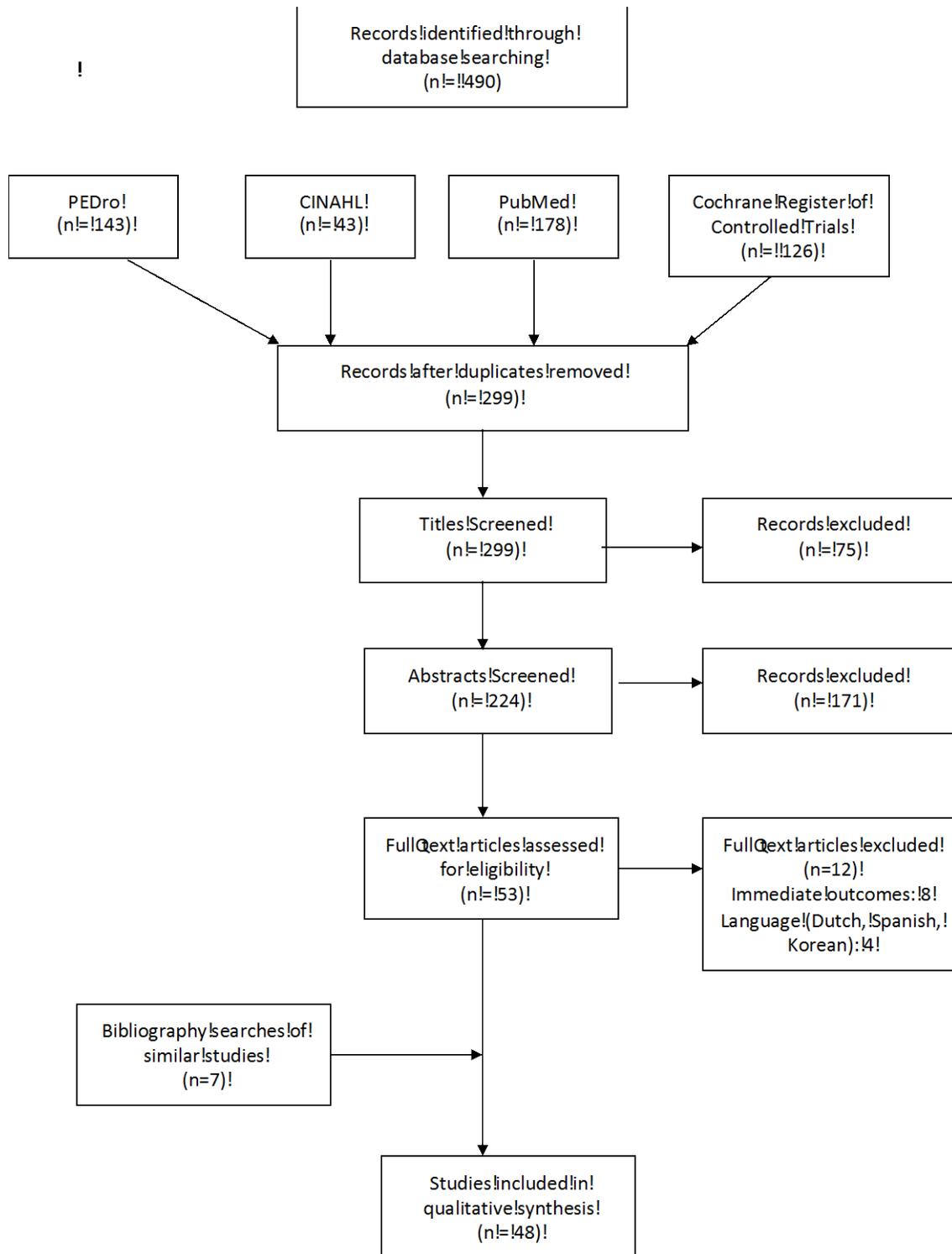
2.3.2 Inclusion/Exclusion Criteria

The goal was to find RCTs that targeted clinical differences (pain and function) in a population of patients who were receiving some type of taping intervention during clinical care. Many trials

focused on immediate effects in healthy subjects, but this type of research design would not provide practitioners with evidence about the clinical effects that their patients would experience with these taping methods. As such, our inclusion criteria required that the RCT design include some real-life clinical outcome such as pain scales or a measure of physical function, and include participants who were actively experiencing pain or some level of functional disability. Exclusion criteria were RCTs with a design that only measured immediate effects in the lab, such as proprioception or immediate muscle strength, or healthy individuals involved in the study. The investigators must have waited at least one day to record the change in pain or disability after treatment in order for the trial to be included in this systematic review.

Unlike our search for systematic reviews which only looked back ten years, we did not place any time limit on our search for RCTs. We only included studies that met the definition of being a randomized controlled trial. Language was not an exclusion criterion, as long as a translation could be acquired from a colleague.

Figure 2: Flowchart of Randomized Controlled Trials



2.3.3 Duplicates

We found a total of 490 clinical trials after searching these four databases: PEDro, CINAHL, PubMed, and the Cochrane Central Register of Controlled Trials. Many of these trials were found in multiple databases, so the process of de-duplication was required. After duplicates were removed, there were 299 trials remaining for further examination.

2.3.4 Titles

The titles of these 299 studies were organized into one document to be examined for possible inclusion or exclusion, based upon a review of the abstracts. The titles were initially sorted by me, but were reviewed by two expert clinicians who decided whether to collect the respective abstracts, based upon the previously established inclusion and exclusion criteria. If they did not agree, they would consult each other and discuss whether to include or exclude the trial. They independently agreed to remove another 75 titles, leaving 224 trials for further examination of abstracts.

2.3.5 Abstracts

The abstracts of these 224 trials were then collected and analyzed by the same previous two independent expert clinicians. These clinicians used the previously established inclusion and exclusion criteria to limit the abstracts to relevant RCTs whose research design included primary outcomes of clinical effects, primarily pain and function. After the abstracts were reviewed, another 171 articles were removed as not meeting the inclusion criteria, leaving a total of 53 trials that remained for full-text acquisition, rating, and data extraction.

2.3.6 Rating the Quality of retained RCTs (PEDro scale)

The Physiotherapy Evidence Database (PEDro) is a free database intended for easy use by clinicians. As such, when an individual searches the PEDro database, each study found by the search engine is already rated by a group of experts organized by the Centre for Evidence-Based Physiotherapy at the George Institute for Global Health using the PEDro scale (4). This scale uses eleven categories upon which articles are rated for a variety of features, including: specification of eligibility criteria; random allocation of subjects; concealed allocation; similar baseline groups; blinding of all subjects, therapists and assessors; measures of key outcomes obtained from more than 85% of subjects initially allocated; intention to treat analysis; between-group statistical comparisons for at least one key outcome; and point measures and measures of variability for at least one key outcome (4). Each category is rated either as a '0' or '1', based on their presence or absence; the sum of which comprises the PEDro rating (possible range:0-11). These ratings are available when searching the PEDro database with each result found.

Rather than re-rating each RCT that we found during our searches, data was extracted from the full-texts of the papers and we used any existing ratings from the PEDro database. In cases where no PEDro rating could be obtained for an individual RCT, the two expert clinicians with experience performing and assessing systematic reviews completed the additional PEDro ratings. In cases where there was more than two points of difference, a third clinician adjudicated the rating.

2.3.7 Full-Text Removals

After the two expert clinicians reviewed the 53 full-text articles, twelve studies were eliminated from further inclusion in this review. Four of the articles were excluded as they were not in English

and translations were not available in time for the publication of this thesis. The other eight all had immediate outcomes that were not obvious from the inspection of their abstracts. This left us with a total of 41 randomized controlled trials on the topic of taping that fit the inclusion and exclusion criteria.

2.3.8 Data extraction for evidence tables

The data was extracted from the full-text articles by myself as well as double-checked by two independent reviewers. Outcome measures and other research criteria were extracted with the hope that pooling and meta-analysis could be performed if the outcome measure and research design of the clinical trials were homogeneous. However, we found the research studies to be extremely heterogeneous with respect to research design, choice of outcome measures, dosage and frequency of taping application, and multiple co-interventions. Therefore, it was not possible to pool data or perform any meta-analysis. Instead, we decided to summarize the results of this systematic review in a qualitative manner, by organizing the systematic reviews and individual RCTs into evidence tables followed by a narrative discussion of the results.

2.3.9 Modification of search strategy

To see if our search strategy for individual taping RCTs was successful in finding appropriate studies, we compared the results of our RCT searches with the RCTs that were included in the existing systematic reviews. Almost all of the RCTs contained within existing systematic reviews overlapped with those RCTs that had been discovered with our search, however there were a few trials that we had not discovered. After further examination, most all of these trials were found to

have used the key word ‘elastic bandage’ that had not previously been identified, instead of the key word ‘tape’ that we had used with our searches.

After discussing this issue with the reference librarian, a new search strategy was suggested including the key words ‘elastic bandage’ as well as the previously listed search terms. By searching for individual RCTs with this new strategy, however, those trials still were not discovered. We were unable to explain this paradoxical finding. However, in order to provide the most comprehensive review of the taping literature, all trials included in previously published systematic reviews were extracted and included in this systematic review, if they fit the inclusion criteria. This led to the addition of seven trials into the final collection of trials for inclusion in our RCT evidence tables. The result was a grand total of 48 relevant randomized controlled trials on the topic of taping.

3.0 RESULTS

After acquiring all of the full-text taping articles of RCTs that met our inclusion criteria, the results were arranged in various evidence tables that were organized by the body region studied in the study. The RCTs were centered around five general body regions: 1) knee, 2) ankle, 3) foot, 4) spine, and 5) upper extremity. One additional journal article that did not fit in any of the previously mentioned body regions was also found, which was placed into a ‘miscellaneous musculoskeletal’ category (27).

3.1 KNEE

3.1.1 Systematic Reviews

All four systematic reviews focused on patellar taping for patellofemoral pain syndrome or anterior knee pain. These four systematic reviews can be found in the evidence table labeled *Appendix A*. Callaghan’s systematic review scored a 10/11 on the AMSTAR, and found that there was insufficient evidence of high quality to draw conclusions about taping (28). In contrast, both Bolgla and Barton found that patellar taping was effective in the short-term for reducing pain and improving function, but evidence for the long-term symptoms was weak and required more research (8; 29). Collins’ study on non-surgical interventions for anterior knee pain showed that in the short-term, patellar taping and exercise were more effective over exercise alone or placebo tape with exercise, but long-term effects were unclear on the benefits of education, taping, and

exercises in combination (30) Three of the four reviews found evidence for reducing pain and function in the short term, but the long term effects were unclear.

3.1.2 RCTS

There were a total of fifteen RCTs that involved taping of the knee. The publication time of these studies spanned a large range, from 1994 through 2013, showing a long history of taping research in this area of the body. Most of the studies were focused on patellofemoral pain syndrome or knee osteoarthritis, but several others focused on knee dislocation or generalized anterior knee pain. An evidence table combining these results can be found in *Appendix B*.

3.1.2.1 Knee Osteoarthritis

There were six RCTs focused on knee osteoarthritis, of which only two focused on the comparison of taping and non-taping interventions. These two studies (31; 32) found that taping of the knee resulted in less pain and disability, but the one (31) with long-term follow-up found that these differences between groups did not remain at one year after treatment. One study focused on the differences between different angles of taping in osteoarthritis (medial, neutral, or lateral) and found that medial patella taping had the most statistically and clinically significant results. However, this study was a comparison of different taping techniques, not the comparison of tape to no tape (33).

The other three studies were all combinations of taping with other treatment methods. One comparison of taping, massage, exercise, and mobilisation to no treatment found that the taping in combination with other commonly applied physical therapy treatments was more effective than regular contact with a physical therapist at reducing pain and disability in patients with knee

osteoarthritis (34). Another comparison of knee osteoarthritis taping compared McConnell patellar taping and Mulligan mobilization with movement as separate therapeutic techniques - and in combination - showing that the combination of the two methods resulted in improved range of motion, pain, and disability (35). Finally, a comparison of taping and closed kinetic chain exercises was compared to a control group, showing that taping in combination with closed kinetic chain exercises was more effective at reducing pain and stiffness and improving function than the control group (36).

The few studies that directly address taping versus a comparable therapy show that although taping may have benefits in the short-term, the long-term differences gradually disappear in regards to the effectiveness of taping of the knee for osteoarthritis.

3.1.2.2 Patellofemoral Pain Syndrome

The results of the systematic review revealed seven RCTs involving taping methods of the knee in patients with patellofemoral pain syndrome (PFPS). Most of these studies used a direct comparison between tape and no tape, but one study combined patellar taping with biofeedback showing that a combination of these techniques could result in a quicker recovery than a strengthening and flexibility program alone (37). Tunay's study was focused on the differences between home and clinic physical therapy exercise programs, but also combined different groups that used taping in combination with these programs (38). This study showed that controlled exercises can result in better results than home programs. Inspection of the relevant data shows that the group with patellar taping had more pain when the study began and less when the study ended, compared to the patellar glide group, showing benefits to taping, although not statistically significant (38). Whittingham (39) compared McConnell taping and exercise to exercise alone, and to placebo taping with exercise. They found that daily taping and exercise were better for improving pain and

function in patients with PFPS, whereas Kowall(40) found that patellar taping offered no additional benefits to a standard physical therapy program.

Akbas' (41) use of patellar Kinesio taping revealed that the addition of Kinesio tape to an exercise program did not improve results in patients with PFPS other than a faster improvement in hamstring muscle flexibility. Miller's (42) comparison of lumbopelvic manipulation, Kinesio tape, and placebo Kinesio tape revealed that Kinesio taping and lumbopelvic manipulation both resulted in better improvements than the control tape, showing an effectiveness of Kinesio tape. Finally, a study by Mason (43) resulted in less positive changes for taping compared to strengthening and stretching, but the combination of these three modalities resulted in large improvements in many measures. Clark's (44) trial investigating anterior knee pain alone also showed improvements in muscle stretching and strengthening, but did not show any significant clinical effects from taping.

3.1.2.3 Dislocation

Only one study addressed the role of taping in primary knee dislocation. Rood's (45) findings point to a tape bandage immobilization being superior to a cylinder cast immobilization process. These findings were extended to a 5-year follow-up and at that time, the function was still better in the taping bandage group than the cylinder cast, showing long-term benefits as well as short-term benefits experienced at weeks 1, 6, and 12.

3.2 ANKLE

3.2.1 Systematic Reviews

There were five systematic reviews found on the topic of taping of the ankle, but these five were very diverse in their clinical focus (7; 24-26; 46). These five systematic reviews can be found in the evidence table labeled *Appendix C*. Several reviews contained studies that compared braces to other methods, whereas others looked at the prevention of ankle sprains, functional recovery methods, or a putative mechanism behind the positive results often experienced with taping. There is good evidence from these reviews to support the claim that functional treatment is a more appropriate way to recover from an ankle sprain than immobilization, but these studies did not find if either bracing or taping were more effective than each other (7; 46).

Some systematic reviews pointed to the effectiveness of bracing over taping for improvements in function as well as being the more cost-effective method for the treatment of acute ankle sprains (24; 26). The remaining review examined the putative mechanisms of action for taping of the ankle, based upon the premise that improved proprioception may lay behind the effectiveness of ankle taping. However Raymond discovered that ankle taping or bracing has no appreciable effective on proprioception, and may actually make proprioception less effective (25). However, these results do not imply that taping is not a clinically effective treatment method, as benefits can still be gleaned; it may simply mean that these clinical benefits may not necessarily be due to proprioceptive improvements that had been previously suggested as the mechanism of action (25).

3.2.2 RCTs

There were a total of ten RCTs focused on taping methods for the ankle. These trials dated back as far as 1969, showing a long history of ankle taping research, primarily in sports-related conditions. These ankle-taping studies were focused on two general categories: 1) prevention of ankle sprains in healthy populations and 2) recovery from ankle sprains in injured populations. Most of these studies compared a taping method with the use of some type of brace. An evidence table summarizing these RCTs can be found in *Appendix D*.

3.2.2.1 Prevention of ankle sprains

There were three studies focused on the prevention of ankle sprains; two of the three (Simon (5) and Ekstrand (47)) are from 1983 and 1969, which helps to explain their low PEDro scores of a 1 and 2 respectively. Simon's (5) findings suggest that there is no statistically significant difference between taping and wrapping of the ankle for prevention of sprains. Ekstrand (47) compared a prophylactic program that consisted of seven steps, including taping, to controls and found that the combination of those seven steps significantly reduced ankle injuries in soccer players. The more recent preventative study from 2006 (48) compared bracing and taping, and found that bracing was more expensive, but less time consuming; providing equal results to adhesive taping for the prevention of ankle sprains.

3.2.2.2 Treatment of ankle injuries

There are a total of seven RCTs regarding taping treatments for ankle ligament injuries. Two of these are in regards to surgical vs. non-surgical treatment. Both Karlsson (49) and Specchiulli (50) found results of non-surgical treatment and surgical treatment having similar results with no

significant differences for lateral ankle Grade III ligament tears. Additionally, Ardevol (51) found that functional treatment with cryotherapy and strapping was safe and associated with a more rapid recovery in athletic populations than immobilization via plaster cast. The other four studies compared taping to a brace for healing from an ankle injury. Johannes (52) found that Scotchrap semi-rigid bandage was just as effective as adhesive taping, which could be beneficial for patients with allergies to tape. Boyce (53) and Lardenoye (54) both found that braces were more beneficial than tape. Boyce (53) found that the Aircast brace was more helpful at improving function than elastic bandages both at ten days and one month, whereas Lardenoye (54) found that a semi-rigid brace led to higher patient satisfaction and less complications, but no functional or pain differences between the brace or taping. Finally, Beynnon (55) found that a combination of elastic wrap and Air-Stirrup brace could provide more effective treatment than either treatment alone.

3.3 FOOT

3.3.1 Systematic Reviews

There were five systematic reviews of taping for foot conditions that fit our inclusion criteria. These five reviews can be viewed in an evidence table found in *Appendix E*. Two of the five reviews focused on anti-pronation, one on low-dye taping as a whole, and the remaining two focused on taping for plantar fasciitis. Cheung's review on pronation of the foot revealed that taping was more effective at reducing calcaneal eversion than footwear or orthoses, but low-dye taping was not found to be effective in reducing excessive foot pronation (56). Franettovich found that anti-pronation tape could change foot and leg posture, but suggested that the placebo effect

may also explain some of the effects (57). Radford's investigation into low-dye taping revealed that some kinematic changes to the foot may occur after taping, suggesting a reduction in foot pronation; but these results were not found to be clinically significant (58). Both van de Water and Podlosky compared taping for plantar fasciitis to other methods and found that taping, especially low-dye taping and calcaneal taping, were effective interventions in the short term for immediate pain relief, but the improvement in functional disability was inconclusive (59; 60). Overall, the systematic reviews seemed to suggest that taping was beneficial for the treatment of individuals with plantar fasciitis or those patients who over-pronate.

3.3.2 RCTs

There are six RCTs focused on taping of the foot, specifically taping to provide treatment for pain experienced from plantar fasciitis. These six RCTs can be found in the evidence table labeled *Appendix F*. The oldest of these six RCTs was from 1998, showing a shorter publication history than the knee and ankle taping research studies. These six studies used a variety of therapies, ranging from low-dye taping, calcaneal taping, orthoses, injections, and heel cups for the treatment methods. Lynch (61) was the most vague in the comparison groups combining both orthoses and low-dye strapping compared to injections and heel cups, finding that a combination of orthoses and low-dye strapping were more effective than the other options. Four other studies all found that taping was beneficial for improvements in pain compared to sham treatments, but all focused on different varieties of taping. Radford (62) found that low-dye taping and sham ultrasound were more beneficial than sham ultrasound alone for improving "first-step" pain. Hyland (63) found that calcaneal taping was more beneficial than stretching, sham taping, or no treatment for the relief of pain.

Tsai (64) used Kinesio tape as a supplement to traditional physical therapy methods and found that the addition of Kinesio tape resulted in more pain relief than the alternative treatment. Vishal (65) compared calcaneal and plantar fasciitis taping and found that both treatments improved pain and function, but were not significantly different, showing that taping was still of benefit for these patients. Finally, the one contradictory study was a RCT by El-Salam (66) who found that medial arch support and stretching was more effective at reducing pain and improving disability management than the same stretching combined with low-dye taping. Overall, most of the evidence suggests that taping is effective for the treatment of plantar fasciitis.

3.4 SPINE

3.4.1 Systematic Reviews

There were no systematic reviews on taping methods specifically for the spine. However, there were some systematic reviews focused on Kinesio taping methods for various musculoskeletal conditions and body regions that happened to include several studies on the spine.

3.4.2 RCTs

The trials that were included in these reviews fit our inclusion criteria and were therefore extracted and combined with other RCTs that were found through our independent searching strategies. This yielded a total of eight RCTs on taping methods for the spine. Four of these RCTs were focused on chronic low back pain, and the other four were focused on the cervical and thoracic spine,

including whiplash and thoracic kyphosis. These studies can be found in an evidence table in *Appendix G*.

3.4.3 Chronic Low Back Pain

All four studies on low back pain required patients to have chronic pain lasting more than three months in duration. Most of these studies used Kinesio tape applied to the low back and compared this to other modalities. The one study that did not use Kinesio tape used functional fascial taping and found that this method reduced worst pain during the treatment phase, but found no post-treatment differences in pain or function (67). The other three studies all found that Kinesio taping could reduce pain immediately after application, but the longer term results between groups tended to decrease over time (68-70).

3.4.4 Cervical and thoracic conditions

Of the remaining four RCTs, three were related to different cervical conditions and one to thoracic kyphosis. Gonzalez-Iglesias' study on whiplash found that acute whiplash patients treated with Kinesio taping show statistically significant improvements in pain and cervical range of motion compared to placebo Kinesio taping, but these improvements may not be clinically meaningful (71). Bautmans' study of elderly women facing osteoporosis found that they can improve their thoracic kyphosis significantly by using a combination of manual mobilization, taping, and exercises compared to remaining on a waitlist with no treatment (72). However, no results were clear on the impact on back pain and quality of life (72). The remaining two studies focused on neck pain, but differed in the type of pain addressed. Saavedra-Hernandez focused on idiopathic

neck pain caused by mechanical positioning and compared Kinesio taping to cervical thrust manipulation (with no control), finding that both modalities led to similar decreases in pain and disability (73). As this study had no control group, these results could have been explained by the passing of time or natural history of the disease. Chronic neck pain was examined in Garcia Llopis' comparison of Kinesio tape and conventional physiotherapy to conventional physiotherapy alone, which resulted in findings showing that Kinesio taping improved the efficiency of the conventional treatment (74). Overall various types of taping methods showed a modest degree of effectiveness for these miscellaneous spinal conditions.

3.5 SHOULDER

3.5.1 Systematic Reviews

There were no systematic reviews focused exclusively on taping methods for conditions involving the shoulder (or upper extremity). However, included within some of the Kinesio tape systematic reviews, there were several shoulder trials that fit our inclusion criteria. Those RCTs were extracted from the systematic reviews, and included with the other RCTs that were found through separate search strategies.

3.5.2 RCTs

All six of the RCTs on shoulder taping included taping methods for the scapula, and most of these trials were focused on shoulder impingement syndrome. The evidence table summarizing these

clinical studies can be found in *Appendix H*. Two of the studies focused on Mulligan mobilizations with movement (MWM) combined with taping; both studies found that MWM and taping may be useful to improve symptoms (75; 76). Teys compared MWM alone and MWM combined with tape, and found that MWM with tape can provide more improvement in ROM compared to MWM alone, but these effects last only for up to one week (76). The other four studies were all direct comparisons of tape to an alternative treatment, but differ in the alternative and treatment combinations (77-80). The results of all four studies were basically the same; taping appears to be an effective adjunct to conventional treatments and can result in effective short-term improvements for patients with shoulder impingement syndrome, however the differences between groups tend to disappear over time (77-80). All of these studies point to an effectiveness of taping for patients with shoulder impingement syndrome and an added effectiveness of MWM with tape for those who respond positively to that therapeutic method.

3.6 ELBOW

3.6.1 Systematic Reviews

There were no systematic reviews found that focused exclusively on taping methods for conditions involving the elbow or any other upper extremity in our searches.

3.6.2 RCTs

Two randomized controlled trials were found during the independent RCT searches that featured taping of the elbow. Data extracted from these two elbow studies can be found in the evidence table in *Appendix H*. Both of these studies were focused on patients experiencing pain around the lateral epicondyle, but used different therapeutic methods to achieve recovery from pain. Kachanathu compared a forearm band, elbow taping, and conventional physiotherapy and found that a forearm band produces statistically significant better responses in function and grip strength compared to taping or conventional physiotherapy (81). In contrast, Desai compared taping and exercise to exercise alone, and found that taping with exercise is more effective for the reduction of pain and improvement in function (82). Overall, these studies suggest a benefit to taping, but show that a forearm band may lead to better improvements for patients with lateral epicondyle pain.

3.7 MISCELLANEOUS CONDITIONS

3.7.1 Systematic Reviews

There were no systematic reviews found that focused on taping methods for miscellaneous musculoskeletal conditions that were not previously included.

3.7.2 RCTs

There was one RCT that dealt with musculoskeletal conditions that did not fit into any of the prior categories of body region. This is recorded within the combined evidence table that is located in *Appendix H*. This study was a comparison of post-isometric relaxation (PIR) both alone and in combination with Kinesio taping. This study focused on myofascial pain due to muscle spasm or shortening in static muscles of the hand, forearm, arm, shoulder girdle, foot, leg, thigh, or spine. The results showed that both PIR and PIR plus taping each resulted in statistically significant reductions in pain, but not with any significant differences between the two treatment methods (83). PIR alone showed better short-term results, but PIR plus taping could be used without therapist intervention on weekends, which resulted in equalizing any between group changes.

3.8 KINESIO TAPE

3.8.1 Systematic Reviews

We found seven systematic reviews of Kinesio tape (KT), which are becoming very common; all seven reviews were published between 2012 and 2014. These seven reviews focused on RCTs of both injured and healthy populations who experienced primarily musculoskeletal conditions, as well as lymphatic and neurologic conditions. These systematic reviews can be found in the evidence table labeled *Appendix I*. Kalron's systematic review included lymphatic and neurological conditions, as well as musculoskeletal conditions, and found that the data were inconclusive for use with musculoskeletal conditions, although immediate improvement in

musculoskeletal symptoms were experienced (8). Williams showed that KT may have small benefits on strength, force sense error, and active range of motion, but there was little other evidence to suggest that KT led to better improvements in clinical outcomes (14). Csapo's review was specifically focused on RCTs that measured KT's effects on muscle strength and found that there was little to no effect, but the methodological quality of the included studies were poor (84). The remaining studies all pointed to perhaps small immediate effects by KT, but these were inconclusive and comparable to other therapeutic methods (6; 12; 13; 15). We found insufficient evidence to recommend KT over other modalities, but the addition of KT was not found to be harmful (13).

3.8.2 RCTs

There were no additional individual RCTs on Kinesio tape that were not previously mentioned and categorized into one of the other evidence tables. However, due to the extreme popularity of Kinesio tape with clinicians, we felt it would helpful to create a separate evidence table organized around this specific taping method. This additional evidence table summarizes the 15 trials found that involved Kinesio tape as a therapeutic intervention and can be seen in *Appendix J*. The table is organized by body region, in order to help the reader find the relevant RCT.

4.0 DISCUSSION

4.1 OBSERVATIONS

When compiling the results for this systematic review, it was surprising to find such an extreme volume of papers on this topic. There were a total of 21 systematic reviews on taping that had been published in the last ten years alone – showing a great volume in the amount of papers published on the topic. Kinesio tape alone had seven systematic reviews that had been published in a three-year span – showing a large increase in popularity for Kinesio tape, particularly in recent times. When looking at individual RCTs, although initial searches turned up a low number of studies due to very specific search parameters, this systematic review eventually retained over 40 full-texts articles for inclusion and analysis – a large amount of taping literature. This large volume of literature speaks to the importance of compiling all high-quality information on taping into one systematic review. It is very hard for clinicians to track down every relevant individual taping article, whereas reading one condensed systematic review is relatively simple.

Although there are many published systematic reviews on taping, none of these systematic reviews focused on taping as a broad topic area. There were many systematic reviews focused on specific conditions in certain body regions or a particular brand of tape, but there was no comprehensive systematic review that covered taping methods of all body regions and all brands of taping. Although these smaller systematic reviews are useful, a larger more comprehensive systematic review would be helpful for clinicians looking for a broad view of taping methods-- not just a look at individual categories, such as taping for prevention of ankle injury. This broad

systematic review addresses a hole in the existing literature by providing a single summary source for all types and regions of tape application.

When looking at the results of this study, there was a definite category that produced more search results than any other, and this was Kinesio tape. As previously stated, there are a large number of systematic reviews looking at Kinesio tape, broadly in multiple body regions, as research into this type of taping appears to be increasing in popularity. Although Kinesio tape is fairly unique in that it can be used in many body regions for musculoskeletal issues as well as neurologic and lymphatic purposes. No other brand of tape has produced as much volume of literature.

The results of this systematic review also showed that the largest volume of taping studies were dedicated to conditions involving the lower extremity. There were no systematic reviews specifically addressing conditions of the upper extremity, except for those that were about Kinesio tape and happened to include some upper extremity trials. Lower extremity taping systematic reviews abounded and ranged from studies of clinical effectiveness to studies of underlying physiological, neurological and biomechanical mechanisms.

This differential in the volume of search results remained between upper and lower extremities when examining RCTs. There were a mere two RCTs on taping of the elbow and only a few for taping of shoulder conditions, whereas taping studies involving conditions of the ankle and knee resulted in the over half of the total number of RCTs found on taping in these searches. A focus on taping methods for conditions of the upper extremity would be useful for future research designs, as there is currently a lack of material on the subject.

There were a wide variety of research designs seen in the taping literature as well. There were many different inclusion and exclusion criteria resulting in a wide range of patients who

participated in these studies. The participants in studies of one body region ranged from athletes to individuals experiencing osteoarthritis. This allowed for a large amount of heterogeneity between studies that confounded the ability to pool data, as well as difficulty in interpretation of the data.

Many trials also used designs that included mixtures of treatment methods, such as a combinations of taping with other therapeutic methods, such as mobilization and exercise. These combination studies made it very difficult to parse out the treatment effect due to taping alone, compared to the treatment effect that came from the combination of other therapeutic methods. Several studies compared ‘placebo’ taping with ‘real’ taping, which was useful to control for the effects of contact with the clinician, but the number of studies that used this placebo-matched design was limited.

One common outcome measure of taping trials that was very prevalent in our searches was immediate effect on pain, but this was considered an exclusion criterion in our review. There were also many studies that measured other effects of taping in both healthy control and patient populations immediately after application. These studies were very prevalent, and included immediate post-taping measures of balance, sensori-motor control, proprioception, and other purported mechanisms of action for the clinical benefits of taping. These studies incorporating measures of mechanisms of action were not included in this review, as there was too much literature to be gathered on both mechanisms and clinical outcomes of pain and function. We recommend that future research studies involving measures of the immediate effects of tape should also consider capturing longer-term outcomes.

When examining the literature found through our searches, there was a wide variety of quality ranging from very poor to very good. Only 43% of the systematic reviews fit the AMSTAR

criteria for ‘good quality’ by scoring over a 70%. Only 46% of randomized controlled trials scored at or above 55% using the PEDro scale. This is not surprising, considering the wide range of time over which these studies were conducted. The oldest RCT that we found dated back to 1969; a time when there was much less scientific rigor in clinical trials. It is important for clinicians to recognize this variation in the scientific quality of taping research, and should alert them to exercise caution when translating these results into clinical practice.

4.2 STRENGTHS

The strengths of this systematic review are the comprehensive search strategy with inclusion and exclusion criteria, as well as the inclusion of studies from every body region, including the upper extremity and spine. As previously mentioned, there are currently no existing systematic reviews that address all types of taping in all body regions. This systematic review is the first of its kind to provide a comprehensive summary of all taping methods for all body regions, following the protocols of a high-quality systematic review.

4.3 LIMITATIONS

The main limitation of this systematic review is the lack of a meta-analysis, which is due to the extreme heterogeneity of the resulting RCTs found during our search. These studies featured many different outcome measures, such as: number of injuries, visual analog scale for pain, function, disability, and time to return to athletic practice; the data from these various outcome measures

could simply not be pooled for statistical analysis. Additionally, these studies all had a wide array of inclusion and exclusion criteria, which led to different patient populations being studied. A good example was previously mentioned; studies that looked at athletes with anterior knee pain due to problems with patellofemoral tracking and other studies of patients with anterior knee pain due to osteoarthritis. These studies were combined into one evidence table organized around one body region (the knee), but these obviously different inclusion/exclusion criteria would not be a solid basis for any data pooling or meta-analysis.

Another example of heterogeneity across studies that prevented compilation into a meta-analysis was a difference in treatment dosage and frequency, such as the use of multiple versus single treatment sessions. Although our goal was to include studies that would emulate clinical applications of taping methods, some studies looked at one application tape per week, whereas others compared multiple applications of the same type of tape several times per week, and over a longer duration of time. These differences in treatment frequency and duration would make data pooling inaccurate, thus confounding our ability to perform a meta-analysis.

Another limitation is the possibility that some publications were missed for inclusion in our review. Although several databases were searched for individual trials, EMBASE was not included due to the reference librarian's suggestion that it was not available for Pitt users at the time of the searches, and that trials that would be found there should also be found included in CINAHL and PubMed. Additionally, the limitation of primarily English trials prevented the inclusion of several studies that were in Dutch and other languages without an available translator.

Finally, this systematic review does not include an overall assessment of all the included articles with clinical recommendations. Due to the many categories of body region and taping methods found in this literature, an assessment of all articles as a whole was seen as neither useful

nor feasible. However, with further editing in the push for publication of this systematic review, recommendations for taping of body regions will be added for the consumer of this review.

4.4 RECOMMENDATIONS FOR FUTURE RESEARCH

When looking forward to the future, recommendations for future research would include a focus on the upper extremity as previously mentioned, as there is a dearth of literature on that area of the body as a whole. Specifically, high quality research focusing on the hand and elbow would be useful for clinicians who use taping methods in those specific body regions.

Many studies that compared taping to other therapeutic methods did not include a control group to account for natural history. The addition of a true control group would be useful to separate out the effectiveness of taping compared to the benefits of time and simple regression to the mean. The studies that did compare taping to a control group would benefit from the addition of a placebo taping group, to help control for differences that may accompany the application of tape and treatment expectation. By adding a control group and/or a placebo-taping group, many studies on taping would be more useful for the clinician by revealing more specific effects of the taping method itself.

Another recommendation would be teasing out the direct and specific effects of taping methods from the many other co-interventions that are typically combined with taping. Several studies used a combination of therapeutic methods that included the use of tape as one of several treatments in a “clinical package”, but this prevented the reader from directly associating any clinical benefits to the taping method itself. This limitation could be overcome by providing a unique treatment group that includes only taping, or by comparing “clinical package A” with

“clinical package A plus taping”. In either of these research designs, the benefits of taping as a separate treatment intervention would be more accurately studied.

Finally, there is an absence of studies in the current literature that provide a direct comparison between the different types of taping methods. Although there are many studies examining whether one specific individual taping method is effective, there is little literature comparing various brands or types of taping methods to each other. For example, a study examining the benefits of Kinesio tape vs. McConnell tape for the knee would be beneficial for the clinician deciding which of these two methods would be more useful to pursue in their treatment patients with anterior knee pain. These comparative effectiveness trials of taping methods would be useful for comparing different brands of tape as well as for exploring their effectiveness in different body regions. By comparing different types of taping methods for each body region, the literature would provide more clinically relevant information to inform treatment approaches that incorporate taping.

The goal of this systematic review was to summarize the current research evidence in the literature on taping for musculoskeletal conditions for all regions of the body. If these recommendations are followed in further research, clinically relevant information will be discovered that helps to inform more appropriate and effective treatment of all musculoskeletal conditions with taping methods.

APPENDIX A

TABLE 1. EVIDENCE TABLE FOR SYSTEMATIC REVIEWS OF THE KNEE

Review title (Primary Author/year)	AMSTAR score	Search Dates	# of included studies	Population	Intervention(s)	Summary of Results
Patellar taping for patellofemoral pain: a systematic review and meta-analysis to evaluate clinical outcomes and biomechanical outcomes (Barton / 2014) (8)	8/11 73%	1/1/13	20	Patellofemoral Pain Syndrome	patellar taping	Moderate evidence to include patellar taping in management of PFP -- in immediate term, it will most likely have a large effect on reducing pain and improving functional capacity during accompanying rehabilitation exercises. Patellar taping also appears to be an effective adjunct to exercise over a 4-week period, although further high-quality research is needed to confirm this.
Patellar taping for patellofemoral pain syndrome in adults (Callaghan / 2012) (28)	10/11 95%	8/1/11	5	Patellofemoral Pain Syndrome	patellar taping	Current available evidence with clinically relevant outcomes is low quality and insufficient to draw conclusions on effects of taping, either alone or as part of a program.
Efficacy of Nonsurgical Interventions for Anterior Knee Pain: Systematic Review and Meta-Analysis of Randomized Trials (Collins / 2012) (30)	7/11 64%	11/30/09	27	participants with insidious onset of anterior or retropatellar knee pain aggravated by activities that load the patellofemoral joint	nonsurgical intervention for AKP	Short-term data showed significant large to very large effects of 4 weeks of taping and exercise over exercise alone, and over placebo tape with exercise. Longer-term data shows no significant between-group effects when patellar taping and education were compared to education alone, and when patellar taping was added to exercise and education.
An update for the conservative management of patellofemoral pain syndrome: a systematic review of the literature from 2000 to 2010 (Bolglia / 2011) (29)	4/11 36%	1/1/2000 to 12/31/2010	22	Patellofemoral Pain Syndrome	conservative treatments (hip strengthening, quadriceps strengthening, patella taping, patella bracing/knee bracing, foot orthosis)	Support the use of taping in conjunction with exercise at least for the short-term. Mechanism that taping uses is still unknown. Manner of tape correction may not necessarily influence its beneficial effects. Taping over exercise alone was not supported. Also, taping for long-term symptoms associated with PFP is minimal.

APPENDIX B

TABLE 2: EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS OF THE KNEE

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
Miller (2013) (42)	Diffuse unilateral anterior knee pain >2 weeks; 3 of the following: pain with running, stair climbing, squatting, sitting, knee flexion	N=18	Group 1: kinesio tape (n=6) Group 2: lumbopelvic manipulation (n=6) Group 3: control taping [strip of KT tape in improper placement] (n=6)	VAS (rest, post movement) Y-balance test, squatting ROM, lower extremity functional scale: baseline, 3 days	Both Kinesio taping and manipulation experienced clinically and statistically significant improvements in VAS pain scores, but not statistically significantly different between both groups.	Kinesio taping and lumbopelvic manipulation may immediately improve PFPS rehabilitation programs through pain reduction and balance and ROM improvement.	6
Sudhesh (2013) (36)	unilateral osteoarthritis, >45 yo	N=30	Group 1: taping and closed kinetic chain (n=15) Group 2: control	WOMAC and Q-angle: baseline and 3 weeks	No significant change in Q-angle in Group A. Group B is no difference in Q angle.	Significant reduction in pain/stiffness and improved functional activities with taping and closed kinetic chain exercises. Q angle had no difference in either group of knee OA patients.	5
Mason (2011) (43)	pain > 1 month; around/behind patella with 2 or more of following: prolonged sitting, squatting, kneeling, ascending/descending stairs, or running	N=41	Group 1: Taping (n=15) Group 2: Strengthening (n=15) Group 3: Stretching (n15=) Group 4: Control (n=15)	VAS in 4 activities (going up stairs, down stairs, stepping down large step, self-selected activity): baseline, 1 week	Statistically significant changes in two of seven measures for the taping group, five of seven for strengthening group, five of seven for the stretching group, and none in the control group. When all three modalities were combined for one week, all seven measures improved significantly.	Quadriceps stretching and strengthening resulted in more improvements than taping for the treatment of patellofemoral pain. Combining these treatments is recommended to treat patellofemoral pain.	6

Rood (2011) (45)	>18yo; present at emergency department with primary lateral patellar dislocation; no previous knee operations; no accompanying fracture of the knee or neurologic disorders; no previous patellar dislocation or other abnormality to one of both knees	N=18	Both groups received pressure bandage and dorsal long leg split for one week. Group 1: taping (n=9) Group 2: cylinder cast immobilization (n=9)	knee function (Lysholm Knee Scoring Scale), redislocation rate: baseline, 1 week, 6 weeks, 12 weeks, 1 year, 5 year	Taping resulted in significant differences in the Lysholm score at 6 weeks, 12 weeks, and 5 years. Knee function was also better in the taping group at the 1-year follow up as well as no cases of recurrent dislocation in either group.	Tape bandage immobilization appears to be superior to a cylinder cast even after 5 years for knee dislocation patients.	5
Akbas (2010) (41)	female; 17-50yo; referred by orthopedic consultant with diagnosis of unilateral PFPS	N=31	Group 1: KT, strengthening, stretching (n=15) Group 2: strengthening, stretching (n=16)	VAS, tension of IT band/TFL, Anterior Knee Pain Scale/Kujala Scale: baseline, 3 week, 6 week/post-treatment	Pain decreased significantly in all positions in both groups with no significant between groups difference. Hamstring tension significantly decreased in both groups - more gradually in the control group and in the first three weeks for the KT group. ITB/TFL length increased significantly in both groups, control group in the last three weeks. Kujala score increased in both significantly, but no between group differences present.	Adding KT to a conventional exercise program does not improve the results in patients with PFPS, other than a faster improvement in hamstring muscle flexibility.	5
Hotwani (2010) (35)	Kellgren and Lawrence grade III radiographic evidence of osteoarthritis knee unilateral or bilateral; >40 yo; duration > 1 year; average knee pain 3/10 or greater; no acute exacerbation in or around joint; no traumatic injury to knee joint within 6 months	N=60	Group 1: McConnell patellar taping and conventional treatment (n=20) Group 2: Mulligan's Mobilisation with movement and conventional treatment (n=20) Group 3: McConnell patellar taping, Mulligan's mobilisation with movement, and conventional treatment (n=20)	VAS; knee flexion range of motion and disability index: baseline, day 12	All groups showed statistically significant improvements in pain, active and passive ROM, and the WOMAC/disability scale, but the combination of McConnell taping and Mulligan mobilisation produced statistically significant better results than the other two separate therapies.	Combining McConnell patellar taping and Mulligan mobilisation with movement may result in improved range of motion, as well as decreased pain and disability in patients with chronic knee osteoarthritis.	4

Bennell (2004) (34)	>50yo; knee pain on most days of last month /severity >4/10; osteophytes on x-ray; pain/difficulty rising from sitting or climbing stairs	N=140	Group 1: physiotherapy [exercise, massage, taping, mobilisation] (n=73) Group 2: placebo treatment [sham ultrasound, no treatment] (n=67)	VAS, global change, WOMAC, knee pain scale, SF-36, quad strength, balance test: baseline, 12 & 24 wks	Similar pain reductions at 12 weeks and 24 weeks. Global improvement reported by similar amounts in both groups (not statistically significant).	Physiotherapy programme was no more effective than regular contact with a PT at reducing pain and disability	8
Whittingham (2004) (39)	2 of the 4: pain on ascending/descending stairs; squatting; sitting for extended periods of time; increase in physical activity	N=30	Group 1: patella taping [McConnell] with standardized exercise (n=10) Group 2: placebo patella taping with standardized exercise (n=10) Group 3: exercise program alone (n=10)	VAS and FIQ; baseline, 1 week, 2 weeks, 3 weeks, 4 weeks	FIQ: Significantly better for taping-and-exercise than placebo taping-and-exercise and exercise only. No significant differences between placebo-taping-and-exercise and exercise only	Daily patella taping and exercises superior to placebo taping and exercises or exercise alone in improving pain and function with PFPS.	8
Hinman (2003) (32)	>50yo; pain in knee; presence of osteophytes; BMI < 38	N=87	Group 1: Therapeutic tape (n=29) Group 2: control tape (n=29) Group 3: no tape (n=29)	VAS; WOMAC, disability VAS: baseline, 3 weeks post treatment; 6 week follow up	Therapeutic tape significantly greater reduction in pain/disability on most secondary outcomes than no tape group. Control tape differences were not significantly different from no tape. At six weeks, both tape groups showed significant improvement than no tape group.	Therapeutic knee taping is efficacious treatment for the management of pain and disability in patients with knee osteoarthritis.	8
Tunay (2003) (38)	Diagnosed with patellofemoral pain syndrome in orthopedic clinic; unilateral patellofemoral pain > 1 month; no history of dislocation/meniscal/ligamentous injury/surgery/trauma	N=80	Group 1: ice, electric nerve stimulation, medial patellar glide and exercise (n=20) Group 2: ice, electrical nerve stimulation, patellar taping, exercise (n=20) Group 3: ice, patellar taping, home exercises (n=20) Group 4: ice and home exercises (n=20)	pain, congruence angle, sulcus angle, patellar tilt angle, Q-angle, Cincinnati Knee Activity Rating Scale, hamstring and IT band flexibility, thigh circumference, and leg-length discrepancy: baseline, DATE, DATE	Statistically significant differences in all groups between pre and post-test, except in sulcus angle. Groups 1 and 2 were significantly better than groups 3 and 4.	Controlled exercises show better results than home programmes for patellofemoral pain syndrome.	5

Quilty (2002) (31)	community cohort study; chronic knee pain and radiographic evidence of predominant PFJ involvement, without advanced TFJ changes and without hip disease	N=87	Group 1: Standard physiotherapy and taping (n=43) Group 2: standard physiotherapy (n=44)	VAS, WOMAC, quadriceps strength: baseline, 5 months, 12 months	No significant differences in disability. Significant increase in quadriceps strength in treatment at 5 months, but at 12 months, no longer significant.	Small improvements in pain and quadriceps strength post-intervention, but these between group differences disappear after 12 months.	8
Clark (2000) (44)	16-40yo; anterior knee pain > 3 months	N=80	Group 1: exercise, taping, education (n=20) Group 2: taping and education (n=20) Group 3: exercise and education (n=20) Group 4: education alone (n=20)	Patient satisfaction, VAS, WOMAC, HAD; baseline, three months, 12 months	All groups improved significantly in WOMAC, VAS, and anxiety scores on the HAD. Scores between groups did not differ significantly though. Quadriceps strength improved in all groups, but appeared to improve more in groups with exercising and education rather than tape alone (approached significance).	Muscle stretching and strengthening had a beneficial effect at three months post physiotherapy. Taping did not influence the outcome.	7
Harrison (1999) (37)	PFPS referred from general medical practitioners and orthopedic surgeons; two of the three: patellar pain with manual compression of the patella on the femur, patellar tenderness with palpation of the posterior-medial and posterior-lateral borders of patella; patellar pain during resisted knee extension; patellar pain with manual compression during isometric knee extensor contraction [Clarke's compression test]	N=113	Group 1: home strengthening and flexibility program (n=42) Group 2: similar exercise program monitored by PT (n=34) Group 3: exercises, patellar taping, biofeedback (n=36)	Functional Index Questionnaire, VAS, subjective clinical change measure, patellofemoral scale, step test: baseline, 1 month, 3 months, 6 months, 1 year	At one month, group three showed significantly higher function and lower pain scores than group 2, but by one year, no differences between groups existed. No significant between group differences in the PF scale. Significant improvements in step test pain threshold for all groups with no between groups differences.	A modified program including taping and biofeedback may result in a quicker improvement, but long-term results remain very similar.	5

Kowall (1996) (40)	unilateral/bilateral patellofemoral pain > 1 month; no history of patellofemoral dislocation, synovial plicae, or meniscal or ligamentous injury; no previous knee trauma/surgery; 14-40yo; 4 week program compliance	N=25	Group 1: standard physical therapy program (n=13) Group 2: standard program and McConnell taping (n=12)	VAS, isokinetic strength, EMG activity: baseline,	Both groups significantly reduced in pain, but not significantly different. Additionally, both groups improved in EMG activity, but not statistically significantly.	A standard physical therapy program seems to show benefits for patients with patellofemoral pain, but taping gives no additional benefits.	4
Cushnaghan (1994) (33)	knee osteoarthritis, anterior knee pain, difficulty walking/with steps and stairs; radiographic evidence of osteoarthritis	N=14	Group 1: neutral (over front of patella without pressure) Group 2: medial taping Group 3: lateral taping **Number of participants per category not available in study	VAS, rating of change with each treatment, tape preference: baseline, 1 hour after application, 4 days then crossover	Medial taping was statistically significantly better than neutral or lateral taping for pain, symptom change, and preference. Medial tape resulted in a 25% reduction in knee pain.	Medial patella taping's results on pain reduction were statistically and clinically significant compared to neutral and lateral taping at all time points except for one hour and one day. Medial patella taping resulted in reduced pain in patients with knee osteoarthritis.	4

APPENDIX C

TABLE 3. EVIDENCE TABLE FOR SYSTEMATIC REVIEWS OF THE ANKLE

Review title (Primary Author/year)	AMSTAR score	Search Dates	# of included studies	Population	Intervention(s)	Summary of Results
The effect of ankle taping or bracing on proprioception in functional ankle instability: A systematic review and meta-analysis (Raymond 2012) (25)	9/11 82%	3/1/12	8	Relatively young adults, history of ankle sprain/instability	Tape	Ankle tape or brace has no effect on proprioception and may in fact make proprioception worse in the inversion/eversion plane where proprioception is measured as threshold to movement detection. Taping and bracing should not be discouraged because they may still prevent injury; it is unlikely that the protective effect is due to enhanced proprioception however.
A systematic review on the treatment of acute ankle sprain: Brace versus other functional treatment types (Kemler / 2011) (24)	9/11 82%	1/1/1990 to 4/1/2009	8	Acute ankle injury; brace vs. other comparison	Ankle brace	In terms of functional outcomes, ankle braces are more effective than other types of functional treatment for treating acute ankle sprains. Findings of other studies suggest that the use of ankle braces is more cost-effective and should be considered for the treatment of acute ankle sprains.
Managing ankle sprains in primary care: what is best practice? A systematic review of the last 10 years of evidence (Seah / 2011) (46)	2.5 / 10 25%	1/1/2000 to 12/31/2009	33	Adults great than 18 yo; ankle sprains	Ankle sprain management	Two studies in this systematic review referred to taping. One found that function interventions, including taping, is better than immobilization of multiple outcome measures. The other found elastic bandaging to be less of an effective functional treatment than lace-up supports.
Optimising ankle sprain prevention: a critical review and practical appraisal of the literature (Verhagen / 2010) (26)	7.5 / 11 68%	1/1/1999 to 1/1/2009	25	Ankle sprain prevention	Preventative measures (brace, orthosis, shoes, tape)	Taping is effective for previously injured athletes, but when compared with bracing, the results are inconclusive. One study found no differences in effect, where another found braces to be more effective.
A systematic review on the effectiveness of external ankle supports in the prevention of inversion ankle sprains among elite and recreational players (Dizon / 2009) (7)	8.5/11 77%	2009	6 (2 taping studies)	Athletes (both elite and recreational) using external ankle supports	External ankle supports (tape, brace, orthosis)	Good evidence for either ankle taping or ankle braces to prevent lateral ankle sprains among previously injured players. Without previous ankle injuries, effects still need to be proven. No evidence on which external ankle support is better than the other.

APPENDIX D

TABLE 4. EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS OF THE ANKLE

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
Lardenoye (2012) (54)	Grade I or II ankle sprain or anterior drawer instability (grade III); 5-7 days; excluded if undergoing preventative treatment of recurrent ankle sprains; 16-55 yo; no previous sprain/fracture; acute lateral ankle sprain	N=100	Group 1: taping (n=50) Group 2: bracing (n=50)	Verbal rating scale (poor=5; excellent=1); ankle joint function/Karlsson; ROM; baseline, 2 weeks, 4 weeks	Karlsson (functional outcome) increased significantly during 4 weeks of treatment and after 8 weeks; no difference between groups. Pain score was similar between tape and brace treatments.	Semi-rigid brace leads to less complications and higher patient satisfaction with tape in the treatment of acute lateral ankle sprain. No difference regarding functional outcome and pain.	7
Beynon (2006) (55)	first-time ankle sprains; 16-65 yo; skeletally mature; presented to clinic within 72 hours of initial ankle trauma; no previous ankle sprain; no abnormal gait prior to injury; no previous ankle fracture in either ankle	N=172	Group 1: elastic wrap (Ace) (n=26) Group 2: Air-Stirrup ankle brace (n=37) Group 3: Air-Stirrup ankle brace combined with elastic wrap (n=39) group 4: Cast (n=26) **These groups were stratified by level of ankle sprain.	time to return to walking a minimum of 1 block and climbing a minimum of 1 flight of stairs with full weight on ankle without limp, time to return to full weight-bearing, full function, full return to activity: baseline, daily for 21 days	Grade 1 and 2 sprains both showed significantly shorter times to return to walking with the Air-Stirrup brace and elastic wrap combined than the alternatives. Grade III sprains had similar times to return for both cast and brace. Each group had no differences in reinjury, motion, or function at 6 months.	Grade I and II ankle ligament sprains can be treated more effectively with a combination of elastic wrap and Air-Stirrup brace, rather than brace, wrap, or a walking cast alone.	6
Mickel (2006) (48)	high school football players (JV and varsity); stable, uninjured ankles; no current complaints related to either ankle	N=93	Group 1: AirSport Ankle Brace/AirCast (n=48) Group 2: adhesive tape in closed basket weave with figure-of-eight heel lock (n=45)	injury exposure; baseline, 23 games	Both groups suffered the same amount of ankle sprains showing not significant between group differences.	As the brace was less expensive and time consuming and the results were equal, bracing can be a substitute for adhesive taping to prevent ankle sprains.	4

Boyce (2005) (53)	moderate or severe lateral ligament sprain after ankle inversion injury; >16yo; within 24 hours of injury	N=35	Group 1: elastic support bandage (n=17) Group 2: Aircast ankle brace (n=18)	ankle joint function (Karlsson); ankle girth/swelling; pain: baseline, ten days	Significantly better ankle joint function in the Aircast brace group than in elastic bandage. No significant differences between groups in either ankle girth/swelling or pain.	The Aircast ankle brace shows significantly better improvement in function than elastic support bandage at both ten days and one month.	5
Ardevol (2002) (51)	closed growth plates; <35 yo; habitually practiced a sport for a minimum of 4 hour/week; first phase of grade III tear of ATFL or ATFL plus CFL	N=121	Group 1: immobilization with below-knee plaster cast (n=57) Group 2: cryotherapy and strapping (n=64)	reduction in objective laxity, late symptoms of injury, reinjury, sporting level upon return, time to return: baseline, 3 months, 6 months	Functional group showed significantly earlier and better return to physical activity, fewer symptoms at 3 and 6 months, but these differences between groups disappeared at 12 months. Functional treatment also showed a better decrease in joint laxity.	Functional treatment is safe, associated with a more rapid recovery, and suitable in athletic populations.	5
Specchiulli (2001) (50)	closed epiphyseal growth plate, < 40yo; treated for grade III lateral ankle ligament injury; no previous history of ankle instability	N=100	Group 1: surgical treatment or immobilization in nonweight-bearing cast (n=50) Group 2: adhesive ankle taping with immediate ankle taping (n=50)	100 point ankle-hindfoot scale (>90 excellent, 80-89 good, 70-79 fair, <69 poor); interval before resumption of exercise; residual functional instability, atrophy of calf muscles	No significant difference in ankle-hindfoot scale. Surgical patients returned to injury weeks after nonsurgical (statistically significant). No significant differences in the level of return to sport between groups. No significant differences in swelling between groups.	No significant advantages to surgical treatments over non-surgical taping for lateral ankle Grade III ligament tears.	2
Karlsson (1996) (49)	acute (<24 h) grade II or grade III lateral ligament ruptures in ankle	N=86	Group 1: compression pads, elevation of injured foot, repeated elastic wrapping [compression bandage followed by ankle tape], full weight bearing, proprioceptive ROM training (n=46) Group 2: conventional treatment with elastic bandage, partial weight bearing and crutches	functional results, sick leave, return to sports activities: baseline, 18 months	Functional results were satisfactory in 91% of group 1 and 87% of group 2. Return to sports activities was significantly earlier in group 1.	Non-surgical treatment of ankle ligament injuries produced satisfactory results in most patients. Early functional treatment provided shorter sick leave and earlier return to sports, but did not influence the final results.	4

Johannes (1993) (52)	12-60yo; ligament injuries to one ankle; compressive bandage, rest, elevation for 4-8 days, persistent symptoms and signs; no fractures or concomitant injuries	N=136	Group 1: semi rigid bandage ('Scotchrap') (n=59) Group 2: standard adhesive tape (n=57)	anamnestic complaints: baseline, 2 weeks, 4 weeks	No significant differences between groups with result to functional result. No significant differences between patient satisfaction.	Scotchrap can be just as effective as adhesive taping for the management of ankle sprains. The length of time it takes to apply is slightly higher, but the effects remain without reapplication and can also be used for individuals allergic to tape.	4
Ekstrand (1983) (47)	senior male soccer players, best 15 players from 12 teams	N=180	Group 1: prophylactic measures [training correction, provision of optimum equipment, prophylactic ankle taping, controlled rehab, exclusion of grave knee instability, information about importance of disciplined play and increased risk of injury at training camps, correction and supervision by doctors and physiotherapists] (n=90) Group 2: controls (n=90)	injuries per month: baseline, 6 months	75% reduction in injuries by the test group. Sprains and strains to the ankles and knees were significantly reduced.	Prophylactic program including these seven steps (training, proper equipment, prophylactic taping, rehab, information about injury, correction, and supervision) significantly reduces soccer injuries.	2
Simon (1969) (5)	SUNY Buffalo varsity football squad; no histories of chronic ankle problems	N=148	Group 1: Louisiana Wrap (n=75) Group 2: taped using double stirrups, double figure-eights, medial and lateral heel locks (n=73)	days of practice attended; ankle injuries: baseline, end of season	No statistically significant difference between the two techniques on the rate of ankle injuries/practice days.	No difference between ankle taping or wrapping on the occurrence of ankle injuries in a relatively health population of athletes.	1

APPENDIX E

TABLE 5. EVIDENCE TABLE FOR SYSTEMATIC REVIEWS OF THE FOOT

Review title (Primary Author/year)	AMSTAR score	Search Dates	# of included studies	Population	Intervention(s)	Summary of Results
Taping for plantar fasciitis (Podolsky/2014) (60)	6/11 55%	12/1/12	8	patients with plantar fasciitis	tapings (low-dye, calcaneal)	In the short-term, taping is beneficial and can be implemented as an immediate pain reliever. The recommended taping techniques are low-dye taping and calcaneal taping.
Efficacies of different external controls for excessive foot pronation: a meta-analysis (Cheung 2011) (56)	8.5 / 11 77%	11/1/10	29 (10 on taping)	Controlling foot pronation	External controls for pronation (footwear, orthoses, taping)	Taping was found to be more effective at reducing calcaneal eversion than both footwear and orthoses. Part of this could be due to the constant readjustment with reapplication of tape. Low-dye taping, although one of the most popular taping methods, was not found to be effective in checking excessive foot pronation.
Efficacy of taping for the treatment of plantar fasciosis: a systematic review of controlled trials (van de Water / 2010) (59)	10/11 91%	10/7/07	5	patients with plantar fasciosis; no trauma; increased pressure/stress --> increased pain	plantar fasciosis treatments (no treatment, orthotic, medication, ultrasound, injections, taping)	There's limited, but supporting evidence of a positive effect of taping as an intervention or part of an intervention for patients with plantar fasciosis on pain in the short term. Inconclusive results were found concerning disability improvement.
A physiological and psychological basis for anti-pronation taping from a critical review of the literature (Franettovich, 2008) (57)	5/11 45%	6/1/06	22	Both symptomatic and asymptomatic individuals	Low-dye taping	Anti-pronation tape was found to change foot and leg posture both statically and possibly dynamically. Preliminary evidence suggests that anti-pronation tape alters muscle activity in the leg during dynamic activity, but caution is advised in interpreting results of a few studies of small sample sizes. The placebo effect of taping is not well understood, but there appears evidence that this idea should not be discounted in anti-pronation taping.
The effect of low-dye taping on kinematic, kinetic, and electromyographic variables: a systematic review (Radford / 2006) (58)	7/11 64%	11/15/2005	5	inner medial longitudinal arch of foot taping	Transverse tape strips	Some kinematic changes to the foot occur after taping application (particularly navicular height after application), suggesting a reduction in foot pronation. The result is not known to be of clinical significance, however, as these trials were scientific in nature. Further studies should focus on patient centered outcomes, such as pain, function, and quality of life.

APPENDIX F

TABLE 6. EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS OF THE FOOT

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
El-Salam (2014) (66)	unilateral plantar fasciitis; 40-60yo; painful attack > 4 weeks prior; pain at plantar heel, worse when first standing or walking after rest and improved initially after first standing, but worsened after increasing activity; were non-athletes; no corticosteroid injection in 3 months prior	N=30	Group 1: ultrasound, calf stretching, Medial Arch Support (n=15) Group 2: ultrasound, calf stretching, low-dye taping (n=15)	VAS; foot pain disability questionnaire: baseline, 3 weeks	Both groups showed statistically significant reductions in pain and improvements in foot disability post-experimentally. These outcomes were significantly better in the Medial Arch Support group over the Low-Dye Taping group.	Medial arch support is both more convenient than low-dye taping in the short-term management of pain and pain-related disability in plantar fasciitis.	6
Tsai (2010) (64)	confirmed plantar fasciitis; onset within 10 months	N=52	Group 1: traditional physical therapy [ultrasound, low frequency electrotherapy] (n=26) Group 2: traditional physical therapy as well as kinesio tape [gastrocnemius and plantar fascia] (n=26)	pain [McGill Melnick], foot functional, plantar fascia thickness, structural change; baseline, one week	Significantly greater pain decreases in experimental group. Thickness of plantar fascia significantly reduced in kinesiotaping group, compared to control, but the difference was not significant at the most inflamed site.	Treatment with standard therapy as well as kinesiotaping for one week can provide pain relief in patients with plantar fascia compared to only a traditional physical therapy program.	5
Vishal (2010) (65)	clinically diagnosed cases of plantar heel pain; 18-65 yo; symptoms of plantar heel pain > 1 month; pain located at heel or plantar surface of midfoot, consistent with plantar fasciitis; no previous surgery/treatment for plantar fasciitis in previous six months	N=60	Group 1: Calcaneal taping, ultrasound, passive stretching of ankle flexors and plantar fascia (n=30) Group 2: ultrasound, stretching, plantar fasciitis taping (n=30)	VAS, Foot Function Index; baseline, 7th day intervention	Significant changes in pain relief and improvement in functional ability in both groups, but the calcaneal taping group showed greater improvements than the plantar fasciitis taping group.	Calcaneal and plantar fasciitis taping may both be useful to reduce pain and improve function in patients with plantar fasciitis.	4

Radford (2006) (58)	plantar heel pain; localized, worst when first standing/walking after rest; improve initially, but worsened with increasing activity; >18yo; symptoms for >4 weeks	N=92	Group 1: low-dye taping and sham ultrasound (n=46) Group 2: sham ultrasound alone (n=46)	First-step' pain (VAS); Foot health status questionnaire: baseline, one week	No significant differences between groups for foot pain, foot function and general foot health.	Low-dye taping provides a small improvement in 'first-step' pain compared to the sham intervention after one week.	7
Hyland (2006) (63)	18-65yo; pain with first steps upon waking (>3/10); pain at heel or plantar midfoot; everted calcaneus >/= 2 degrees	N=41	Group 1: stretching alone (n=10) Group 2: calcaneal taping only (n=11) Group 3: control (n=10) Group 4: sham taping (n=10)	VAS and PSFS (self-rated functional); baseline and one week	Significant change pretreatment to post treatment for the control group in PSFS, but not significantly in other groups.	Calcaneal taping was shown to be more effective for the relief of plantar heel pain than stretching, sham taping, or no treatment.	4
Lynch (1998) (61)	pain upon rising in the morning or after rest; no history of trauma to the heel within previous 3months; no professional treatment [arch supports, heel cups, injections, or NSAIDs] within 1 month	N=103	Group 1: anti-inflammatory therapy [injection and capsules] (n=35) Group 2: accommodative/heel cup and acetaminophen (n=33) Group 3: orthoses and low-dye strapping (n=35)	VAS, effect of pain on work, leisure, and exercise: baseline, 2, 4, 6, 12 weeks	No statistically significant differences with heel pain in work, exercise, leisure activities or in first-step pain. Statistically significant differences in final VAS (45% of anti-inflammatory progressed to VAS between 0 and 2; 23% of accommodative; 64% of mechanical)	Mechanical therapy, including orthoses and taping, is a more effective method than an anti-inflammatory therapy of NSAIDs and injections or an accommodative method of a heel cup.	3

APPENDIX G

TABLE 7. EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS OF THE SPINE

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
Bae (2013) (70)	chronic low back pain > 12 weeks; no lumbar region surgery; VAS and ODI > 6; no adrenocortical hormones or pain alleviation medication	N=20	Group 1: placebo tape and physical therapy [hot pack, ultrasound, TENS] (n=10) Group 2: Kinesio tape and physical therapy (n=10)	VAS, Oswestry: baseline, 12 weeks	Significant changes in the muscle contraction initiation time of the transversus abdominis for Kinesio tape group. Both groups significantly decreased in VAS and ODI scores, but ODI of experimental group had most significant changes.	Applying Kinesio tape to patients with chronic low back pain can reduce pain and thus positively affect anticipatory postural adjustment. The repetitive feedback formation of the cerebrum through the taping triggers a decrease in Movement Related Cortical Potential, positively influencing functional movements.	5
Castro-Sanchez (2012) (68)	18-65yo; low back pain > 3months; Roland-Morris Low Back Pain and Disability Questionnaire score > 4; no flexion-relaxation in lumbar muscles during trunk flexion	N=60	Group 1: Kinesio taping (n=30) Group 2: placebo Kinesio tape application (n=30)	Oswestry, Roland-Morris Disability, VAS, Tampa Scale for Kinesiophobia: baseline, 1 week, 4 weeks	After one week, statistically significant improvement in disability, but not significant at 4 weeks. Pain improved significantly at one week and was maintained at 4 weeks. Fear of movement did not show statistically significant differences, nor did trunk flexion ROM.	Statistically significant improvements immediately after application in: disability, pain, endurance of trunk muscles, and perhaps trunk flexion ROM. Small effects in all but pain and trunk muscle endurance disappeared at week 4 measurements.	9
Chen (2012) (67)	18-65yo; non-acute non-specific low back pain; discomfort during trunk flexion; no spinal pathology/major trauma/systematic disease/cancer/osteoporosis/inflammatory disease/neurological deficit	N=43	Group 1: functional fascial taping and standardized simple trunk flexion exercise (n=21) Group 2: placebo taping and trunk flexion exercise (n=22)	Worst and average pain and function: baseline, 2 weeks/post-intervention, 6 week, 12 week	No significant differences in proportion of group who achieved minimal clinical important differences between groups, but a higher portion of the Functional Fascial Taping group attained the MCID in worst pain	Functional fascial taping reduced worst pain in patients with non-specific low back pain during treatment phase. No differences in average pain or function were found.	9

					in the first two weeks of the intervention. The taped group also attained a higher proportion of participants with the MCID in Oswestry.		
Garcia Llopis (2012) (74)	Chronic neck pain	N=10	Group 1: conventional physiotherapy and Kinesio taping (n=5) Group 2: conventional physiotherapy (n=5)	VAS; neck and shoulder ROM; SF-36; cervical pain questionnaire: baseline, ??	Kinesio taping improved efficiency of conventional chronic neck pain, as well as neck flexion, extension, lateral tilt, and shoulder internal rotation. Mental health status was also significantly improved compared to control.	Kinesio taping improves efficiency of conventional chronic neck pain treatment.	3
Saavedra-Hernandez (2012) (73)	mechanical idiopathic neck pain provoked by sustained neck postures, movement, or palpation; 18-55yo	N=80	Group 1: Kinesio taping (n=40) Group 2: cervical thrust manipulation (n=40)	Neck pain (NPRS); disability (NDI); cervical-range-of-motion: baseline, 7 days post intervention	CROM changes small and not clinically meaningful. Changes in disability slightly less than the MCID.	KT and cervical thrust manipulation both lead to similar decreases in pain and disability and increases in CROM. The effects on pain are small, but positive. There was no control group included so effects could be due to placebo or simply time passing.	8
Paoloni (2011) (69)	30-80 yo; CLBP (back pain > 12 weeks); fail to achieve FR in lumbar muscles during trunk flexion	N=39	Group 1: Kinesio tape and exercise (N=13) Group 2: Kinesio tape only (n=13) Group 3: exercise only (n=13)	VAS, RMDQ (disability): baseline, four weeks	Significant reduction in VAS scores from baseline in all three groups. RMDQ scores reduced in all three groups as well, significant for exercise group alone.	Kinesio tape leads to pain relief and lumbar muscle function normalization shortly after application and persists over a short follow-up period.	7

Bautmans (2010) (72)	elderly female patients scheduled for 3 monthly IV pamidronate treatment for post-menopausal osteoporosis at a geriatric day hospital in Belgium	N=48	Group 1: rehabilitation [manual mobilization, taping, exercises] (n=29) Group 2: waitlist (n=19)	thoracic kyphosis degree, VAS, quality of life: baseline, three months	Thoracic kyphosis improved significantly. Mental health worsened slightly in the rehabilitation group, but not significantly compared to controls.	Three months of rehabilitation with manual mobilization can attenuate thoracic kyphosis in elderly patients with osteoporosis. Impact on back pain and quality of life remains unclear.	7
Gonzalez-Iglesias (2009) (71)	Quebec Task Force Classification of WAD II (whiplash); no evidence of conduction loss on clinical neurological examination	N=41	Group 1: Kinesio taping to cervical spine (n=21) Group 2: placebo Kinesio tape application (n=20)	NPRS; cervical ROM: baseline, after application, 24-hour follow-up	Statistically significant differences in pain and cervical range of motion between groups, but not MCID.	Acute WAD patients show statistically significant improvements immediately after application and at 24-hour follow-up in pain and cervical ROM, but these changes are small and may not be clinically meaningful.	8

APPENDIX H

TABLE 8. EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS FOR THE UPPER EXTREMITY (INCLUDING SHOULDER, ELBOW, AND MISCELLANEOUS CONDITIONS)

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
SHOULDER							
Simsek (2013) (80)	18-70yo; positive subacromial impingement syndrome diagnosis; pain interfere with daily routine, lasting one month or longer; positive Neer and Hawkin's impingement	N=38	Group 1: therapeutic KT technique and exercises (n=19) Group 2: sham KT technique and exercises(n=19)	VAS (rest, activity, night); DASH; painless ROM (flex, abd, IR, ER): baseline, day 5, day 12	Therapeutic group significant differences day 12 in: night/activity pain scores, DASH, painless abduction ROM, and muscle strength during external rotation	The addition of KT to an exercise program appears to be more effective than exercise alone to treat SIS.	5
Teys (2013) (76)	>18yo; pain in antero-superior aspect of one shoulder; pain > 4 weeks duration; reduced shoulder elevation due to pain; respond positively to application of shoulder Mulligan's Mobilization with Movement (MWM) at initial visit	N=25	Group 1: MWM Group 2: MWM with tape ---- Crossover study with one week washout period between treatments	range of motion, pressure pain threshold, current pain severity (VAS); pre-post, 30 minute, 24 hours, one week	MWM with tape provided statistically and clinically significant improvement of 20degrees ROM maintained for one week, whereas MWM alone only produced improvement for 30 minutes post intervention. No significant pain differences between groups for any time point.	In individuals who show positive responses to MWM, a single-intervention of MWM with tape can provide an improvement in ROM for up to one week, compared to MWM alone.	6

Djordjevic (2011) (75)	Rotator cuff lesion/impingement shoulder syndrome; 34-79yo; shoulder pain; painful/restricted ROM with ADL	N=20	Group 1: MWM and KT (n=10) Group 2: supervised exercise (n=10)	Pain-free active abd and flexion; baseline, day 5, day 10	Both groups showed improvement, but the MWM/KT group improved more quickly and with greater effect.	MWM and KT may be useful therapy modalities in improving active ROM in individuals with rotator cuff lesion and impingement syndrome.	6
Kaya (2010) (79)	pain before 150degree active shoulder elevation, positive empty can test, subjective complaint of difficulty performing ADLs, 18-70yo	N=55	Group 1: Kinesio tape and home exercise program (isometric, ROM, strengthening, stretching) (n=30) Group 2: local modalities (ultrasound, TENS, exercise, hot pack) and same home exercise program (n=25)	DASH, night pain, daily pain, pain with motion: baseline, 1 week, 2 week	Rest, night, and movement median pain scores of Kinesio taping were statistically significantly lower at the first week of the trial, but there was no significant difference at the end of the second week. DASH score of Kinesio tape group was significantly lower at the end of the second week than the physical therapy group.	Kinesio tape has been found to be more effective than the local modalities at both first and second week of treatment. May be an effective treatment for shoulder impingement syndrome.	4
Miller (2009) (78)	18-70yo; unilateral shoulder pain > 6 weeks; Hawkins-Kennedy positive	N=17	Group 1: scapular taping 3 x week and routine care (n=6) Group 2: routine care (n=11)	SPADI; shoulder ROM and VAS (flex, abd): baseline, 2 weeks, 6 weeks	SPADI all markedly lower in the taped group than physiotherapy only. VAS during movements also much lower in taped group. No differences in impairment measures. At 6 weeks, between group differences are minimal.	Scapular taping as an adjunct to physiotherapy may be an effective short-term tool to manage shoulder impingement symptoms.	6
Thelan (2008) (77)	military hospital; shoulder pain: before 150degrees elevation, positive empty can test, positive Hawkins-Kennedy test, difficulty ADL, between 18-50 yo	N=42	Group 1: Kinesio Tape in therapeutic application (n=21) Group 2: Kinesio Tape in sham application (n=21)	VAS, SPADI, ROM baseline, 3 days, 6 days	Kinesio tape provided statistically significant improvements in pain-free shoulder abduction immediately after application, but no other difference between groups were present.	KT tape may help give immediate improvement in pain-free shoulder abduction, but over time no significant differences inn pain or function between groups.	9

ELBOW							
Desai (2014) (82)	30-50 yo; pain at lateral epicondyle for past 6 months; increased pain with gripping, palpation, resisted finger and wrist extension, positive Mill's and Cozen's test	N=40	Group 1: taping [non-elastic, 3.8-cm wide zinc oxide tape with adhesive backing] and exercise (n=20) Group 2: exercise (n=20)	VAS and PRTEE: baseline and 4 weeks	Statistically significantly better VAS and PRTEE in group with taping and exercise vs. exercise alone.	Taping with exercise programme is more effective than just exercise programme in reduction of pain and improvement of function.	5
Kachanathu (2013) (81)	20-40yo; pain with 2/3 tests : (resisted middle finger extension, resisted wrist extension, passive wrist extensors stretch); discomfort/tenderness lateral epicondyle; 3 weeks from onset of symptoms	N=45	Group 1: Forearm band/nonelastic support band (n=15) Group 2: Elbow taping/Johnsonplast (n=15) Group 3: Control/conventional physiotherapy (n=15)	pain-free grip strength and functional improvement PRFEQ: baseline, 2 & 4 weeks	Highly significant post-test PRFEQ, Group 1 > Group 2 > Group 3	Forearm band produces significantly greater responses in both PRFEQ and grip strength compared to taping and conventional physiotherapy.	5
MISCELLANEOUS							
Aleksiev (2013) (83)	myofascial pain due to muscle spasm/shortening of static muscles in: hand, forearm, arm, shoulder girdle, foot, leg ,thigh, or spine	N=320	Group 1: Post-isometric relaxing [PIR] (n=160) Group 2: Post-isometric relaxing and kinesio taping (n=160)	VAS: baseline, 10 days	Both PIR and PIR-taping resulted in a decrease in pain that was statistically significant, but the differences were not significant. PIR-taping decreased pain on weekends, whereas PIR alone increased pain on weekends	PIR displayed better short-term effects than PIR-taping, but the extended period of PIR-taping effects results in no statistically significant differences between groups.	3

APPENDIX I

TABLE 9. EVIDENCE TABLE FOR SYSTEMATIC REVIEWS OF KINESIO TAPE

Review title (Primary Author/year)	AMSTAR	Search Dates	# of included studies	Population	Summary of Results
Effect of kinesiology taping on pain in individuals with musculoskeletal injuries: systematic review and meta-analysis (Montalvo / 2014) (15)	7	2003 to 2013	13	Musculoskeletal injury	Pain reduction from KT was no different from pain reduction achieved by more traditional modalities. KT may be useful for reducing pain in individuals with musculoskeletal injury, but reductions may not be clinically meaningful. KT may be used in conjunction with or in place of more traditional therapies, as resulting decreases in pain were no different between KT and other modalities in the context of these articles.
Current evidence does not support the use of Kinesio taping in clinical practice: a systematic review (Parreira / 2014) (6)	8	6/10/13	12	Musculoskeletal conditions	When used for musculoskeletal conditions, KT has no benefit over sham taping/placebo and active comparison therapies. The benefit was too small to be clinical worthwhile, or the trials were of low quality. Therefore, current evidence does not support the use of KT for musculoskeletal conditions. Some authors concluded that KT was effective when their data did not identify significant benefit.
Effects of kinesio taping on skeletal muscle strength - a meta-analysis of current evidence (Csapo / 2014) (84)	6	3/1/14	19	Healthy adults	The application of KT to facilitate muscular contraction has no or only negligible effects on muscle strength. The strength-enhancing effects of KT are not muscle-group dependent. The methodological quality of studies investigating KT tends to be lower in studies reporting significant effects.
The clinical effects of Kinesio Tex taping: a systematic review (Morris / 2013) (12)	8	n/a	8	Musculoskeletal conditions	Limited to moderate evidence that KT is no more clinically effective than sham or usual care tape/bandage in short term. There is insufficient evidence to support the use of KTT over other modalities.
A systematic review of the effectiveness of Kinesio taping for musculoskeletal injury (Mostafavifar / 2012) (13)	6.5	10/1/11	6	Musculoskeletal injury	There is insufficient evidence for or against use of KT to improve pain, function, performance, and time to return to play following musculoskeletal injury. This review shows that KT is a safe modality and although there is no evidence, the athlete may perceive a beneficial effect following KT application.
Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness (Williams/2012) (14)	6.5	n/a	6	Musculoskeletal injury	KT may have a small beneficial effect on strength, force sense error and active range of motion in an injured area, but there was no substantial evidence to support the use of KT for improvements in other musculoskeletal outcomes (pain, ankle proprioception or muscle activity).
A systematic review of the effectiveness of Kinesio Taping - fact or fiction? (Kalron / 2012) (9)	7.5	3/1/12	12	Musculoskeletal, lymphatic, neurological	Inconclusive evidence of a beneficial effect for musculoskeletal f KT treatment. Most studies had an immediate reduction in pain, but there was limited follow up assessments so there is no support for long-term effects. No evidence for any KT effects on hemiplegic patients. Inconclusive data for lymphatic disorder use.

APPENDIX J

TABLE 10. EVIDENCE TABLE FOR RANDOMIZED CONTROLLED TRIALS OF KINESIO TAPE

Study	Population description	Sample size	Interventions	Outcomes/time points	Results	Key author conclusions	PEDro Score
Knee							
Miller (2013) (42)	Diffuse unilateral anterior knee pain >2 weeks; 3 of the following: pain with running, stair climbing, squatting, sitting, knee flexion	n=18	Group 1: kinesio tape (n=6) Group 2: lumbopelvic manipulation (n=6) Group 3: control taping [strip of KT tape in improper placement] (n=6)	VAS (rest, post movement) Y-balance test, squatting ROM, lower extremity functional scale: baseline, 3 days	Kinesio taping group performed better at Y-balance test and squatting ROM than lumbopelvic manipulation and control groups. Kinesio and lumbopelvic performed significantly better than the control at double-leg squatting ROM.	Kinesio taping may improve gluteus medius activation and lumbopelvic manipulation may also immediately improve PFPS rehabilitation programs.	6
Akbas (2010) (41)	female; 17-50yo; referred by orthopaedic consultant with diagnosis of unilateral PFPS	n=31	Group 1: KT, strengthening, stretching (n=15) Group 2: strengthening, stretching (n=16)	VAS, tension of IT band/TFL, Anterior Knee Pain Scale/Kujala Scale: baseline, 3 week, 6 week/post-treatment	Pain decreased significantly in all positions in both groups with no significant between groups difference. Hamstring tension significantly decreased in both groups - more gradually in the control group and in the first three weeks for the KT group. ITB/TFL length increased significantly in both groups, control group in the last three weeks. Kujala score increased in both significantly, but no between group differences present.	Adding KT to a conventional exercise program does not improve the results in patients with PFPS, other than a faster improvement in hamstring muscle flexibility.	5

Foot							
Tsai (2010) (64)	confirmed plantar fasciitis; onset within 10 months	n=52	Group 1: traditional physical therapy [ultrasound, low frequency electrotherapy] (n=26) Group 2: traditional physical therapy as well as kinesio tape [gastrocnemius and plantar fascia] (n=26)	pain [McGill Melnick], foot functional, plantar fascia thickness, structural change; baseline, one week	Significantly greater pain decreases in experimental group. Thickness of plantar fascia significantly reduced in kinesiotaping group, compared to control, but the difference was not significant at the most inflamed site.	Treatment with standard therapy as well as kinesiotaping for one week can provide pain relief in patients with plantar fascia compared to only a traditional physical therapy program.	5
Spine							
Bae (2013) (70)	chronic low back pain > 12 weeks; no lumbar region surgery; VAS and ODI > 6; no adrenocortical hormones or pain alleviation medication	n=20	Group 1: placebo tape and physical therapy [hot pack, ultrasound, TENS] (n=10) Group 2: Kinesio tape and physical therapy (n=10)	VAS, Oswestry: baseline, 12 weeks	Significant changes in the muscle contraction initiation time of the transversus abdominis for Kinesio tape group. Both groups significantly decreased in VAS and ODI scores, but ODI of experimental group had most significant changes.	Applying Kinesio tape to patients with chronic low back pain can reduce pain and thus positively affect anticipatory postural adjustment. The repetitive feedback formation of the cerebrum through the taping triggers a decrease in Movement Related Cortical Potential, positively influencing functional movements.	5
Castro-Sanchez (2012) (68)	18-65yo; low back pain > 3months; Roland-Morris Low Back Pain and Disability Questionnaire score > 4; no flexion-relaxation in lumbar muscles during trunk flexion	n=60	Group 1: Kinesio taping (n=30) Group 2: placebo Kinesio tape application (n=30)	Oswestry, Roland-Morris Disability, VAS, Tampa Scale for Kinesiophobia: baseline, 1 week, 4 weeks	After one week, statistically significant improvement in disability, but not significant at 4 weeks. Pain improved significantly at one week and was maintained at 4 weeks. Fear of movement did not show statistically significant differences, nor did trunk flexion ROM.	Statistically significant improvements immediately after application in: disability, pain, endurance of trunk muscles, and perhaps trunk flexion ROM. Small effects in all but pain and trunk muscle endurance disappeared at week 4 measurements.	9

Garcia Llopis (2012) (74)	Chronic neck pain	n=10	Group 1: conventional physiotherapy and Kinesio taping (n=5) Group 2: conventional physiotherapy (n=5)	VAS; neck and shoulder ROM; SF-36; cervical pain questionnaire: baseline, ??	Kinesio taping improved efficiency of conventional chronic neck pain, as well as neck flexion, extension, lateral tilt, and shoulder internal rotation. Mental health status was also significantly improved compared to control.	Kinesio taping improves efficiency of conventional chronic neck pain treatment.	3
Saavedra-Hernandez (2012) (73)	mechanical idiopathic neck pain provoked by sustained neck postures, movement, or palpation; 18-55yo	n=80	Group 1: Kinesio taping (n=40) Group 2: cervical thrust manipulation (n=40)	Neck pain (NPRS); disability (NDI); cervical-range-of-motion: baseline, 7 days post intervention	CROM changes small and not clinically meaningful. Changes in disability slightly less than the MCID.	KT and cervical thrust manipulation both lead to similar decreases in pain and disability and increases in CROM. The effects on pain are small, but positive. There was no control group included so effects could be due to placebo or simply time passing.	8
Paoloni (2011) (69)	30-80 yo; CLBP (back pain > 12 weeks); fail to achieve FR in lumbar muscles during trunk flexion	n=39	Group 1: Kinesio tape and exercise (N=13) Group 2: Kinesio tape only (n=13) Group 3: exercise only (n=13)	VAS, RMDQ (disability): baseline, four weeks	Significant reduction in VAS scores from baseline in all three groups. RMDQ scores reduced in all three groups as well, significant for exercise group alone.	Kinesio tape leads to pain relief and lumbar muscle function normalization shortly after application and persists over a short follow-up period.	7
Gonzalez-Iglesias (2009) (71)	Quebec Task Force Classification of WAD II (whiplash); no evidence of conduction loss on clinical neurological examination	n=41	Group 1: Kinesio taping to cervical spine (n=21) Group 2: placebo Kinesio tape application (n=20)	NPRS; cervical ROM: baseline, after application, 24-hour follow-up	Statistically significant differences in pain and cervical range of motion between groups, but not MCID.	Acute WAD patients show statistically significant improvements immediately after application and at 24-hour follow-up in pain and cervical ROM, but these changes are small and may not be clinically meaningful.	8

Shoulder							
Simsek (2013) (80)	18-70yo; positive subacromial impingement syndrome diagnosis; pain interfere with daily routine, lasting one month or longer; positive Neer and Hawkin's impingement	n=38	Group 1: therapeutic KT technique and exercises (n=19) Group 2: sham KT technique and exercises(n=19)	VAS (rest, activity, night); DASH; painless ROM (flex, abd, IR, ER): baseline, day 5, day 12	Therapeutic group significant differences day 12 in: night/activity pain scores, DASH, painless abduction ROM, and muscle strength during external rotation	The addition of KT to an exercise program appears to be more effective than exercise alone to treat SIS.	5
Djordjevic (2011) (75)	Rotator cuff lesion/impingement shoulder syndrome; 34-79yo; shoulder pain; painful/restricted ROM with ADL	n=20	Group 1: MWM and KT (n=10) Group 2: supervised exercise (n=10)	Pain-free active abd and flexion; baseline, day 5, day 10	Both groups showed improvement, but the MWM/KT group improved more quickly and with greater effect.	MWM and KT may be useful therapy modalities in improving active ROM in individuals with rotator cuff lesion and impingement syndrome.	6
Kaya (2010) (79)	pain before 150degree active shoulder elevation, positive empty can test, subjective complaint of difficulty performing ADLs, 18-70yo	n=55	Group 1: Kinesio tape and home exercise program (isometric, ROM, strengthening, stretching) (n=30) Group 2: local modalities (ultrasound, TENS, exercise, hot pack) and same home exercise program (n=25)	DASH, night pain, daily pain, pain with motion: baseline, 1 week, 2 week	Rest, night, and movement median pain scores of Kinesio taping were statistically significantly lower at the first week of the trial, but there was no significant difference at the end of the second week. DASH score of Kinesio tape group was significantly lower at the end of the second week than the physical therapy group.	Kinesio tape has been found to be more effective than the local modalities at both first and second week of treatment. May be an effective treatment for shoulder impingement syndrome.	4

Thelan (2008) (77)	military hospital; shoulder pain: before 150degrees elevation, positive empty can test, positive Hawkins-Kennedy test, difficulty ADL, between 18-50 yo	N=42	Group 1: Kinesio Tape in therapeutic application (n=21) Group 2: Kinesio Tape in sham application (n=21)	VAS, SPADI, ROM baseline, 3 days, 6 days	Kinesio tape provided statistically significant improvements in pain-free shoulder abduction immediately after application, but no other difference between groups were present.	KT tape may help give immediate improvement in pain-free shoulder abduction, but over time no significant differences inn pain or function between groups.	9
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