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EFFECT OF THE MAITLAND CONCEPT TECHNIQUES ON LOW BACK PAIN: A SYSTEMATIC REVIEW

EFEITO DAS TÉCNICAS DO CONCEITO MAITLAND NA DOR LOMBAR: REVISÃO SISTEMÁTICA

EFECTO DE LAS TÉCNICAS DEL CONCEPTO MAITLAND EN LA LUMBALGIA: REVISIÓN SISTEMÁTICA

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ABSTRACT

Low back pain has a prevalence that reaches up to 70% of the population between 35-55 years of age and is the principal cause of occupational disability. The scientific evidence on the effect of manual therapy on low back pain is conflicting and there are no specific reviews on the Maitland concept of manual therapy. Therefore, the objective of this systematic review is to analyze the effect of the techniques of the Maitland concept of manual therapy in patients with low back pain and/or determine the level of scientific evidence.For this, a search was carried out in the Cinahl, Medline, Web of Science, PubMed and Scopus databases during the months of January and February 2021 and it was updated in August 2021. In the search, 894 records were obtained, of which 15 randomized clinical trials that obtained a minimum of 3 points out of 5 on the Jadad scale were included.The main results in the current scientific literature suggest that there is solid evidence that the manipulations and mobilizations described in the Maitland Concept, applied alone or in combination with other interventions, reduce pain and disability in subjects with low back pain.The effects on musculature are contradictory. Exercise and patient education increase the effect of manual therapy. Future research requires analyzing whether the effects are preserved in the long term and more homogeneous treatment protocols are needed to determine a prescriptive guideline for manual therapy. ***Level of evidence I; Systematic review.***

Keywords: Low Back Pain; Systematic Review; Musculoskeletal Manipulations; Exercise Therapy.

RESUMO

*A dor lombar tem uma prevalência que atinge até 70% da população entre 35-55 anos e é a principal causa de incapacidade ocupacional. As evidências científicas sobre o efeito da terapia manual na dor lombar são conflitantes e não há revisões específicas sobre o conceito de terapia manual de Maitland. Portanto, o objetivo desta revisão sistemática é analisar o efeito das técnicas do conceito Maitland de terapia manual em pacientes com lombalgia e/ou determinar o nível de evidência científica.Para isso, foi realizada uma busca nas bases de dados Cinahl, Medline, Web of Science, Pubmed e Scopus durante os meses de janeiro e fevereiro de 2021 e foi atualizada em agosto de 2021. Na busca foram obtidos 894 registros dos quais foram incluídos 15 ensaios clínicos randomizados que obtiveram um mínimo de 3 pontos em 5 na escala de Jadad. Os principais resultados na literatura científica atual sugerem que há evidências sólidas de que as manipulações e mobilizações descritas no conceito de Maitland, aplicadas isoladamente ou em combinação com outras intervenções, reduzem a dor e a incapacidade em indivíduos com dor lombar. Os efeitos nos músculos são contraditórios. O efeito da terapia manual é aumentado quando combinada com exercícios e educação do paciente. Pesquisas futuras requerem analisar se os efeitos são preservados em longo prazo e protocolos de tratamento mais homogêneos são necessários para determinar uma diretriz prescritiva para a terapia manual. **Nível de evidência I; Revisão sistemática**.*

Descritores: *Dor Lombar; Revisão Sistemática; Manipulações Musculoesqueléticas; Terapia por Exercício.*

RESUMEN

*La lumbalgia tiene una prevalencia que alcanza hasta el 70% de la población entre los 35-55 años y es la primera causa de discapacidad laboral. La evidencia científica sobre el efecto de la terapia manual en la lumbalgia es contradictoria y no existen revisiones específicas sobre el concepto Maitland de terapia manual. Por tanto, el objetivo de esta revisión sistemática consiste en analizar el efecto de las técnicas del concepto Maitland de terapia manual en pacientes con lumbalgia y o determinar el nivel de evidencia científica.Para ello se llevó a cabo una búsqueda en las bases de datos Cinahl, Medline, Web of Science, PubMed e Scopus durante los meses de enero y febrero de 2021 y se actualizó en agosto de 2021. En la búsqueda se obtuvieron un total de 894 registros de los cuales fueron incluidos 15 ensayos clínicos aleatorizados que obtuvieron un mínimo de 3 puntos sobre 5 en la escala de Jadad. Los principales resultadosen la literatura científica actual sugieren que existe evidencia sólida de que las manipulaciones y movilizaciones descritas en el concepto Maitland, aplicadas de forma aislada o en combinación con otras intervenciones, disminuyen el dolor y la discapacidad en sujetos con lumbalgia. Los efectos sobre la musculatura son contradictorios. El efecto de la terapia manual se ve incrementado cuando se combina con ejercicio y educación del paciente. Futuras investigaciones requieren analizar si los efectos se preservan largo plazo y se necesitan protocolos de tratamiento más homogéneos para determinar una pauta prescriptiva de terapia manual. **Nivel de evidencia I; Revisión sistemática.***

Descriptores: *Dolor de la Región Lumbar; Revisión Sistemática; Manipulaciones Musculoesqueléticas; Terapia por Ejercicio.*

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INTRODUCTION

Low back pain or lumbalgia is a feeling of discomfort located between the last rib and the gluteal region, which may be accompanied by pain radiatingalong the lower limbs.[1]

Low back pain is the leading cause of occupational disability of musculoskeletal origin worldwide. The prevalence of nonspecific low back pain, the most common form, is between 60 and 70% in industrialized countries. The incidence is higher in women and the most affected age range is from 35 to 55 years. In addition, it commonly presents with concurrent musculoskeletal pain.[2–4]

There are various classifications for low back pain basedon different variables, including knowledge of the cause of the pain (specific or nonspecific), characteristics of the signs and symptoms (mechanical or inflammatory), and duration (acute, lasting for less than 4 weeks;subacute, lasting between 4 and 12 weeks; and chronic, lasting more than 12 weeks). Also, it is necessary to differentiate between simple low back pain, which is in a fixed location and does not radiate to the lower limbs, and radiated low back pain, when the pain is distributed through the lower limbs.[4]

The interventions used to treat low back pain are varied: education, recommendations to remain active, physical activity, cognitive-behavioral therapy, and physical therapy.[5]The Maitland Concept stands out among the possible treatments that physical therapy can offer us.[6]The Maitland Concept is a manual therapy technique that encompasses individual evaluation and individualized treatment, supporting reasoning based on the main clinical discoveries.[7]This manual therapy concept was developed by the Australian physical therapist Geoffrey Douglas Maitlandin the mid-20th century and has the following characteristics: a conceptual model of a brick wall (combination of theoretical knowledge and clinical presentation), continuous clinical reasoning, the use of movement diagrams, an approach that uses mobilizations in different planes, and the inclusion of different nerve structures.[8]

Therefore, the Maitland Concept does not correspond only to a set of manual therapy techniques used in physical therapy. In this concept, the importance of clinical reasoning associated with an exhaustive process of patient evaluationfocused on establishing a cause-effect relationshipfor the patient's dysfunction stands out. In addition, it is basedon the biopsychosocial model established by the International Classification of Functioning, Disability, and Health (ICF), which entails taking individual, social, and contextual factors of the patient and their clinical condition into account.[6-8]

In this concept, mobilizations can be differentiated from manipulations. Mobilizations are defined as passive, low-speed movements of the vertebral segments within their physiological limits, while manipulation is defined as thebrief, selective manual maneuver of small amplitude and high speed, of a vertebral segment that exceeds normal physiological movement, but without reaching the anatomical limit. Additionally, in the Maitland Concept accessory articular movements (arthrokinematic movements) are used in both patient evaluation and treatment. Although the use of the Maitland Concept is described for the peripheral regions, its application at the vertebral level is highlighted.[8,9]

There are a number of studies about the use of manual therapy for low back pain, but the evidence is limited or contradictory.[5,10,11]A previous systematic review concluded that manual therapy does not seem to be better than other therapeutic approaches.[12]

Additionally, no systematic reviews specifically addressing clinical trials of the Maitland Concept for low back pain have been published.Therefore, the overall objective of this systematic review was to determine the current scientific evidence for the effect of the Maitland Concept treatment techniques on low back pain.

Taking the structure of the PICO question into account, the objective of this research is to determine whether, in patients with low back pain,the application of manual therapy according to the Maitland Concept (mobilizations and manipulations), alone or in combination with other treatments, produces improvement in pain, disability, range of motion (ROM), and muscle activity. The effect of Maitland Concept manual therapy can be evaluated against any other type of intervention, combination of techniques, or placebo interventions.

METHODS

A bibliographical search was conducted in the CINALH, MEDLINE, Web of Science (WoS), PubMed, and Scopus databases during the months of January and February 2021 and updated in August 2021.

The descriptors used to create the different search equations were the three Medical Subject Headings (MeSH) terms"low back pain", "manual therapy", "musculoskeletal manipulations", and the keyword "mobilization", connected by the Boolean operators "AND" and "OR". They were also replicated using the term "Maitland" to broaden the search. The different search equations are shown in Table 1.

The eligibility criteria are shown in Table 2.

The last update of the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta-Analyses) was used as a guideline for carrying out the systematic review.[13] The methodological quality of the randomized clinical trials (RCT) included in this review was assessed using the Jadad scale,[14] which evaluates the randomization of the patients, the blinding, and the loss of individuals, assigning a score ranging from 0 to 5. The filtering and scoring of the articles were performed by two researchers, who consulted a third researcher in cases of discrepancy.

RESULTS

The search in the different databases returned a total of 894 records. After applying the eligibility criteria, the number of valid articles for this review was 15 publications. The flowchart in Figure 1 illustrates the search and selection process. Table 3 shows the score received by each article, considering the various Jadad scale components.[14]

The main objective of all the publications was to analyze or compare the effects on pain and disability produced by Maitland Concept treatment, either standalone or in combination with other physical therapy techniques. To analyze pain, 73.3% used the Numeric Pain Rating Scale (NPRS).[15,17,18,20,22,23,25–27,29] The VAS scale[21,24,28,29] was also used, though in a smaller number of articles.

Table 1. Search equations.

Database	Search equation
Cinahl	(MH"LowBack Pain")AND(MH"ManualTherapy") AND"mobilization" (MH"LowBackPain")AND((MH"ManualTherapy")OR"mobilization") (MH "Low Back Pain") AND ((MH "Manual Therapy") OR "mobilization") AND "Maitland"
Medline	(MH "Low Back Pain") AND (MH "Musculoskeletal Manipulations") AND "mobilization" (MH "Low Back Pain") AND ((MH "Musculoskeletal Manipulations") OR "mobilization") (MH "Low Back Pain") AND ((MH "Musculoskeletal Manipulations") OR "mobilization") AND "Maitland"
Web of Science	THEME:(lowbackpain)ANDTHEME: (manualtherapy) ANDTHEME:(mobilization) Low back pain (Keywords) and Manual therapy (keywords) or mobilization (Keywords) and Maitland (Keywords)
Pubmed	("Low Back Pain"[MeSH]) AND (("Musculoskeletal Manipulations"[MeSH] OR "mobilization") ("Low Back Pain"[MeSH]) AND ("Musculoskeletal Manipulations"[MeSH]) AND "mobilization" ("Low Back Pain"[MeSH]) AND ("Musculoskeletal Manipulations"[MeSH] OR mobilization) AND Maitland
Scopus	TITLE-ABS-KEY ("low back pain") AND TITLE-ABS-KEY ("manual therapy") AND TITLE-ABS-KEY (mobilization) TITLE-ABS-KEY ("low back pain") AND TITLE-ABS-KEY ("manual therapy") OR TITLE-ABS-KEY (mobilization) (TITLE-ABS-KEY (low AND back AND pain) AND TITLE-ABS-KEY (manual AND therapy) OR TITLE-ABS-KEY (mobilization) AND TITLE-ABS-KEY (Maitland)

ABS- abstract, KEY- keywords;MH- Medical Subject Headings (MeSH terms).

Regarding disability, the most used tool was the Oswestry Disability Index (ODI),[17,18,20,22–24,26–29] and, to a lesser extent, the Roland-Morris Disability Questionnaire (RMQ).[15,21,30] It is noteworthy that the study by Krekoukias et al.[25] used both scales to assess disability.

The mean sample size was 63.2 ± 40.2 subjects (mean ± standard error of the mean).[15-29] In 40% of the studies included, the Maitland Concept was combined with another intervention and the mean duration of the studies was 5.2 weeks.[14-17,25,28] Table 4 shows the key study data.

In general terms, in the different studiesthe Maitland Concept techniques (standalone or in combination with other interventions) caused a reduction in pain.[15,17–19,21,23–25,28,29] At the muscular level, the manual therapy caused a reduction in erector spinae activity[27] and did not influence the thickness of the transversus abdominis muscle.[22] Table 5 summarizes the main results of each of the selected studies.

Table 2. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Articles published between 2016 and 2021 Language: English and Spanish Randomized clinical trials	Articles that do not meet the objective Without access to the full text Methodological quality less than 3 on the Jadad scale Other types of publications: bibliographical reviews, meta-analyses, theses, case reports or series, etc.

DISCUSSION

The goalof this systematic review was to analyze the effects of Maitland Concept treatment techniques in subjects with low back pain. In general, the articles included in this review indicate that Maitland Concept techniques, either alone or in combination with other interventions, have a positive impact on various low back pain signs and symptoms, especially on pain reduction.[15-29]

In seven of the fifteen studies analyzed,[17,18,21,24,25,28,29] applications of the Maitland Concept were compared with different exercise programs. In all the studies, it was observed that the manual techniques, alone or in combination, produced a reduction in low back pain and improveddisability and functionality. The fact that most of the resultswere obtained in the short term,[18,21,24,25,28] a maximum of 6 weeks, except for two[17,29] with longer follow-ups of 6 and 4 months, respectively, must be taken into account.

The results obtained for pain[17,18,21,24,25,28,29] agree with previous studies. Powers et al.[31] applied PA mobilization according to Maitland and a flexion exercise for one day in a sample of 30 patients with low back pain. They demonstrated that both techniques produced immediate effects on patient pain and mobility. Ferreira et al.[32] compared vertebral manipulation against motor control and general exercise and observed that, in both groups, function and perception of the therapy with respect to general exercise in the short term improved. However, there were no differences between the variables in the long term.[32]

One study analyzed the effect of mobilizations and exercise on

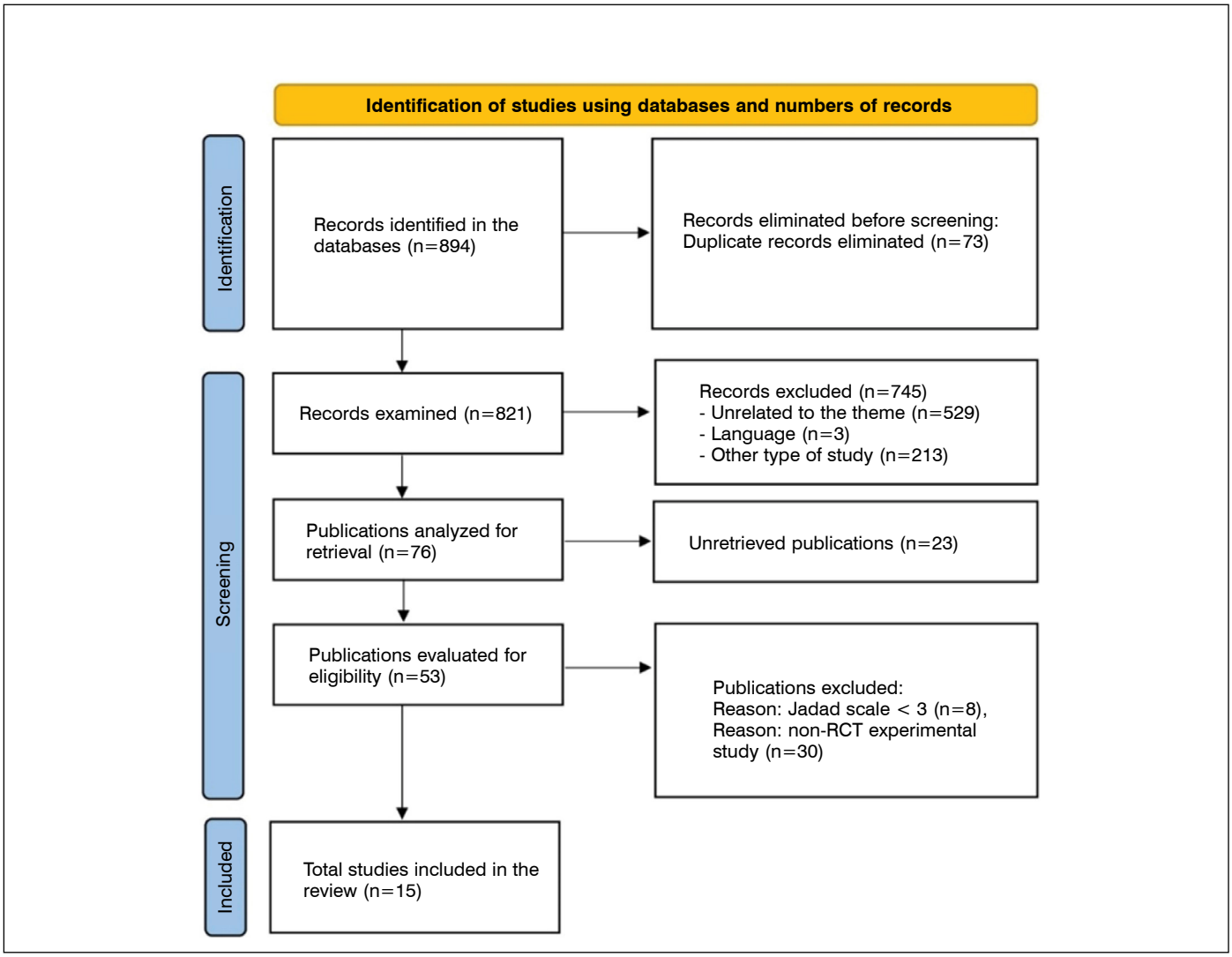

Figure 1. Flowchart according to PRISMA.

Table 3. Scoring of the articles according to the Jadad scale.

Reference	Randomization	Description of the randomization method	Blinding	Description of the blinding method	Description of losses	Total Jadad score
Added et al.[15]	Yes	Yes	Yes	No	Yes	4
Ali et al.[16]	Yes	Yes	Yes	No	Yes	4
Alt et al.[17]	Yes	Yes	No	No	Yes	3
Bade et al.[18]	Yes	Yes	No	No	Yes	3
De Oliveira et al.[19]	Yes	Yes	Yes	No	Yes	4
Donaldson et al.[20]	Yes	Yes	Yes	Yes	Yes	5
Ferreira et al.[21]	Yes	Yes	Yes	Yes	Yes	5
Fosberg et al.[22]	Yes	Yes	Yes	Yes	Yes	5
Griswold et al.[23]	Yes	Yes	Yes	Yes	Yes	5
Kamali et al.[24]	Yes	Yes	Yes	No	Yes	4
Krekoukias et al.[25]	Yes	Yes	No	No	Yes	3
Louw et al.[26]	Yes	Yes	No	No	Yes	3
Mehyar et al.[27]	Yes	Yes	No	No	Yes	3
Shah y Kage[28]	Yes	Yes	Yes	Yes	No	4
Teychenne et al.[29]	Yes	Yes	Yes	No	Yes	4

Table 4. Summary of the key study data.

Reference	n	Age	Interventions performed	Measurement instruments	Duration	Follow-up
Added et al.[15]	148	18-60 years	Manual therapy and general and specific exercise Manual therapy, exercise, andKinesio Taping.	NPRS, RMQ,GEP	5 weeks	Yes(5 weeks, 3 and 6 months)
Ali et al.[16]	33	20-45 years	Maitland mobilization and exercise Mulligan mobilization and exercise	NPRS, ODI,ROM, EMG	4 weeks	No
Alt et al.[17]	44	25-60 years	Counseling, massage, and anterior mobilization Exercise and counseling	ODI, NPRS	16 weeks	No
Bade et al.[18]	90	> 18 years	Manual therapy focused on the hips and exercises Manual therapy and exercise	ODI, PASS, NPRS, GRoC	2 weeks	No
De Oliveira et al.[19]	148	18-80 years	Manipulation at the most painful level Generic manipulation of the mid-thoracic region	NPRS, RMQ, PPT	4 weeks	Yes (12 and 26 months)
Donaldson et al.[20]	63	> 18 years	Grade I to IV mobilization at the painful level Grade III PA mobilization at levels L4 and L5	TKS, NPRS, PASS, GRoC, ODI	2 weeks	Yes(6 months)
Ferreira et al.[21]	12	18-33 years	Central PA mobilization Stretching, exercise, and relaxation	VAS, RMQ, BMI	6 weeks	No
Fosberg et al.[22]	67	18-70 years	Grade V manipulation Grade I mobilization	NPRS, ODI, FABQ, GRoC	1 day	Yes(2 days)
Griswold et al.[23]	65	18-70 years	Manipulation without pushing to the symptomatic level Dry needling of the paraspinals and lower limbs	ODI, PPT, NPRS, PSFS	3 weeks	No
Kamali et al.[24]	40	20-60 years	Manipulation on the positive side of the SIJ Stabilization exercises	VAS, ODI	4 weeks	No
Krekoukias et al.[25]	75	21-78 years	Mobilization in the degeneration levels Light touching without movement Exercise, stretching of the lower limbs, TENS, and massage	NPRS, ODI, RMQ	5 weeks	No
Louw et al.[26]	62	>18 years	Grade II central PA mobilization and explanation of neuroplasticity Mobilization and biomechanical explanation	ODI, FABQ, NPRS, SLR	1 day	No
Mehyar et al.[27]	21	18-55 years	Grade III PA mobilization. Light touching at L4	NPRS. IPAQ, MOSQ, FABQ	2 weeks	No
Shah y Kage[28]	40	18-45 years	Grade 1 to IV PA mobilization Flexion in prone decubitus	VAS, ODI	1 week	Yes (7 days)
Teychenne et al.[29]	40	25-45 years	Mobilization, light techniques in the lumbopelvic zone, and exercises Fitness exercises	VAS, CES-D 10	6 months	No

CES-D10- Center for Epidemiologic Studies Depression Scale-10; EMG- electromyography; VAS –Visual analog scale; SLR – Straight leg raise test; FAQB- Fear Avoidance Beliefs Questionnaire; GEP- Global Perceived Effect Scale; GRoC- Global Rating Of Change Scale;SG - Simulated group;BMI –Body mass index;IPAQ- International Physical Activity Questionnaire;MOSQ- Modified Oswestry Back Pain Disability Questionnaire; n – number of participants (sample size); NPRS- Numeric Pain Rating Scale; ODI- Modified Oswestry Disability Index; PA-Posteroanterior; PASS- Patient Acceptable Symptom State; PSFS- Patient Specific Functional Scale; PPT- pressure pain threshold; RMQ- Roland-Morris Disability Questionnaire; SIJ- sacroiliac joint dysfunction; ROM- Range of motion; TKS-Tampa Kinesiophobia Scale.

the depressive symptomology in this type of patient,[29] observing significant improvement.This coincides with the publication by Wand et al.,[33] in which two models for low back pain intervention and the effects they produced were compared. The results demonstrated that timely physical therapycare improves anxiety, depressive symptoms, and distress in the short term.

As stated in the articles by Fritz et al.[34] and Childs et al.,[35] these findings may be due to the fact that early physiotherapy reduces the chronicity in patients, increases adherence to the treatment performed, and reduces the load of drugs prescribed for morbidities.

Another variable analyzed is the effect of the Maitland Concept on the spinal and the transversus abdominis muscles. Regarding the posteriormusculature of the spine, the study by Mehyar et al.[27]observed that mobilization produces changes in both the superficial and deep muscles (greater activation of the multifidi). Other publicationsconcur with what was reported in this article. Abe et al.[36] investigated the effect of PA mobilization according to Maitland on endurance and posterior muscle strength. With a sample of 16 women with low back pain who underwent a central PA mobilization session on the five lumbar vertebrae, they concluded that this technique is effective in increasing the strength and endurance of the posterior musculature and in stabilizing pain.

Table 5. Summary of the main study results.

Reference	Objective	Results	Conclusion
Added et al.[15]	To compare the effect of Kinesio Tapingwith manual therapy (Maitland Concept) in patients with low back pain	Reductions in pain and disability and an increase in perceived improvement were observed among the groups. At 6 months, there were differences in disability among the groups in the therapy group.	In patients with low back pain treated with manual therapy (Maitland Concept), the application of Kinesio Taping did not produce additional improvement of pain or disability in chronic low back pain.
Ali et al.[16]	To compare Maitland (manual therapy) posteroanterior (PA) mobilization with the sustained glides (SNAG) of the Mulligan Concept (manual therapy) in patients with chronic low back pain	In both the Maitland and Mulligan technique groups,significant improvements in pain, range of motion, paraspinal muscle activity, and disability were observed.	The Maitland Concept and Mulligantechniques produced improvements in subjects with chronic low back pain. The application of manual therapy (PA mobilizations and sustained glides) improve pain, range of motion, muscle activity, and disability in patients with chronic low back pain.
Alt et al.[17]	To determine the most effective and sustainable strategy to reduce and avoid the chronification of low back pain	Significant results in NPRS (4a *p=0.002,* 5a *p=0.001*) and ODI (4a *p=0.001,* 5a *p=0.000*) were observed in the exercise group in weeks 6 and 16.	Manual therapy combined with exercise is more effective in improving chronicity in people with low back pain.
Bade et al.[18]	To assess the effectiveness of a protocolof exercises and manual therapy on the hip to improve symptoms in patient with low back pain	Significant results were obtainedin the groups for ODI (*p=0.03*), NPRS (*p=0.02*), GRoC (*p<0.01*), and patient satisfaction (*p<0.01*). These results were more favorable in the LBP+ HIP group.	Direct manual therapy of the hip combined with exercise reduces pain anddisability, and improves patient satisfaction.
De Oliveira et al.[19]	To evaluate the effect of thoracolumbar manipulations on pain	Both groups had a reduction in pain, however the changes were not clinically relevant.	No differences in pain were observed in people with chronic low back pain when manipulation was applied to the symptomatic segment or when applied to a thoracic level (asymptomatic).
Donaldson et al.[20]	To examine the effects of manipulation or mobilization in subjects with low back pain	There were significant results in the GRoC scores (*p<0.01*) for the mobilization selected by the physical therapist.	Both techniques reduced the pain and the disability, but mobilization has better results in the long term.
Ferreira et al.[21]	To assess the efficacy of the Maitland method in reducing pain and improving functionality in students	The control group had significant differences in the RMQ (T1 *p= 0.026,* T2 *p= 0.018*) and in the VAS (T1 *p= 0.018,* T2 *p=0.017*).The intervention group presented better mobility (*p=0.001*).	Both the Maitland method and exercise are effective in reducing pain and improving functionality.
Fosberg et al.[22]	To observe whether changes in the thickness of the transversus abdominis are produced after applying a manipulation in patients with low back pain	No significant results relative to the thickness of the transversus abdominis were observed. At 48 hours, changes to the FABQ-PA (*p=0.028*) and NPRS (*p=0.047*) were obtained.	Manipulation did not influence a change in the thickness of the transversus abdominis in patients with low back pain.
Griswold et al.[23]	To compare the effects of dry needling with those of mobilization in patients with nonspecific low back pain	There were differences in the PSFS (*p=0.018*), ODI (*p=0.015*),and NPRS (*p=0.009*) in each group.	Mobilization and dry needling both independently improved pain, disability, and the perception of recovery of patients with nonspecific low back pain. Either of the techniques can be considered physical therapy treatment for nonspecific low back pain.
Kamali et al.[24]	To compare the effects of manual therapy and exercises on pain and disability in patients with low back pain and sacroiliac dysfunction.	There were improvements in pain (*p=0.0001*) and in the ODI scale (*p=0.0001*) in both groups.	Manual therapy and stabilization exercises improved the pain and disability of patients with sacroiliac dysfunction.
Krekoukias et al.[25]	To analyze the efficacy of lumbar mobilization in subjects with low back pain and degeneration	Significant results were obtained in the manual therapy group and the control group (*p=0.001*) for pain, disability, and satisfaction, while in the simulated group there were no differences.	Mobilization is effective for this type of subject, but even more so when combined with exercise.
Louw et al.[26]	To analyze whether the explication of neuroplasticity is superior to the traditional biomechanical explanation in patients who receive PA mobilizations	There were significant leg elevation results in the experimental group (*p=0.001*).	The explanation of neuroplasticity,as compared to that of biomechanics, resulted in a measurable difference in the SLR in patients with low back pain.
Mehyar et al.[27]	To analyze the effect of mobilization onerector and multifidus muscle activity in people with low back pain	The mobilization caused greater contraction of the multifidi (*p=0.003*) in people with moderate low back pain, and in the EMG of the erectors for L1 (*p=0.01*) and L4 (*p=0.05*) in those with severe pain.	Mobilization reduces the activity of the erectors and increases the contraction of the multifidi.
Shah y Kage[28]	To analyze the effect of mobilization and flexion in prone decubitus in patients with low back pain.	Both interventions were significant in terms of pain and ROM (*p <0.05*), though the PA mobilization proved to be superior.	Both PA mobilization and flexion are effective in nonspecific low back pain.
Teychenne et al.[29]	Viability of the protocols used for back pain in improving depressive symptoms in low back pain	There was a small reduction (*p= 0.02*) in the depressive symptoms.	Both therapies produced a reduction in the depressive symptoms in people with low back pain.

EMG- Electromyography;VAS –Visual analog scale; SLR –Straight leg raise test;FABQ-PA- Fear Avoidance Beliefs Questionnaire (Physical Activity); GRoC- Global Rating Of Change Scale; LBP+HIP- Pragmatic low back pain treatment plus prescriptive hip treatment; NPRS- Numeric Pain Rating Scale; ODI- Modified Oswestry Disability Index; PA- Posteroanterior ; PSFS- Patient Specific Functional Scale;RMQ- Roland--Morris Disability Questionnaire; ROM –Range of motion; T1- reevaluation 1; T2- reevaluation 2.

In contrast, as regards the transversus abdominis, Fosberg et al.[22] observed that manipulation did not modify the thickness of this muscle, either when at rest or in contraction. In a case study (a 43-year-old patient with a 30-day history of diffuse pain on the right side down to the ankle), Gill NW et al.[37] demonstrated that lumbopelvic manipulation producedan immediate improvement in the contraction of the transversus abdominis. The difference between these results may be due to the different levels at which the manipulation was applied to the patients, and it can be concluded that positive results were obtained whena manipulation was performed at the lumbopelvic level and not only in the lumbar region. While,being a case study, it is not representative, it would be interesting to conduct such a study with a larger sample.

Despite the differences in the results on the muscles, the effects on the pain were consistent. In both publications,[22,27]reductions inpain and in fear of low back pain were observed.

Hungerford et al.[38] andRichardson et al.[39] observed that, when an injury at the lumbar level occurs, it can cause neuronal inhibition of the stabilizing muscles, such as the transversus abdominis and the multifidi, which can cause signs and symptoms of instability. As a treatment option, Murphy et al.[40] concluded that, through manipulation and reflex responses, this neural control can be restored or improved and, consequently, the symptoms associated with instability can be minimized.

As regards the different treatment application regions, Bade et al.[18] compared physical therapy applied inthe lumbar region with another that included intervention in the hip. The results obtained showed greater pain reduction, improvement in disability and patient satisfaction in the group that received a second treatment. This information can be corroborated with the publication by Burns et al.,[41] whose goal was to demonstrate the short-term results on low back pain. In this study, the sample consisted of 8 patients who received manual therapy (Grade III and IV AP mobilizations, mobility exercises focused on the lumbo-pelvic-hip region, among others) for one week. The results showed that their perceived recovery was greater and that they experienceda decrease in disability.[41]

To explain these results, the relationship that exists between the adjacent joint in these patients must be considered. Van Diller et al.[42] conducted an investigation in which they concluded that there is a relationship between low back pain and a deficiency in the hips and lumbopelvic region.

On the other hand, Kamali et al.[24] state that a combination of manual therapy and exercise improves pain associated with various pathologies, such as sacroiliac dysfunction. Another publication, byRana and Bansal,[43] corroborates these results. They conducted an RCT with 45 subjects divided into 3 groups: one submitted to muscle energy techniques and exercise, another to Maitland and exercise, and the third acting as the control group. The results showed improved pain and functional capacity in both experimental groups. This article supports the observation of various studies included in this review, in which the importance and effectiveness of manual therapy combined with exercise are emphasized.[17,18,21,24,25,28,29]

Regarding the comparison of manual therapy with other types of techniques, Added et al.[15] compared manual therapy against manual therapy with Kinesio Taping and concluded that the addition of this technique to the treatment protocol was not effective for any of the parameters analyzed.

Paoloni et al.[44] also studied Kinesio Taping for low back pain. They used a sample of 39 patients divided into three groups: only Kinesio Taping, relaxation and muscle strengthening techniques, and a combination of both, with the goal of evaluating pain intensity and disability in patients with chronic low back pain. The results showed that there were no significant differences between the groups.

Although this last article[44] did not use the Maitland Concept for the intervention, the conclusions from the taping were similar. Standalone Kinesio Taping treatment did not produce any change in low back pain.[15,44]

In their study, Griswold et al.[23] compared Maitland techniques with dry needling. They observed that both techniques have a positive effect on pain, disability, and recovery. These results can be contrasted against the systematic review by Furlan et al.,[45] who concluded that dry needling is a useful complement to other low back pain therapies. Because the study analyzed in this scientific research was the first to be conducted on this topic, their review[45] did not compare it against any other type of therapy.

One of the articles analyzed whether manipulations at different levels influencedpain, disability, and the overall perceived effect. Parreira et al.[30] demonstrated that there are no significant differences between manipulations at different levels, though they do have a positive pain reduction effect. Along the same lines, Mohanty and Pattnaik[46] reported that mobilization at the thoracic level improved low back pain in their sample of 200 patients with spondylolisthesis, which indicates that the effect may be independent of the mobilization level.

In the study by Louw et al.[26] an educational explanation of neuroplasticity as compared to the traditional explanation of biomechanics wasoffered to patients prior to treatment. The results achieved showed that manual therapy is more effective when the patients receive an explanation of brain neuroplasticity before undergoing treatment. A previous systematic review pointed out that this type of education is effective for the treatment of chronic musculoskeletal pain and increases the effectiveness of manual therapy combined with exercise.[47] A recent review concluded that the combination of exercise with other therapeutic modalities is more effective than the use of physical agents alone.[48]

In addition, patients with chronic pain have greater representation in the somatosensory cortex of the affected zones, since body maps expand and contract, increasing and decreasingtheir representation in the brain's body map.[49] These changes in shape and size are related to an increase in pain and disability. Because this reorganization occurs rapidly, various studies highlight the importance of using strategies, such as movement and tactile and visual stimulation of the central nervous system, to help maintain it.[50-52]

For a correct interpretation of the results, the main biases described by the Cochrane Collaboration[53] have been considered in the analysis of the articles included in this review.

In the first place, since all the articles analyzed are RCTs with an overall methodological quality equal to or greater than 3 points on the Jadad scale (Table 3), the validity of the studies can be assumed to be adequate and the risk of bias is reduced.

No selection bias was observed since one of the selection criteria was that the studies be RCTs, which implies that randomization was used to assign subjects to the study groups in all the articles included.

Regarding the blinding ofsubject assignment to the different groups, only 8 of the 15 studies complied, using opaque envelopes to inform the physical therapist of the group to which they belonged.

As for execution bias, the fact that the risk of this bias is high due to the very nature of the intervention must be considered. In many cases in physical therapy and rehabilitation, even though blinding of the subjects and experimenters is indicated, there is knowledge about the intervention that is being performed. Participants can be considered aware that they arereceiving Maitland Concept therapy or another intervention.

On the other hand, in nine of the fifteen articles the results were blind to the evaluators, presenting low detection bias risk. In the remaining articles, it was either not specified or the evaluation was conducted by the physical therapist who applied the treatment.

As regards attrition bias, fourteen of the fifteen articles described losses throughout the entire duration, stating the reasons why they occurred. The exception was the article by Shah and Kage,[28] which did not describe any loss.

Finally, all the articles had a low risk of notification bias, since the results of all the variables analyzed were presented with numeric values and detailed descriptions.

The main limitations of the present review were the language of the publications included (limited to studies in English and Spanish), the limitation on the search to the last 5 years with the goal of conducting an updated review, and the thematic focus on the

Maitland concept, which did not allow extrapolation to other manual therapy techniques.

On the other hand, one of the limitations observed in the studies analyzed was the use of different questionnaires and scales for the same variables, making it difficult to compare the various results. It would be interesting to establish a protocol for their use.

Another key limitation of the studies was that the long-term results were unknown,either because there was no follow-up or because it was too short.

As previously mentioned, other publications have shown that short-term results are not necessarily maintained in the long term.[32] Therefore, the results observed in the present review cannot be extrapolated into the long term and publications with longer follow-up periods are required.

On the other hand, the studies included did not consider the fact that notall patients with nonspecific low back pain are susceptible to mobilizations and manipulations.[35] Certain signs and symptoms should be considered when selecting subjects, for example, the presence of hypomobility in some of the spinal segments that are susceptible to mobilization or manipulation.

Moreover, few studies apply manual therapy techniques in standalone form, which makes it impossible to discern whether the effects were produced by the Maitland Concept techniques or other interventions, such as exercise.[17,18,21,24,25,28,29]

The heterogeneity of the applied treatments (different Maitland Concept mobilization grades and different combinations of techniques) did not allowa determination of the most suitable parameters or specific techniques for each clinical condition,since there is a wide range of combinations and measurement tools.

Bearing in mind the levels of scientific evidence according to the Van Tulder[54] criteria, there is solid evidence in the most recent scientific literature that, in subjects with low back pain, the Maitland Concept manual therapy techniques, most often combined with exercise, produce a decrease in short-term pain and disability. Regarding the effect on the musculature, the evidence observed is contradictory because the studies that address these variables are disparate.[22,27] Further study of these variables is required.

In future lines of research, long-term patient follow-up is suggested to determine if the effect is maintained, as well as to unify the treatment protocols to allow a common prescriptive guideline for all health professionals that takes the particularities of each patient into account.

CONCLUSION

There is solid scientific evidence that, in subjects with low back pain, Maitland Concept mobilization and manipulation techniques applied to the spine are effective in reducing low back pain and disability in the short term. The effect of these techniques is usually observed in combination with exercise, although other interventions, such as patient education, have a positive effect.

While there is solid evidence that the Maitland Concept techniques reduce pain in patients with low back pain, the most recent publications do not allow us to conclude that there was any clear effect on the muscles (transversus abdominis, multifidi, and erector spina) nor could we determine the long-term persistence of the effects.

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