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Effect of physiotherapy in patients with chronic sciatica: a systematic review with meta-analysis

Tesi di laurea in Innovazioni in Fisioterapia

Presentata da:
Rahmani Romina

Relatore:
Prof. Dr. Turolla Andrea

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Abstract

Introduzione La sciatalgia è caratterizzata da dolore che irradia lungo il nervo sciatico, con una prevalenza globale che varia dall'1,2% al 43%. La sciatalgia cronica persistente per più di 3 mesi, spesso deriva dall'erniazione del nucleo polposo nella regione lombare o da altre malattie degenerative. Nonostante esistano vari trattamenti, tra cui le iniezioni corticosteroide epidurali e gli interventi chirurgici, la fisioterapia è tra le opzioni non invasive ed economicamente sostenibili che possono migliorare dolore e funzionalità. Nonostante esistano prove a sostegno dell'efficacia della fisioterapia per il trattamento della sciatalgia acuta, esiste una lacuna nella ricerca sulla sua efficacia per il trattamento della sciatalgia cronica. Questo studio mira a valutare l'efficacia della fisioterapia per i pazienti affetti da sciatalgia cronica, per fornire eventuali raccomandazioni basate sull'evidenza per la sua gestione.

Metodi Sono stati selezionati studi che confrontavano gli interventi di fisioterapia con trattamenti di controllo nei pazienti con 'sciatalgia cronica'. Gli studi inclusi indagavano una varietà di trattamenti di fisioterapia per il trattamento di partecipanti con dolore alla gamba lungo il decorso neurale spinale, mentre nei gruppi di controllo si utilizzavano approcci non fisioterapici. Le banche dati, CENTRAL, PubMed, Medline e PsycINFO, sono state consultate fino al 31 maggio 2023. I dati estratti includevano le specifiche del trattamento ed i risultati riportati, in riferimento a diversi follow-up temporali. La qualità dello studio è stata valutata utilizzando lo strumento RoB2. È stata eseguita una meta-analisi per gli esiti sulla disabilità, utilizzando Revman V5.4, con modelli ad effetti fissi, mentre l'eterogeneità è stata valutata con la statistica I^2.

Risultati Le ricerche hanno individuato 12.249 studi, di cui 8 soddisfacevano i criteri di inclusione, per un totale di 951 partecipanti, con età compresa tra 23,1 e 59,6 anni, che presentavano varie durate e gravità del dolore sciatico. Gli interventi utilizzati includevano le manipolazioni ed esercizi sintomo contingenti, mentre i gruppi di controllo sono stati trattati con varie procedure, che includevano operazioni chirurgiche ed esercizi sham. La meta-analisi ha considerato il Roland Morris Disability Questionnaire come unico outcome. Nel follow-up a breve termine, la fisioterapia ha mostrato un effetto significativamente migliore rispetto al trattamento di controllo (MD = -1,40; IC95%: -1,52, -1,29). Tuttavia, nel follow-up a lungo termine, l'effetto si è spostato significativamente, anche se con un piccolo effetto, a favore degli interventi di controllo (MD = 0,40; IC95%: 0,28, 0,52).

Conclusione/Implicazione Questa revisione ha valutato 8 studi sull'efficacia del trattamento della sciatalgia cronica. A breve termine, la fisioterapia ha mostrato un effetto migliore rispetto ai trattamenti di controllo nella riduzione della disabilità. Tuttavia, i risultati a lungo termine sono risultati essere a favore dei trattamenti di controllo, in particolare delle modalità invasive, suggerendo la loro potenziale superiorità per il trattamento della sciatalgia cronica con ernia del disco. Anche se alcuni studi hanno evidenziato benefici specifici della fisioterapia, nessuna evidenza chiara ha individuato la superiorità di un trattamento specifico rispetto ad altri. La maggior parte degli studi aveva limitazioni come campioni di piccole dimensioni e misure di outcome inconsistenti. La forza della revisione risiede nei suoi rigorosi criteri di inclusione, che distinguono tra fisioterapia ed altri metodi di trattamento. I dati attuali non forniscono chiare raccomandazioni sull'impatto della fisioterapia sulla sciatalgia cronica a causa di incongruenze nei metodi di studio. Per ottenere risultati più definitivi, gli studi futuri dovrebbero concentrarsi sulla standardizzazione delle definizioni, sul confronto più diretto dei trattamenti e sulla dettagliata descrizione dei protocolli di fisioterapia**.**

Abstract

Background Sciatica is characterized by pain radiating along the sciatic nerve, with a global prevalence ranging from 1.2% to 43%. Chronic sciatica, persisting for more than 3 months, often results from herniation of the nucleus pulposus in the lumbar region or other degenerative diseases. Diagnostic challenges arise when standard imaging fails to detect treatable causes. While various treatments, including epidural corticosteroid injections and surgeries, are available, physiotherapy has been emphasized as a non-invasive, cost-effective option that can improve pain and functionality. Despite evidence supporting physiotherapy for acute sciatica, there's a research gap concerning its efficacy for chronic sciatica. This study aims to evaluate the effectiveness of physiotherapy for patients with chronic sciatica and to provide evidence-based recommendations for its management.

Methods Studies were selected that examined physiotherapy interventions against control methods in 'chronic sciatica' patients. Eligible trials investigated a variety of physiotherapy treatments for participants with leg pain from the spinal neural pathway, while control groups used non-physiotherapy approaches. Databases including CENTRAL, PubMed, Medline, and PsycINFO were searched up to May 31st, 2023. Data extracted included study details, treatment specifics, and outcomes, categorized by duration. Study quality was assessed using the Rob2 tool. A meta-analysis was performed for disability outcomes, using Revman V5.4, with fixed effects models applied and heterogeneity assessed by I^2 statistics.

Results From 12,249 records, 8 studies met the inclusion criteria, encompassing 951 participants aged 23.1 to 59.6 years, with varying sciatica durations and pain severities. The interventions ranged from manipulative treatments to symptom-guided exercises, while control groups underwent various procedures from surgeries to sham exercises. The meta-analysis focused on the Roland Morris Disability Questionnaire. In short-term follow-up, physiotherapy showed a significant better effect, than control treatment (MD = -1.40; CI95%: -1.52, -1.29). However, at long-term follow-up, effect significantly moved in favour of control interventions (MD = 0.40; CI95%: 0.28, 0.52).

Conclusion/Implication This review assessed 8 studies on chronic sciatica treatment effectiveness. At short term, physiotherapy showed a better effect than control treatments in reducing disability. However, long-term results slightly favoured controls, especially those undergoing invasive strategies, suggesting their potential superiority for chronic sciatica with

disc herniation. While some studies highlighted specific benefits of physiotherapy, no clear evidence pinpointed any standard treatment's superiority. Most studies had limitations like small sample sizes and inconsistent measures. The review's strength lay in its strict inclusion criteria, distinguishing between physiotherapy and other methods. Yet, more research is needed to guide treatment choices. Current data doesn't provide clear recommendations on physiotherapy impact on chronic sciatica due to inconsistencies in study methods and lack of high-quality trials. Future studies should focus on standardizing definitions, comparing treatments more directly, and detailing physiotherapy protocols to yield clearer results.

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Chapter 1: Introduction

1.2 Background

1.1.1 Sciatica an overview

The sciatic nerve, the longest and thickest nerve in the human body, originates from the lumbosacral plexus, which is formed by the ventral rami of the spinal nerves L4 to S3 [1]. It consists of two main branches, the tibial nerve, and the common peroneal nerve, which provide motor and sensory innervation to the posterior thigh, leg, and foot [1]. The sciatic nerve passes through the greater sciatic foramen, located between the sacrum and the piriformis muscle, and continues down the posterior aspect of the thigh before dividing into its two main branches [1].

Chronic sciatica is a condition characterized by persistent pain radiating along the sciatic nerve, which runs from the lower back down through the buttocks and legs. It is estimated that the global prevalence of sciatica varies widely, ranging from 1.2% to 43% [2]. The wide range in prevalence reflects the lack of unified diagnostic criteria and the diverse clinical manifestations of the condition [2]. Acute sciatica typically lasts less than 3 months, while chronic sciatica persists for 3 months or longer [3].

The pathophysiological mechanisms underlying chronic sciatica are not fully understood. However, one of the most common causes of sciatica is the herniation of the nucleus pulposus, a component of the intervertebral disk in the lumbar region [4]. This herniation can lead to stenosis and inflammation, resulting in compression of the sciatic nerve and the development of chronic pain [4]. Other factors that may contribute to chronic sciatica include degenerative diseases such as canal stenosis or chronic instability of the affected spinal segments [4].

Diagnosing the cause of chronic sciatica can be challenging, as standard diagnostic methods such as lumbar magnetic resonance imaging (MRI) often fail to identify a primary impairment to be treated efficaciously in a significant number of patients [1]. In such cases, alternative imaging techniques like MR neurography and interventional MR imaging may be employed to provide a more accurate diagnosis [1]. These techniques can help identify the presence of nerve compression syndromes, such as piriformis syndrome, which can mimic the symptoms of sciatica [1].

1.1.2 Importance of Physiotherapy in Sciatica Management

Physiotherapy interventions offer several benefits in the management of sciatica. Firstly, physiotherapy provide a valid non-invasive and conservative treatment option, reducing the need for surgical intervention. Boote et al. (2016) [5] emphasized the importance of identifying and managing patients with sciatic symptoms in primary care, including physiotherapy to potentially prevent the need for surgery in a subgroup of patients. Secondly, physiotherapy interventions have been shown to ameliorate pain, function, and quality of life in individuals with sciatica. Foster et al. (2017) [6] reported that active physiotherapy increased the proportion of sciatica patients showing improvement, particularly in those with severe symptoms. This highlights the significant impact of physiotherapy on symptom relief and functional recovery. Furthermore, physiotherapy interventions are cost-effective compared to surgical interventions for sciatica. Foster et al. (2017) [6] conducted a cost-benefit analysis and found that stratified care, including physiotherapy, was more cost-effective than usual care alone. This finding underscores the economic advantages of incorporating physiotherapy into the management of sciatica.

Exercise-based interventions are a cornerstone of physiotherapy for sciatica. They aim to improve strength, flexibility, and endurance, thereby reducing pain and disability. A systematic review by Jacobs et al. (2010) [7] found that physiotherapy interventions, including exercise programs, were effective in increasing the proportion of sciatica patients showing improvement, particularly in those with severe symptoms. Manual therapy techniques, such as spinal mobilization and manipulation, are commonly used by physiotherapists to alleviate pain and improve spinal function in patients with sciatica. These techniques can help reducing nerve root compression and improve overall spinal alignment. The systematic review by Dove et al. (2022) [8] highlighted the effectiveness of manual therapy interventions in treating people with sciatica. Electrotherapy modalities, such as transcutaneous electrical nerve stimulation (TENS) and ultrasound, are often employed in physiotherapy for sciatica. While evidence for the effectiveness of electrotherapy in sciatica management is limited, it is still considered a valuable adjuvant to other physiotherapy interventions. Moreover, education and self-management strategies are essential components of physiotherapy for sciatica. Patients are educated about their condition, advised on proper posture and body mechanics, and provided with strategies to manage pain and prevent recurrence. This comprehensive approach empowers patients to take an active role in their recovery and promotes long-term self-care.

1.1.3 Other Treatment Options for Chronic Sciatica

There are alternative treatment options available including epidural corticosteroid injections and surgical interventions. Epidural Corticosteroid Injections (ESIs) deliver corticosteroids directly into the epidural space, aiming to reduce inflammation and alleviate pain. The WEST study conducted by Arden et al. [9] investigated the efficacy of ESIs for sciatica. The study found that ESIs did not reduce the need for surgery or other interventions, including physiotherapy and provide temporary relief and serve as an adjunct to other treatment modalities.

In cases where conservative treatments fail to provide adequate relief, surgical interventions may be considered for chronic sciatica. Surgical options aim to address the underlying cause of sciatica, such as a herniated disc or spinal stenosis.

Different types of surgical interventions include:

- Microdiscectomy: a minimally invasive surgical procedure that involves removing a portion of the herniated disc that is compressing the sciatic nerve. This procedure aims to relieve pressure on the nerve and alleviate symptoms. It has been shown to be effective in improving pain and function in patients with chronic sciatica [10].

- Spinal Decompression: surgeries like laminectomy or laminotomy, aim to relieve pressure on the spinal cord or nerve roots. These procedures involve removing a portion of the vertebral bone or ligament to create more space for the nerves. Spinal decompression surgeries can be effective in relieving symptoms of chronic sciatica caused by spinal stenosis or other structural abnormalities [10]

- Spinal Fusion: is a surgical procedure aimed to stabilize the spine by fusing two or more vertebrae together. This procedure is typically reserved for cases of chronic sciatica caused by spinal instability or degenerative disc disease. Spinal fusion can help alleviate pain and improve spinal stability, but it is a more invasive procedure with a longer recovery period [10].

The choice of surgical intervention depends on various factors, including the underlying cause of sciatica, the severity of symptoms, and the patient's overall health. It is essential for healthcare professionals to carefully evaluate each patient's condition and consider the potential risks and benefits of surgical interventions.

1.1.4 Research Gap and Purpose of the Study

Despite the effectiveness of physiotherapy interventions in managing sciatica, there is still a need for further research to evaluate the overall effectiveness of physiotherapy on patients with chronic sciatica. Chronic sciatica refers to persistent or recurrent symptoms lasting for more than 12 weeks [11]. While there is existing evidence supporting the use of physiotherapy in acute sciatica, there is a lack of studies specifically focusing on the effectiveness of physiotherapy in chronic sciatica.

The purpose of this study is to evaluate the effectiveness of physiotherapy interventions on patients with chronic sciatica. By examining the outcomes of physiotherapy interventions in this specific population, the study aims to contribute to the existing literature and provide evidence-based recommendations for the management of chronic sciatica.

1.2 Research Questions and Hypotheses

1.2.1 Primary Research Question

The primary research question of this study is: "What is the effectiveness of physiotherapy interventions in reducing pain, improving functional outcomes and lost workdays in patients with chronic sciatica in comparison to any other type of intervention like placebo, or usual care.?"

1.2.2 Secondary Research Questions

The secondary research questions include: What are the specific physiotherapy interventions that have been used in the management of chronic sciatica? What are the factors that may influence the effectiveness of physiotherapy interventions in patients with chronic sciatica?

1.2.3 Hypotheses

Based on the existing literature, the following hypotheses can be formulated:

- Physiotherapy interventions will lead to a significant reduction in pain intensity in patients with chronic sciatica.
- Physiotherapy interventions will improve functional outcomes, such as mobility and quality of life, in patients with chronic sciatica.

1.3 Significance of the Study

1.3.1 Clinical Significance

By evaluating the effectiveness of physiotherapy interventions, healthcare professionals will be able to make informed decisions regarding the most appropriate treatment approach for this specific population. This study may also help in identifying the specific physiotherapy interventions that are most effective in reducing pain and improving functional outcomes in patients with chronic sciatica.

1.3.2 Contribution to Literature

This study will contribute to the existing literature by filling the research gap regarding the effectiveness of physiotherapy interventions in patients with chronic sciatica. The findings of this study may also guide future research and contribute to the development of evidence-based guidelines for the management of chronic sciatica.

Chapter 2: Methodology

2.1 Research Design

2.1.1 Inclusion and Exclusion Criteria

The pool of included studies consisted of randomized controlled trials published in English investigating physiotherapy interventions compared to a control intervention, in cohorts of patients with 'chronic sciatica.'

Eligible trials were required to assess a range of physiotherapy interventions, including exercise regimens, manual therapy modalities, physiotherapy-led educational programs, physical instrumental therapy, or combinations of these interventions, in participants with a diagnosis of leg pain stemming from the neural pathway of the spine. In contrast, the control intervention needed to adhere to a non-physiotherapy approach (e.g., surgical procedures, general practitioner care, or other non-physiotherapy treatments). Furthermore, the control intervention could involve placebo treatments, sham procedures, or a complete absence of any therapeutic intervention.

Regarding the duration of sciatica, studies that explicitly stated their inclusion of patients with chronic sciatica were incorporated. Some scholars define chronic sciatica as pain persisting for more than 6 weeks, while others categorize it as chronic when the pain endures for more than 12 weeks.

2.1.2 Search Strategy

The following databases were systematically searched from inception to May 31st, 2023: Cochrane Central Register of Controlled Trials (CENTRAL), PubMed, Medline, and PsycINFO. The search strategy, encompassed keywords associated with chronic sciatica, radicular pain, lumbar radiculopathy, physiotherapy, and randomized controlled trials (see Appendix A).

2.2 Data Collection

2.2.1 Selection of Studies

In a first step, titles and abstracts were screened using the Rayyan platform [12] followed by the review of full texts. Any discrepancies were resolved through discussion by the thesis supervisor, if required.

2.2.2 Data Extraction

The following information was extracted as follows: author, year, country, population, inclusion and exclusion criteria, details of physiotherapy and control interventions (including type, frequency, and duration), outcomes and results. Outcomes were collected at baseline and at various follow-up time points, categorized as primary and secondary outcomes, as reported in the study. Means, standard deviations, and sample sizes were extracted for each outcome.

If available, outcomes were pooled according to different time points and categorized based on time elapsed after randomization as follows: short term (< 4weeks), medium-term (4 < weeks <48), or long-term (≥48 weeks). In cases where multiple time points were reported within a single period, the outcome closest to 4 weeks, 26 weeks and 48 weeks was selected. In case that more than one body part was employed for pain assessment (e.g., leg and back pain), the highest baseline score was considered reflecting patient's dominant symptoms. Furthermore, when multiple outcome measures were employed within a trial for a specific outcome of interest, the outcome measure identified by the trial authors as their primary measure was adopted.

2.2.3 Quality Assessment

The RoB 2 (Risk of Bias 2) tool was utilized to assess study quality and evaluate the risk of bias [13]

2.3 Data Analysis

2.3.1 Data synthesis and analysis

If data were available for the same outcome measure from at least two trials, meta-analysis was performed using Revman V5.4. Mean differences (MD) and 95% confidence intervals (CI) were calculated. Fixed effects models with inverse variance weighting were employed to account for the variability of the included studies. Heterogeneity was assessed using I^2 statistics and was interpreted as follows: ‘might not be important’ (0–40%), ‘moderate’ (30–60%), ‘substantial’ (50–90%), and ‘considerable’ (75–100%) [14].

Separate overall meta-analyses at short and long term, comparing physiotherapy interventions with control interventions for our primary outcome of disability were performed.

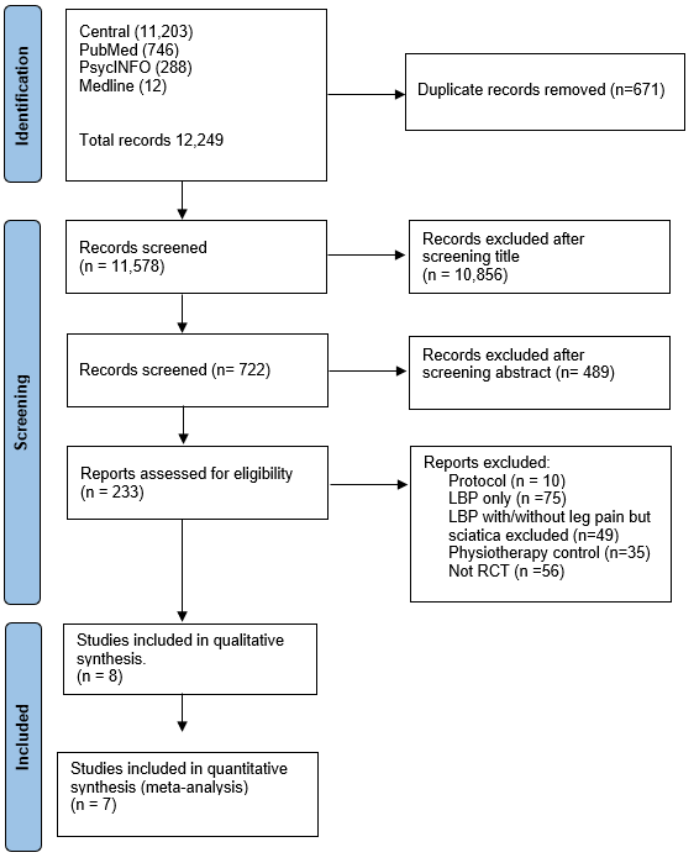
Chapter 3: Results

3.1 Study Selection

3.1.1 Flowchart of Study Selection

The electronic database searches returned 12,249 records. Duplicates and studies deemed ineligible from titles/abstracts were removed, leaving 233 full-text articles. Of those, 225 were discarded as they did not meet the inclusion criteria. A total of 8 studies were included in this systematic review (Fig. 1)

Figure 1. PRISMA flow diagram



3.2 Characteristics of Included Studies

3.2.1 Participants

Table 1 (Appendix B) contains details of study characteristics. A totale of 951 participants were included. According to data from six trials [15]–[20]participant's age ranged from a mean of 23.1 (SD = 9.6) to 59.6 (SD = 12.3) years. Baseline duration of sciatica was reported in six

trials, >3 months in [21], [22], >4 weeks in [19], between 2 weeks and 1 year [16], 6 to 12 weeks [18] and in [17] was at least 2 years. Pain severity at baseline on a 10 points scale (Visual Analog scale) by 4 trials[17], [19]–[21], ranging from a mean of 5.3 (SD = 1.7) [19] to 7.63 (SD = 1.42) [21]. The diagnostic criteria for sciatica used in the included studies are listed in Supplement Table 1.

3.2.2 Physiotherapy interventions

Physiotherapy interventions varied considerably in the components, including manipulative treatment [15], shockwave therapy [21],conservative treatment [17]–[20] and symptom-guided exercise [16]. In two trials [17], [20] the type of conservative treatment was not reported, while in others [18]–[20], conservative treatments included flexion distraction procedures; light soft tissue massage; heat; cold; informing the patient on their positive prognosis and inviting to maintain the daily activities.

The frequency and duration of physiotherapy interventions were unreported in four trials [17]–[20]. Where duration was reported, it ranged from 3 [21] to 12 weeks [15]. Further details on physiotherapy interventions are available in Table 1.

3.2.3 Control interventions

Control interventions included the chemonucleolysis [15], corticosteroid injection [21], epidural neuroplasty [19], [20], microdiscectomy [22], self-care [19], surgery (disk herniation removal) [18], lumbar fusion [17] and sham exercise [16]. Self-care consisted of advice regarding postural instructions and practical demonstration of proper body mechanism performed with patient participation.

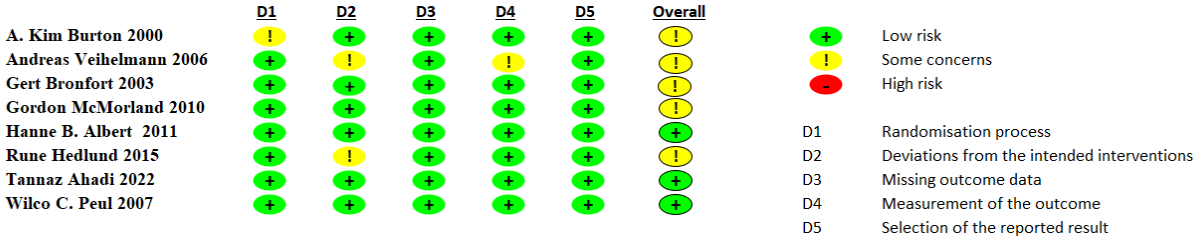
3.2.4 Outcome Measures

Five trials reported leg pain measures as a continuous outcome with Visual Analog Scale (VAS) [16], [17], [19]–[21], one with Seven-point ‘annotated thermometer’[15] and another with 7-point Likert self-rating scale[18]. The remaining study reported the McGill pain score as categorical outcome for general pain [22]. One trial did not report a measure of disability [16], one reported two scales (i.e., Roland Morris, Oswestry Disability Index) [19]. Other trials reported one disability scale [15]–[18], [20], [21]. Two Trials [21], [22] used the SF-36 scale as primary outcome and 1 trial [18] as a secondary outcome. Bronfort et al. [19] was the only trial with number of missed work or school days. Other secondary outcomes included in the

trials are Global Improvement: (5-points Likert scale), number of neurological signs, quality-adjusted life years (QUALY) [16], Zung depression scale [17], the Sciatica Frequency and Bothersomeness Index [18]. A summary of outcomes is reported in Table1 (Appendix B).

3.3 Risk of Bias

Figura 2. Risk of Bias



In the context of the randomization process, all trials but one (Burton et al.) [16] used a randomized allocation sequence concealed until participants were enrolled and assigned to their respective interventions. In the Burton et al. trial, randomization did not occur due to administrative issues involving 15 patients. Importantly, an assessment of differences at baseline between intervention groups does not indicate any issues with the randomization process.

Regarding deviations from the intended intervention in the study conducted by Veihelmann[20], an observation was the occurrence of patients in the conservative treatment group who chose to swap to the epidural neuroplasty (ENP) group, after experiencing unsatisfactory results with physical therapy for a duration of 3 months. This phenomenon of patient crossover bears the potential to introduce confounding variables that could influence the study's outcomes.

Remarkably, in trial conducted by Hedlund et al. [17], 26 of 72 (36%) patients of conservative group at the : 7 patients were operated on before treatment was initiated and 19 were operated on post treatment.

In other studies, there is no evidence of deviations from the intended intervention arising due to the trial context.

All trials included in the study are characterized by low missing data about outcome investigated, which is available for the full or substantial majority of the sample planned, thus pre-specified analysis plans were mostly respected.

Regarding the outcomes collected by Veihelmann et al. [20], it is noteworthy that there may have been variations in the measurement or ascertainment of outcomes between groups. Data indicates that the ENP group exhibited significant reduction in Visual Analog Scale (VAS) for leg pain, VAS for backpain and Oswestry Disability Index (ODI) scores at 3, 6, and 12 months, when compared to the experimental group. Nevertheless, it is essential to acknowledge that the evaluation of only 27 patients at 6 and 12-months follow-up could have introduced a certain imprecision in the outcome measurement. Furthermore, 12 patients from the conservative treatment group swapped to the ENP group after 3 months, with data not considered in the final statistical analysis. Consequently, while the study suggests favorable outcomes for the ENP intervention, it is plausible that the measurement or determination of the outcomes may have been influenced by these biases.

There is no evidence in any of the trials suggesting a bias in data analysis based on a pre-specified plan confirmed before unblinding.

3.4 Meta-Analysis Results

3.4.1 Overall Effect Size

In the meta-analysis, only the studies measuring disability with the Roland Disability Questionnaire Index (RDQI) could be included due to low heterogeneity while pain by Visual Analog Scale (VAS) was planned, but not doable.

Three trials were included in the overall meta-analysis at short term and two trials at long term. Significant differences between the physiotherapy treatments and control groups were evident across those two time points. At short-term follow-up, the physiotherapy treatments demonstrated a superior effect, (MD = -1.40; CI95%: -1.52, -1.29; $p < 0.00001$), and low heterogeneity ($I^2 = 15\%$) (Fig.3). Conversely, at long-term follow-up, the control group showed better results than physiotherapy group (MD = 0.40; CI95%: 0.28, 0.52; $p < 0.00001$) and no heterogeneity ($I^2 = 0\%$) (Fig.4).

Figure 3. Forest plot disability short term (< 4 weeks)

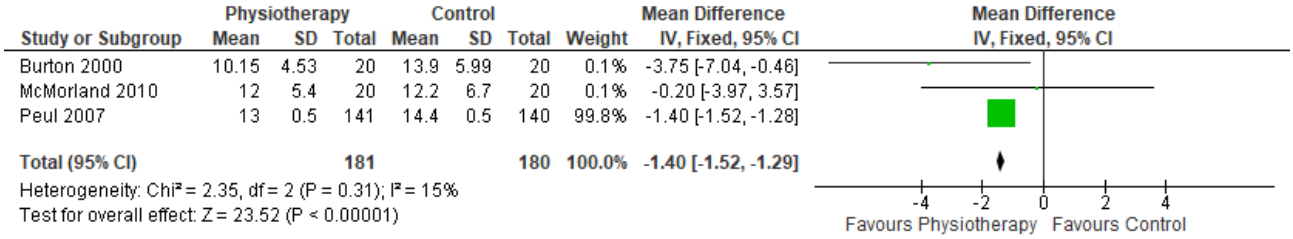
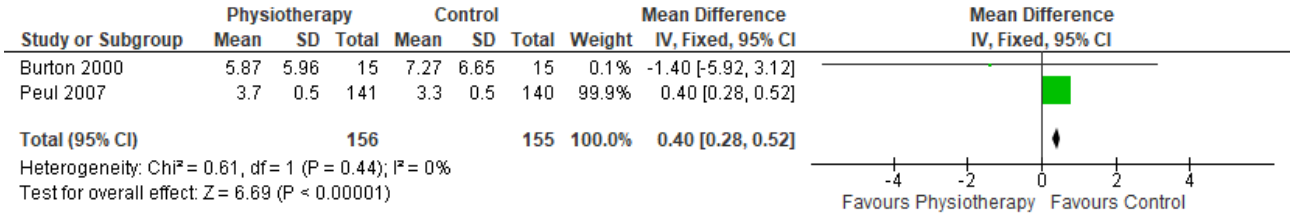


Figure 4. Forest plot disability long term (> 48weeks)



Chapter 4: Discussion

This systematic review including 8 studies for an overall cohort of 951 participants diagnosed with chronic sciatica, critically evaluates the comparative efficacy of physiotherapy interventions, against control treatments. Our meta-analyses showed that the reduction at short-term disability is favourable to physiotherapy treatment. However, results at long-term shifted in favour of the control group, although with minimal difference .

It must be noted that studies include in the disability meta-analysis were those with control group referred to invasive or minimally invasive strategies, such as disc herniation removal [18], microdiscectomy [22], and single injection of chymopapain [15]. These findings could suggest a potential superiority of invasive or minimally invasive approaches over conservative treatments, in diminishing disability among chronic sciatica patients diagnosed with disc herniation. Albert et al.[16] further delineates the enhanced benefits of specific physiotherapeutic treatments over sham exercises.

Also, in response to the initial questions, "What are the specific physiotherapy interventions that have been used in the management of chronic sciatica?" and "What are the factors that may influence the effectiveness of physiotherapy interventions in patients with chronic sciatica?" there is no clear evidence that any standard physiotherapy treatment or factors are more effective, than others.

The main limitation found in most of the studies included is the low number of participants and a lack of consistent outcome measures and follow-up periods among them. However, the strength of this systematic review lies in its strict criteria for including studies that had explicitly defined the patient population as those suffering from chronic sciatica. Furthermore, the control group did not include any specific physiotherapeutic treatment. This approach allowed for a clear understanding of the differences in improvements in pain and disability between those who opted for physiotherapy and those who referred to other non-physiotherapeutic methods.

However, more evidence is needed to allow patients suffering from chronic sciatica to determine whether it's better to proceed directly with invasive or minimally invasive treatments or to continue with physiotherapy. Peul et al.[18] suggests that patients are more likely to choose surgery if they are not able to cope with leg pain, find the natural course of recovery from sciatica unacceptably slow, and want to minimize the time to recovery from pain. Patients whose pain is controlled in a manner that is acceptable to them may decide to postpone surgery in the hope that it will not be needed. Although both strategies have similar outcomes after 1-year, early surgery remains a valid treatment option for well-informed patients.

Chapter 5: Conclusion

In conclusion, the existing research on the effectiveness of physiotherapy interventions for individuals experiencing clinically diagnosed chronic sciatica does not offer sufficient evidence to formulate detailed guidance on their impact in alleviating pain or disability. This uncertainty might stem from various aspects such as inconsistencies in clinical and research methods, statistical variances, and a general absence of trials with rigorous methodological standards.

For future research, it is paramount to establish a more standardized criterion for what constitutes chronic sciatica, potentially by setting a uniform baseline for the duration of symptoms. This standardization could enhance the homogeneity in study populations and contribute more precise results. Furthermore, there is a need for studies that specifically compare outcomes between physiotherapy and non-physiotherapy interventions, intentionally omitting physiotherapy treatments in the control groups. Such research designs would offer more clarity on the distinct value provided by physiotherapy itself. In addition, when therapeutic exercises are part of the treatment protocol, studies should meticulously report the type, length, and frequency of physiotherapy treatment administered. Adherence to a well-defined set of guidelines for these treatments could not only enhance the consistency of care, but also facilitate the reporting of more accurate and uniform findings.

With the aim of reducing clinical variability, employing up-to-date physiotherapy interventions, and committing to the highest levels of methodological rigor, future research can be informative in identifying the most efficient physiotherapy strategies for patients suffering from chronic sciatica.

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Appendices

Appendix A. Search Syntax

PUBMED

((physiotherapy OR physical therapy OR PT OR physio OR physical rehabilitation OR rehabilitation therapy OR sports therapy OR manual therapy OR musculoskeletal therapy) AND (sciatica OR chronic sciatica OR sciatic nerve pain OR sciatic nerve compression OR lumbar radiculopathy OR radicular pain OR piriformis syndrome OR back pain OR leg pain OR herniated disc OR spinal stenosis OR radicular OR radiculopathy OR disc OR disk OR back pain OR lumbago OR dorsalgia OR coccydynia OR lumbar OR lumbosacral) AND (pubstatusaheadofprint OR publisher[sb] or pubmednotmedline[sb]))

CENTRAL (2019)

#1 MeSH descriptor: [Physical Therapy Modalities] explode all trees

#2 MeSH descriptor: [Rehabilitation] explode all trees

#3 MeSH descriptor: [Musculoskeletal Manipulations] explode all trees

#4 MeSH descriptor: [Exercise Therapy] explode all trees

#5 MeSH descriptor: [Musculoskeletal Manipulations] explode all trees

#6 MeSH descriptor: [Electric Stimulation Therapy] explode all trees

#7 MeSH descriptor: [Hydrotherapy] explode all trees

#8 MeSH descriptor: [Implosive Therapy] explode all trees

#9 physiotherap*:ti,ab,kw

#10 physical therap*:ti,ab,kw

#11 manual therapy:ti,ab,kw

#12 manipulative therapy:ti,ab,kw

#13 ((therapeutic or therapy) near/2 exercise):ti,ab,kw

#14 electrotherapy or TENS or transcutaneous electrical nerve stimulation or therapeutic ultrasound or interferential or shortwave diathermy or laser therapy or heat therapy or cryotherapy:ti,ab,kw

#15 tactile sensory discriminatory training:ti,ab,kw

#16 sensory-motor integration:ti,ab,kw

#17 sensory-motor re-tuning:ti,ab,kw

#18 hydrotherapy:ti,ab,kw

#19 (pain near/3 (advice or education)):ti,ab,kw

#20 (manipulation or massage or de-sensiti?ation or mobili?ation):ti,ab,kw

#21 (Bio-Electro-Magnetic-Energy-Regulation):ti,ab,kw

#22 (neuromuscular electrical stimulation):ti,ab,kw

#23 (Electromagnetic Field Therapy):ti,ab,kw

#24 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23

#25 MeSH descriptor: [Back Pain] explode all trees

#26 ((lumb* or back) near pain)

#27 dorsalgia or lumbago or ischialgia or coccydynia or backache* or back ache*

#28 back disorder* or spondylosis or coccyx

#29 MeSH descriptor: [Sciatic Neuropathy] explode all trees

#30 MeSH descriptor: [Sciatica] explode all trees

#31 MeSH descriptor: [Radiculopathy] explode all trees

#32 MeSH descriptor: [Polyradiculopathy] explode all trees

#33 sciatic* or radicul* or polyradicul*

#34 discitis or diskitis

#35 ((disc* or disk*) near (degenerat* or prolapse* or herniat*))

#36 MeSH descriptor: [Intervertebral Disc] explode all trees

#37 MeSH descriptor: [Intervertebral Disc Displacement] explode all trees

#38 MeSH descriptor: [Intervertebral Disc Degeneration] explode all trees

#39 MeSH descriptor: [Lumbar Vertebrae] explode all trees

#40 MeSH descriptor: [Nerve Compression Syndromes] explode all trees

#41 MeSH descriptor: [Spinal Osteophytosis] explode all trees

#42 spinal osteophytosis

#43 MeSH descriptor: [Spinal Nerve Roots] explode all trees

#44 MeSH descriptor: [Piriformis Muscle Syndrome] explode all trees

#45 sciatic nerve compression

#46 sciatic nerve pain

#47 lumbar radiculopathy

#48 radicular pain

#49 back pain with leg pain

#50 #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49

#51 #24 AND #50

MEDLINE

#1 physiotherapy*.tw.

#2 physical therapy*.tw.

#3 PT*.tw.

#4 physio*.tw.

#5 physical rehabilitation*.tw.

#6 rehabilitation therapy*.tw.

#7 sports therapy*.tw.

#8 manual therapy*.tw.

#9 musculoskeletal therapy*.tw.

#10 therapeutic exercise.tw.

#11 electrotherapy.tw.

#12 TENS.tw.

#13 transcutaneous electrical nerve stimulation.tw.

#14 therapeutic ultrasound.tw.

#15 interferential.tw.

#16 shortwave diathermy.tw.

#17 laser therapy.tw.

#18 heat therapy.tw.

#19 cryotherapy.tw.

#20 hydrotherapy.tw.

#21 manipulation.tw.

#22 massage.tw.

#23 desensitization.tw.

#24 mobilization.tw.

#25 implosive therapy.tw.

#26 bioelectromagnetic energy regulation.tw.

#27 neuromuscular electrical stimulation.tw.

#28 electromagnetic field therapy.tw.

#29 sensory-motor re-tuning.tw.

#30 musculoskeletal therapy*.tw.

#31 or/ 1-30

#32 randomized controlled trial.pt.

#33 controlled clinical trial.pt.

#34 pragmatic clinical trial.pt.

#35 comparative study.pt.

#36 random*.ti,ab,kw.

#37 placebo.ti,ab,kw.

#38 control*.ti,ab,kw.

#39 prospective*.ti,ab,kw.

#40 compar*.ti,ab,kw.

#41 trial.ti,ab,kw.

#42 groups.ti,ab,kw.

#43 drug therapy.fs.

#44 randomly.ab.

#45 or/32-44

#46 chronic sciatica.tw,kf.

#47 sciatic nerve pain.tw,kf.

#48 sciatic nerve compression.tw,kf.

#49 lumbar radiculopathy.tw,kf.

#50 radicular pain.tw,kf.

#51 piriformis syndrome.tw,kf.

#52 back leg pain.tw,kf.

#53 herniated disc.tw,kf.

#54 spinal stenosis.tw,kf.

#55 back disorder*.tw,kf.

#56 dorsalgia.tw,kf.

#57 exp Back Pain/

#58 (backache* or back ache*).tw,kf.

#59 ((lumb* or back) adj3 pain).tw,kf.

#60 coccyx.tw,kf.

#61 coccydynia.tw,kf.

#62 sciatic*.tw,kf.

#63 exp sciatic neuropathy/

#64 spondylosis.tw,kf.

#65 lumbago.tw,kf.

#66 ischialgia.tw,kf.

#67 (discitis or diskitis).tw,kf.

#68 ((disc* or disk*) adj3 degenerat*).tw,kf.

#69 ((disc* or disk*) adj3 prolapse*).tw,kf.

#70 ((disc* or disk*) adj3 herniat*).tw,kf.

#71 Intervertebral Disc/

#72 exp Intervertebral Disk Displacement/

#73 exp Intervertebral Disc Degeneration/

#74 Lumbar Vertebrae/

#75 Nerve Compression Syndromes/

#76 Spinal Osteophytosis/

#77 Radiculopathy/

#78 Polyradiculopathy/

#79 radicul*.tw,kf.

#80 polyradicul*.tw,kf.

#81 arachnoiditis.tw,kf.

#82 or/46-81

#83 31 AND 45 AND 82

PsycINFO

1 clinical trials/

2 control*.mp.

3 RCT.mp.

4 trial.mp.

5 (sing* adj2 blind*).mp.

6 (doub* adj2 blind*).mp.

7 exp Placebo/

8 placebo*.mp.

9 latin square.mp.

10 random*.mp.

11 prospective studies/

12 prospective*.mp.

13 compar*.mp.

14 treatment effectiveness evaluation/

15 evaluation.mp.

16 exp Posttreatment Followup/

17 (followup or follow up).mp.

18 or/1-17

19 "Back (Anatomy)"/

20 exp back pain/

21 lumbar spinal cord/

22 spinal column/

23 ((lumb* adj3 pain) or (back adj3 pain)).mp.

24 dorsalgia.mp.

25 lumbago.mp.

26 spondylosis.mp.

27 coccyx.mp.

28 back disorder$.mp.

29 coccydynia.mp.

30 (backache or back ache).mp.

31 ischialgia.mp.

32 sciatic$.mp.

33 Spinal Nerves/

34 (radicul$ or polyradicul$).mp.

35 (discitis or diskitis).mp.

36 ((disc$ or disk$) adj3 (degenerat$ or herniat$ or prolapse$)).mp.

37 spinal osteophytosis.mp.

38 arachnoiditis.mp.

39 or/19-38

40 Desensitization, Psychologic+

41 Transcranial direct current stimulation

42 Transcranial Direct Current Stimulation

43 "Pain-contingent treatment*"

44 "Electromagnetic Field Therapy"

45 neuromuscular electrical stimulation

46 "Bio-Electro-Magnetic-Energy-Regulation"

47 Behavior Therapy+

48 (manipulation or massage or de-sensitization or mobilization)

49 (pain N3 (advice or education))

50 hydrotherapy

51 Manual Therapy

52 (electrotherapy or TENS or "transcutaneous electrical nerve stimulation" or "therapeutic ultrasound" or interferential or "shortwave diathermy" or "laser therapy " or "heat therapy" or cryotherapy)

53 Transcutaneous Electrical Nerve Stimulation (Iowa NIC)

54 ((therapeutic or therapy) N2 exercise)

55 manipulative therapy

56 manual therapy

57 "Physical therap*"

58 physiotherap*

59 Physical Therapy+

60 or/40-59

61 18 AND 39 AND 6

Appendix B. Table of Characteristics of included studies

ARTICLE	Author/s	Year of publication/country	Population/ Inclusion and exclusion criteria	Experimental intervention	Control intervention	Primary outcome/s	Secondary outcome/s	Results
EPIDURAL NEUROPLASTY VERSUS PHYSIOTHERAPY TO RELIEVE PAIN IN PATIENTS WITH SCIATICA: A PROSPECTIVE RANDOMIZED BLINDED CLINICAL TRIAL	Andreas Veihelmann, H.J. Refior	2006, Germany	**I:** Radicular pain with a corresponding nerve root compressing substrate **E:** Paralysis, spinal canal stenosis, rheumatologic disease, and malignancy	Physiotherapy	Epidural neuroplasty	Visual analog scale (VAS) scores for back pain (VASbp) and leg pain (VASlp), Oswestry disability Index (ODI), Gerbershagen score (GHS),and a quantified score for the use of analgesics	-	A significant difference in the reduction of VAS bp and VAS lp ($P < 0.02$) as well as in the Owestry scores ($P < 0.01$) at 3 months in the ENP group compared to the conservatively treated group. Moreover, after 3, 6, and 12 months the VAS bp and VAS lp (both $P < 0.01$) as well as the ODS ($P < 0.02$) were significantly reduced only in the group with ENP in contrast to the group with conservative treatment.
THE EFFICACY OF SYSTEMATIC ACTIVE CONSERVATIVE TREATMENT FOR PATIENTS	Hanne B. Albert, Med Sci	2011, Denmark	**I:** radicular pain in one or both legs, with pain radiating to the knee or below between 2 weeks-1year. Leg pain severity rated > 3 on a 1 to 10 scale. **E**: cauda equina syndrome, previous back surgery, spinal tumors, pregnancy,	"Symptom-guided exercises". consisted of back-related exercises: directional end-range exercises and postural	sham exercises: low-dose exercises to simulate an increase in systemic blood circulation. The treatment period lasted for 8 weeks for both	Activity Limitation by Roland Morris Disability Questionnaire Index (RDQI),	Global Improvement: (5-point Likert scale), number of neurological signs, quality-adjusted life years	Active conservative treatment is an efficacious treatment for patients with severe sciatica. Patients who had symptoms and

WITH SEVERE SCIATICA			not Danish as first language, depression or hear failure.	instructions guided by the individual patient's directional preference (based on the McKenzie method of assessing pain-related physical impairment). Furthermore, these patients were instructed in stabilizing exercises for the transverse abdominis and multifidus muscles and dynamic exercises for the outer layers of the abdominal wall and back extensors.	intervention and control groups.	leg pain on 0-10 scale.	(QUALY): Measured using the EuroQOL (EQ-5D) with adjusted Danish scores, composite score for total leg Pain, sick Leave: measured by self-reporting the number of sick leave days, Patients' Satisfaction with Information.	clinical findings that would qualify them for surgery in most hospitals improved greatly with active conservative treatment. Although the patients had greater faith in the sham exercises before treatment, the symptom-guided exercises were superior for most outcomes.
THE LONG-TERM OUTCOME OF LUMBAR FUSION IN THE SWEDISH LUMBAR SPINE STUDY	Tycho Tullberg Hedlund	2015, Sweden	**I:** Age 25-65 years, severe CLBP of at least 2 years duration with no signs of nerve root compression, sick leave, or "equivalent" major disability for at least 1 year **E:** previous spine surgery except for successful removal of a herniated disc, spondylolysis, spondylolisthesis, new or old fractures, infection,	Non-specific physiotherapy	Lumbar fusion	Global Assessment (GA) in which the patient classified the outcome as "much better," "better," "unchanged," or "worse."	Oswestry disability Index (ODI), visual analogue scale (VAS) for back pain, VAS for leg pain, patient satisfaction, Zung depression scale, work status, pain	The analysis of VAS leg pain between the surgical group and the conservative group showed no significant difference. The mean VAS leg pain scores were similar in both

			inflammatory process, or neoplasm				frequency, and pain medication.	groups at long-term follow-up. DM= 5.6 (−6.8 to 18.0) p-value: 0.376. No statistically significant differences for other primary and secondary outcomes.
SURGERY VERSUS PROLONGED CONSERVATIVE TREATMENT FOR SCIATICA	Wilco C. Peul, Bart W. Koes	Netherlands, 2007	**I:** 18 to 65 years with disk herniation, lumbosacral radicular syndrome that had lasted for 6 to 12 weeks. **E:** cauda equina syndrome, muscle paralysis, or insufficient strength to move against gravity, occurrence of another episode of symptoms similar to those of the current episode during the previous 12 months, previous spine surgery, bony stenosis, spondylolisthesis, pregnancy, or severe coexisting diseases.	physiotherapy	Surgery: symptomatic disk herniation was removed by a minimal unilateral transflaval approach with magnification	Roland Morris Disability Questionnaire Index (RDQI) for sciatica, the 100-mm visual-analogue scale for leg pain, 7-point Likert self-rating scale of global perceived recovery assessed at 2, 4, 8, 12, 26, 38, and 52 weeks.	Medical Outcomes Study 36-Item Short-Form General Health Survey (SF-36) scale, the Sciatica Frequency and Bothersomeness Index, and a 100-mm visual-analogue scale for health perception scheduled at 8, 26, and 52 weeks.	There was no significant overall difference in disability scores during the first year (P=0.13). Relief of leg pain was faster for patients assigned to early surgery (P<0.001). Patients assigned to early surgery also reported a faster rate of perceived recovery (hazard ratio, 1.97; 95% confidence interval, 1.72 to 2.22; P<0.001).
SINGLE-BLIND RANDOMISED CONTROLLED TRIAL OF CHEMONUCLEOLYSIS AND	A. Kim Burton, John Cleary	2000, England	**I**: 18–60 years, Unilateral unremitting sciatica, Positive SLR, radiculopathy limited to a single nerve root, unequivocal evidence of single-level non-	The manipulative treatment comprised a few 15 min. treatment	A single injection of chymopapain	Leg pain, back pain with seven-point 'annotated thermometer'	Cost analysis	Both treatment groups showed statistically significant improvement for mean scores on

MANIPULATION IN THE TREATMENT OF SYMPTOMATIC LUMBAR DISC HERNIATION			sequestrated lumbar disc herniation on either computed tomography (CT) or magnetic resonance imaging (MRI) **E**: Sequestrated herniation, Multiple level marked lumbar degenerative changes, Previous lumbar surgery or chemonucleolysis or manipulative treatment for the present complaint.	sessions over a period not exceeding 12 weeks, with the bulk of the sessions occurring in the first 6 weeks.		rating scales and Roland Morris Disability Index (RDQI) at 2-6 weeks and 12 months.		all three measures, with no statistically significant differences between groups, although there were between-group differences during the first few weeks. in this cohort, suggest that the extra principal costs incurred over 1 year for treatment by chemonucleolysis rather than manipulation would be of the order of £300 per patient.
COMPARING RADIAL EXTRACORPOREAL SHOCKWAVE THERAPY AND CORTICOSTEROID INJECTION IN THE TREATMENT OF PIRIFORMIS SYNDROME: A RANDOMIZED	T. Ahadi, Arash Babaei-Ghazani	2022, Iran	**I**: >20 y, Pace sign, Freiberg sign, and FAIR test, VAS 5-10 in Buttock area who did not respond to conservative treatments, the duration of symptoms at least 3 months. **E:** lumbar discopathy, signs of coxopathy, mechanical or inflammatory disorders of the sacroiliac joint, any inflammatory or infectious pelvic disorders, pregnancy, history of lumbar surgery, history of lumbar epidural block in last 6 months.	r-ESWT,1 session per week with an interval of 7 days in 3 consecutive weeks	Methylprednisolone injection (1 mL of methylprednisolone (40 mg) mixed with 1 mL of 1% lidocaine)	VAS, SF-36	-	Both groups had a significant improvement in pain and quality of life compared to before the intervention with no significant difference between, in the quarterly follow-up. However, according to the VAS, in the shockwave group improvement was

CLINICAL TRIAL								seen in the first follow-up while not seen in the corticosteroid group (P-value <0.001 and p-value 1.00, respectively). According to the SF-36 questionnaire, the overall score in both groups had a significant improvement (Pvalue <0.05)
MANIPULATION OR MICRODISCECTOMY FOR SCIATICA? A PROSPECTIVE RANDOMIZED CLINICAL STUDY	Gordon McMorlandd, John Hurlbert	2010, Canada	**I:** leg-dominant symptoms with objective signs of nerve root tethering ± neurologic deficit correlated with evidence of appropriate root compression, failed at least 3 months of nonoperative management. **E:** Cauda equina syndrome, Systemic or visceral disease, Previous surgery at symptomatic level, Concurrent treatment involving spinal manipulation, Spondylolisthesis grade III or IV	Manipulation therapy	Microdiscectomy	SF-36, McGill Pain Questionnaire, Aberdeen Back Pain Scale, and Roland-Morris Disability Index (RDQI) at 3, 6, 12, 24, and 52 weeks.	-	Intent-to-treat repeated measures analysis of variance failed to reveal any significant differences in McGill pain, Roland Morris disability index, or SF-36 total scores based on type of treatment received.60% of patients with sciatica and had failed other medical management benefited from spinal manipulation to

								the same degree as if they underwent surgical intervention. Of the 40% of patients that showed unsatisfactory results with spinal manipulation, subsequent surgical intervention conferred excellent outcome.
SPINAL MANIPULATION, EPIDURAL INJECTION, AND SELF-CARE FOR SCIATICA: A PILOT STUDY FOR A RANDOMIZED CLINICAL TRIAL	Gert Branford, Anderson, MD	USA,2003	**I:**18 to 65 years of age with a current sciatica episode that had lasted 4 weeks or longer. With or without neurologic signs. **E:** spinal fracture, spinal stenosis, or other diagnoses, including visceral diseases, compression fractures, and metastases. Progressive neurological deficits, cauda equina syndrome, surgical lumbar spine fusion, a leg pain score of less than 3 (on a 0-10 scale)	Chiropractic treatment; low-amplitude, high-velocity, manual spinal manipulation, and mobilization; flexion distraction procedures; light soft tissue massage; heat; and cold	1.Self-Care consisted of advice regarding postural instructions and practical demonstrations of proper body mechanics performed with patient participation. In addition, patients were given a self-care booklet for low-back pain and sciatica patients. 2. Epidural steroid injection. 3 injections over a 12-week period	level of leg pain and low back pain for the past week were each rated using separate 11-box ordinal scales (0 = no symptoms, 10 = worst pain possible) (), Roland Morris Disability Index (RDQI) and Oswestry Disability Questionnaire at 3-12-52 weeks.	-	No group comparisons were planned or performed because of the small sample size.). At week 12, the outcome measures indicating the most change were the Oswestry questionnaire (mean, 22.9; SD, 19.9; effect size [ES], 1.8), leg pain severity (mean, 2.9; SD, 1.7; ES, 1.7). After 52 weeks,

								the outcome measure showing the most change was leg pain severity (mean, 2.3; SD, 2.6; ES, 1.35), followed by the Oswestry questionnaire (mean, 15.6; SD, 20; ES, 1.2)