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Physiotherapy approaches for coccydynia: evaluating effectiveness and clinical outcomes

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Abstract

Background Coccydynia, or tailbone pain, significantly impairs patients' quality of life, affecting daily activities such as sitting and transitioning between positions. It can arise from trauma, childbirth, repetitive strain, or idiopathic causes. Although conservative treatments like physiotherapy are widely employed, their clinical effectiveness remains uncertain due to inconsistent methodologies and varied outcomes reported in the literature.

Objective To evaluate the effectiveness of physiotherapy interventions, in reducing pain and improving functional outcomes in patients with coccydynia.

Methods A comprehensive search was conducted in PubMed, PEDro, Scopus, and Web of Science databases, including randomized controlled trials (RCTs) published between 1963 and 2024. The methodological quality was assessed using the PEDro scale and the Cochrane risk-of-bias tool. Inclusion criteria focused on studies evaluating conservative physiotherapy interventions in patients with coccydynia.

Results Nine RCTs comprising 532 participants were included. The Cochrane risk-of-bias assessment indicated a moderate to high risk in several domains, particularly in allocation concealment and blinding. ESWT demonstrated significant reductions in pain and improvements in functional outcomes, with benefits sustained up to six months in some cases. Manual therapy was particularly effective in recent-onset coccydynia, although its efficacy diminished over time. kinesiotaping (KT) improved pain perception but showed limited impact on disability measures. Six studies were rated as moderate to high quality (PEDro scores 6–7), while three were low quality (scores ≤ 4). Despite promising results, heterogeneity in interventions, small sample sizes, and short follow-up periods limited definitive conclusions.

Conclusion Physiotherapy interventions, particularly ESWT, are promising conservative treatment options for coccydynia. However, methodological variability and limited long-term follow-up hinder definitive conclusions. Future research should prioritize standardized protocols, larger sample sizes, and extended follow-up to strengthen the evidence base for clinical recommendations.

Keywords Coccydynia, Physical therapy modalities, Extracorporeal shock wave therapy, Manual therapy, Tape therapy, Systematic review

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Introducción

Coccydynia is defined as pain in and around the coccyx that intensifies during sitting or certain postural transfers [1, 2]. This condition can lead to chronic pain and functional impairment, significantly affecting patients' quality of life [3]. Although its exact incidence remains unknown, it is estimated to account for approximately 1% of all low back pain cases [4]. The clinical and social impact of this condition highlights the importance of effective and accessible treatment strategies [5].

Coccydynia is more prevalent in women than in men, with a 5:1 ratio, likely due to differences in pelvic anatomy and hormonal influences [6–8]. Other risk factors include obesity, which alters pelvic rotation and increases coccygeal pressure [9, 10], and traumatic injuries, such as falls or repetitive microtrauma from prolonged sitting or high-impact sports (e.g., cycling, horseback riding).

The most common causes of coccydynia include direct axial trauma, obstetric-related injuries, and chronic overuse, leading to inflammation of the sacrococcygeal joint [11].

In some cases, abnormal coccygeal mobility with postural changes, tumors, infections, or difficult childbirth may explain the pain in some patients. However, in around one-third of the patients, the cause is idiopathic, where no clear traumatic, anatomical, or pathological factor is identified. This subtype remains challenging in clinical practice due to the lack of clear etiology and standardized treatment approaches [12]. Less frequent etiologies include referred pain from visceral structures (e.g., rectum, sigmoid colon, urogenital system) or tumors in the sacrococcygeal region [13].

Diagnosis of coccydynia is primarily based on patient history and clinical examination, sometimes supported by dynamic X-rays taken in standing and sitting positions to assess coccygeal mobility. A mobility angle exceeding 25 degrees is considered abnormal [2, 14, 15].

Treatment options range from conservative measures, such as specialized cushions, sitz baths, and nonsteroidal anti-inflammatory drugs (NSAIDs) [16], to manual intrarectal techniques, pharmacological nerve blocks, radiofrequency ablation, and, in refractory cases, surgical coccygectomy [17]. Among conservative approaches, physiotherapy plays a crucial role in managing pain, mobility restrictions, and functional impairments. Various techniques aim to reduce pain, improve coccyx mobility, and enhance the flexibility of surrounding soft tissues. Manual therapy and soft tissue mobilization may help alleviate muscle spasms, while postural education, ergonomic adjustments, and defecation mechanics training are often recommended to minimize coccygeal stress [5]. Conservative therapy, including physiotherapy-based approaches, has been reported to achieve success in 90% of patient [18].

Methods

This systematic review aimed to evaluate the effectiveness of conservative physiotherapy interventions used in the management of coccydynia. While the focus was not limited to any single technique, the search strategy targeted commonly studied modalities such as ESWT, manual therapy, and kinesiotaping (KT), which were the most frequently reported interventions in the included randomized controlled trials.

Study design

This systematic review was conducted with the agreement of three independent evaluators, ensuring methodological rigor and reducing bias during the selection and analysis processes. The predefined protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO/NHS) under the number CRD42024548052. Reporting adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [19], ensuring methodological transparency and reproducibility.

The study question was framed using the PICO (Population, Intervention, Comparison, and Outcomes) framework [20]. The research question was "Can physiotherapy be considered an effective conservative option for the treatment of coccydynia?"

Search strategy

A comprehensive literature search was conducted between May 20, 2024, and July 13, 2024, in four major databases: PubMed, PEDro, Scopus, and Web of Science. The search strategy was designed to identify all relevant studies on physiotherapy interventions for coccydynia. Eligibility was determined by predefined inclusion and exclusion criteria.

Boolean operators ("OR" and "AND") were applied to optimize the search results. Additional manual searches of journals and reference lists were conducted to identify potentially relevant studies not captured in the initial database queries.

The full search strategies for each database, including specific search strings and filters, are provided in Appendix A.

Eligibility criteria

The inclusion and exclusion criteria for this review were established to ensure the selection of relevant and high-quality studies.

Inclusion criteria

Studies were included if they met the following criteria:

- Study design: Randomized controlled trials (RCTs).

- Population: Adults (≥ 18 years old) with a primary diagnosis of coccydynia.
- Intervention: Physiotherapy-based treatments.
- Outcomes: Pain intensity, quality of life, and/or functional capacity.
- Publication status: Peer-reviewed studies published between 1963 and 2024.

Exclusion criteria

Studies were excluded if they met any of the following criteria:

- Non-RCT designs, including observational studies, case series, and case reports.
- Studies focusing on surgical or pharmacological treatments without a physiotherapy component.
- Studies lacking sufficient methodological details (e.g., missing statistical analysis or unclear intervention protocols).
- Duplicate publications or studies without full-text availability.

Study selection and data extraction

The study selection process was conducted by three independent reviewers who screened articles based on their titles, abstracts, and, when necessary, full texts. Discrepancies regarding study inclusion were resolved through consensus. Duplicate records were eliminated, and all references were manually verified for accuracy.

Studies were selected based on predefined eligibility criteria. Risk of bias was assessed using the Cochrane risk-of-bias tool and the PEDro scale. Studies classified as having a high risk of bias were included but their results were interpreted with caution. Sensitivity analyses were performed when applicable to assess the impact of studies with a high risk of bias on the overall findings.

Study outcome

This review analyzed several key Study outcome to assess the effectiveness of physiotherapy interventions for coccydynia. Pain intensity, a primary focus, was measured using validated tools like the (Visual Analogue Escale (VAS) and the Pain Numeric Rating Scale (PNRS), offering insights into patients' perceived pain relief.

Functional outcomes were evaluated through instruments such as the Oswestry Disability Index (ODI) and Short-Form Health Survey (SF-36), which assessed the impact of coccydynia on daily activities and overall quality of life. These tools complemented subjective pain measures by providing a broader understanding of treatment benefits.

Objective measures, including the Pressure Pain Threshold (PPT) and Magnetic Resonance Imaging (MRI), added quantitative data, highlighting changes in pain sensitivity and structural alterations in the coccyx associated with clinical improvement.

Additional study outcomes, such as pain-free sitting duration and the number of therapy sessions, provided intervention-specific insights, while follow-up periods, ranging from immediate post-treatment to six months, limited the evaluation of long-term effectiveness.

Together, these study outcomes offered a robust framework for understanding the clinical and functional impacts of physiotherapy interventions for coccydynia.

Quality assessment

The methodological quality of the selected studies was assessed using the PEDro scale [21] and the Cochrane Collaboration's risk of bias tool [19].

Cochrane tool is specifically designed to evaluate the methodology of scientific evidence in systematic reviews and provides a detailed analysis of the included RCTs. It examines six levels of bias. These evaluations revealed varying levels of methodological rigor across the studies, with some presenting potential limitations related to blinding and allocation concealment. The detailed findings are summarized in Table 1, which highlights the strengths and weaknesses of the included studies. This assessment ensures a comprehensive understanding of the reliability of the presented evidence.

The PEDro scale evaluates internal validity and statistical information across 11 criteria. Studies with scores of ≥ 6 were considered moderate to high quality, while those with scores ≤ 3 were deemed low quality.

Data synthesis and reporting

As this systematic review does not include a meta-analysis, we followed the SWiM [15] (Synthesis Without Meta-analysis) reporting guideline to ensure transparent synthesis of the findings. he included studies were grouped based on the type of physiotherapy intervention: ESWT, manual therapy, KT, and biofeedback. Results were synthesized narratively for each outcome, including pain intensity, functional capacity, and objective measures (e.g., pressure pain threshold).

Due to heterogeneity in outcome measures, intervention protocols, and follow-up durations, statistical pooling was not feasible. None of the included studies reported effect sizes. Moreover, most did not provide the necessary statistical details (such as post-treatment standard deviations or group-level means) to allow for accurate estimation. Therefore, we did not attempt to calculate effect sizes post hoc. When possible, we reported the direction and magnitude of effects qualitatively.

The findings were organized by outcome, specifying the number of studies, participant characteristics, interventions, comparators, and reported results. The certainty of

Table 1 Cochrane risk of bias tool

Author	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessors	Incomplete outcome data	Selective reporting	Other sources of bias
Maigne JY et al. (2006)	✓	✓	×	×	✓	✓	!?
Shih Feng Lin et al. (2015)[22]	✓	✓	✓	✓	✓	×	!?
Wang D, Luo J et al. (2016)	✓	✓	!?	×	✓	✓	✓
Mohanty PP et al. (2017)	✓	!?	×	✓	✓	✓	×
Çağlar Okur, Sibel et al. (2017)	×	×	×	×	✓	✓	×
Canan Gönen Aydın et al. (2018)	×	×	×	×	✓	✓	×
Ahadi, T et al. (2020)	✓	!?	×	×	✓	✓	×
Ahadi T et al. (2020)	✓	✓	×	✓	✓	✓	×
Mosaad EH et al. (2023)	✓	✓	×	✓	×	✓	×

From: Higgins, J., D. Altman, et al. (2011). Chapter 8: Assessing risk of bias in included studies. Cochrane Handbook for Systematic Reviews of Interventions. J. Higgins and S. Green, Version 5.1.0. The Cochrane Collaboration

✓: Low risk of bias

×: High risk of bias

!?: Unclear risk of bias

evidence was not formally assessed due to the narrative nature of the synthesis.

Results

A total of 241 studies were retrieved from the database search. After removing 83 duplicates, 158 records remained for title and abstract screening. Of these, 98 were excluded, and 60 full-text articles were assessed for eligibility. Ultimately, nine randomized controlled trials (RCTs) met the inclusion criteria and were included in the final analysis (Fig. 1).

Among the 60 full-text articles reviewed, 51 were excluded for the following reasons: the intervention did not involve physiotherapy ($n = 18$); the study design was not a randomized controlled trial ($n = 12$); clinical outcomes were not adequately reported or clearly defined ($n = 8$); full text was unavailable ($n = 5$); the intervention was exclusively pharmacological or surgical ($n = 6$); and other reasons, such as insufficient methodological detail or duplicate publication ($n = 2$). These reasons are detailed in the PRISMA 2020 flow diagram (Fig. 1).

The total sample size across the nine included studies was 532 patients. The results provide insight into the effects of various physiotherapy interventions, such as manual therapy, extracorporeal shock wave therapy (ESWT), and kinesiotaping (KT), on pain relief, functional outcomes, and quality of life. The findings are summarized in Table 2.The results provide insight into the impact of various physiotherapy interventions, such as manual therapy, ESWT, and KT, on pain relief, functional outcomes, and quality of life. Below, the findings are presented in Table 2.

Study characteristics

The selected studies investigated various physiotherapy approaches for managing coccydynia, encompassing manual therapy, ESWT, KT, and biofeedback. These interventions targeted pain reduction and functional improvement, measured using validated tools such as the VAS and the ODI. Follow-up periods varied between studies, ranging from immediate post-treatment assessments to evaluations extending up to six months. The diversity in intervention methods and assessment timelines provides a comprehensive understanding of physiotherapy's potential benefits for coccydynia.

The methodological quality assessment using the PEDro scale and the Cochrane risk-of-bias tool showed that six studies were rated as moderate to high quality (scores 6–7), while three were of low quality (scores ≤ 4). The primary sources of bias identified were related to blinding of participants and allocation concealment (Table 3).

Pain reduction

Pain reduction was evaluated in eight of the nine included studies [7, 10, 11, 15, 16, 23, 25, 29], using tools such as the VAS, PNRS, and the McGill Pain Questionnaire.

Three studies assessed the effects of ESWT. Lin et al. [34] compared ESWT with shortwave diathermy and interferential current in 41 patients, reporting significantly greater reductions in VAS and disability scores in the ESWT group. Gönen Aydın et al. [16] observed sustained improvements in pain and SF-36 scores at one and six months in 34 patients. Ahadi et al. [11] compared ESWT with corticosteroid injections and found longer-lasting pain relief in the ESWT group.

Maigne et al. [15] found moderate short-term pain relief after intrarectal mobilization compared to

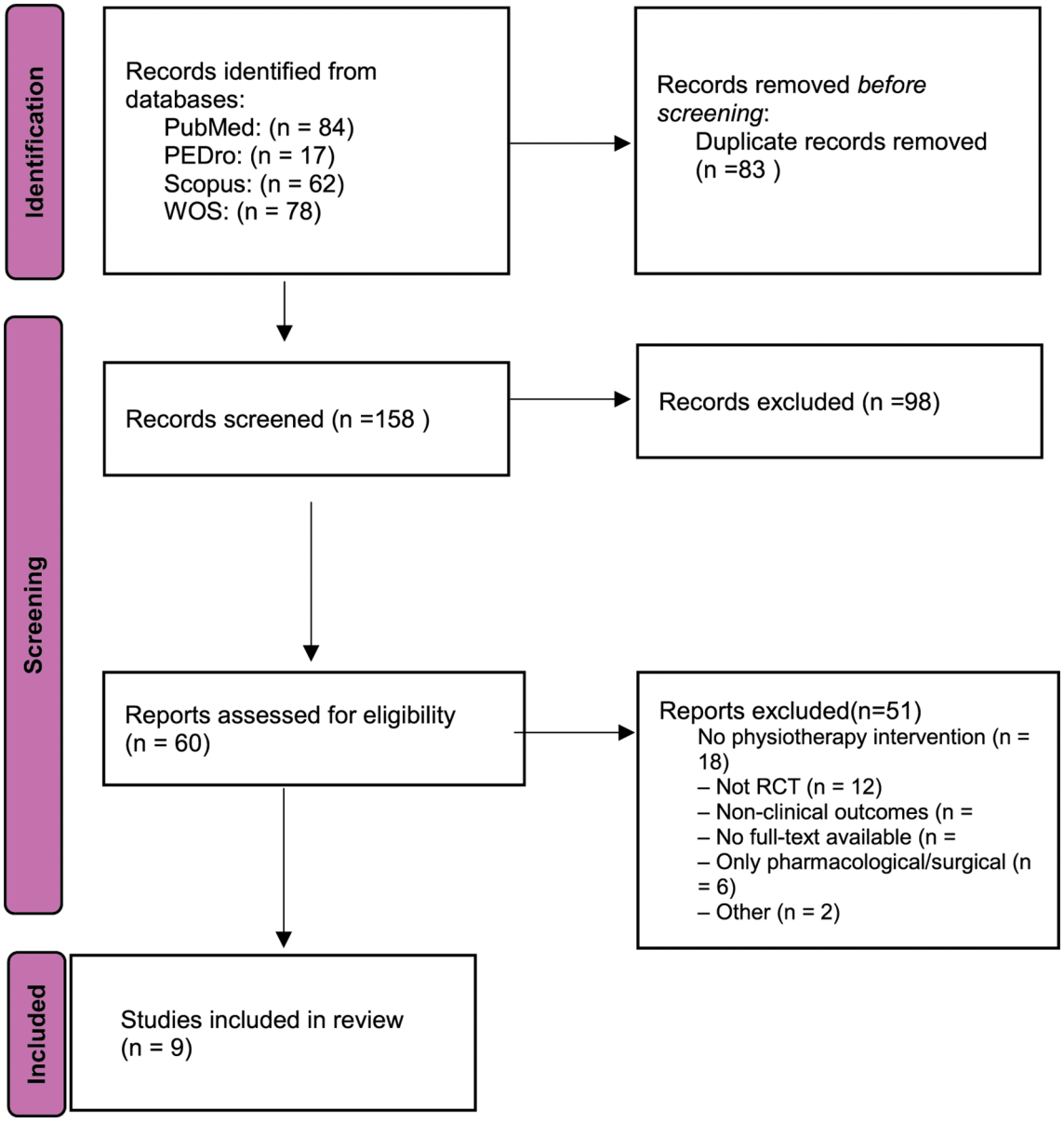


Fig. 1 Prisma Flow diagram. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71

shortwave therapy in 100 participants, although the effect diminished by six months. Okur & Vural [25] reported pain reduction following four weekly manual sessions in 19 patients with acute traumatic coccydynia.

Mohanty & Pattnaik [10], although not using standard pain scales, evaluated the effects of stretching and mobilization techniques using PPT and pain-free sitting duration. Their findings indicated increased PPT values and improved sitting tolerance, indirectly reflecting reduced pain sensitivity.

Mosaad et al. [7] observed significantly greater pain reduction in the group receiving KT combined with conventional therapy, compared to reverse Kegel exercises or conventional therapy alone.

Biofeedback was evaluated by Ahadi et al. [29] as an adjunct to corticosteroid injection. Although pain improved in both groups, the addition of biofeedback did not result in superior analgesic effects.

Wang et al. [23] reported significant reductions in VAS scores following external sacrococcygeal manipulation in a large cohort of 184 patients.

Functional outcomes

Six of the included studies evaluated functional outcomes using standardized tools such as the ODI, the Dallas Pain

Table 2 Description of the included study characteristics

Reference (Author and Year)	Objective	Protocol	Subjects / Average Age (Years)	Study outcome	Results	PEDro Scale
Maigne JY, Chatellier G, Faou ML, Archambeau M. (2006)	To evaluate the efficacy of intrarectal manual therapy in chronic coccydynia and determine factors predicting a positive outcome.	EG: Intrarectal manipulation for 5 min, including massage, levator ani stretching, and external sphincter energy technique. 3 sessions over 10 days. CG: Low-intensity shortwave therapy to the sacrum. 3 sessions over 10 days.	*N* = 100 EG: 50 CG: 50 EG: 45.2 ± 11.5 CG: 44.6 ± 13	VAS, McGill, Paris, and Modified Dallas Questionnaires.	Mild treatment effectiveness in EG. Success rates decreased between the first and sixth months.	6
Shih-Feng Lin, Yi-Jen Chen, et al. (2015)	To evaluate the effect of shockwave therapy (ESWT) in coccydynia.	EG: 1 session per week of ESWT (2000 impulses at 5 Hz, 3–4 bars) for 4 weeks. CG: Shortwave diathermy (SWD) at 27.12 MHz and interferential current (IFC) at 100 Hz, applied for 20 min each, 3 times per week for 4 weeks. Patients were prone with abdominal support pillows.	*N* = 41 EG: 20 CG: 21 EG: 44.75 ± 14.85 CG: 44.46 ± 18.88	VAS and ODI.	Both non-invasive treatments improved pain, disability, and subjective satisfaction, with better results for ESWT.	6
Wang D, Luo J, et al. (2016)	To assess the efficacy of external sacrococcygeal manipulation for treating coccydynia.	EG: External sacrococcygeal manipulation therapy, 3 times per week for 2 weeks. CG: Topical diclofenac diethylamine emulgel, applied twice daily for 2 weeks.	*N* = 184 EG: 91 CG: 93 EG: 39.63 ± 11.62 CG: 41.47 ± 11.56	VAS, sacrococcygeal pain observation scale, and pressure pain measurement at 4 levels.	The EG showed superior results in VAS and pressure pain measurements. Follow-up extended to 3 months.	6
Mohanty PP et al. (2017)	To compare the effects of piriformis and iliopsoas stretching combined with thoracic mobilization (GI2) and conventional therapy (CT) in treating coccydynia.	GI1: Piriformis and iliopsoas stretching (2 min). GI2: GI1 plus Maitland thoracic mobilization. CG: CT including seat cushioning, sitz baths, and phonophoresis. 5 sessions over 3 weeks.	*N* = 48 GI1: 16 GI2: 16 CG: 16 Average Age: Not specified	PPT, pain-free sitting duration, measured at baseline, 3 weeks, and 1 month after treatment.	Significant improvements in PPT and pain-free sitting duration in GI1 and GI2, with benefits persisting after 1 month.	4
Çağlar Okur, Sibel et al. (2018)	To evaluate the efficacy of manual therapy and muscle techniques in acute traumatic coccydynia.	EG: 1 session per week for 4 weeks. Intrarectal technique to align the coccyx to the midline. Lateral decubitus position with trunk, hip, and knee flexion. Post-isometric relaxation of levator ani with 5 contractions on each side. Patients were advised to avoid constipation, supine positions, and to use appropriate cushions.	*N* = 19 EG: 19 Average Age: 37.45 ± 9.85	Numerical Pain Scale (0–10) during sitting and movement.	Manual therapy techniques were effective for acute traumatic coccydynia. Pain reduction and satisfaction levels persisted after 1 month.	3
Canan Gönen Aydın et al. (2020)	To evaluate the efficacy of ESWT in treating coccydynia.	ESWT: 1 session per week, 3000 shockwaves at 0.2 mJ/mm^2, until VAS < 3. Average: 6–8 sessions.	*N* = 34 EG: 34 Average Age: 38.9 ± 14.3	VAS, SF-36, MRI. Measured at baseline and 1 and 6 months post-treatment.	ESWT effectively controlled pain in chronic coccydynia. At least 4 sessions recommended. Longer follow-up needed for further validation.	3
Ahadi, T et al. (2020)	To investigate the effects of biofeedback in treating coccydynia.	GI1 & GI2: Corticosteroid injections, cold application for 5 min every 6 h, Kegel exercises at home, and cushioning for sitting. GI2: 8 sessions of biofeedback (30 min, twice a week).	*N* = 30 GI1: 15 GI2: 15 GI1: 35.60 ± 10.61 GI2: 41.47 ± 8.96	VAS, Dallas Pain Questionnaire, SF-36 Quality of Life Scale. Follow-up: 6 months.	Adding biofeedback did not improve outcomes. Larger sample sizes are needed to clarify its potential benefits.	6

Table 2 (continued)

Reference (Author and Year)	Objective	Protocol	Subjects / Average Age (Years)	Study outcome	Results	PEDro Scale
Ahadi T et al. (2022)	To compare the efficacy of ESWT and corticosteroid injections in treating coccydynia.	GI1: ESWT, 1 session per week for 3 weeks (2000 shock-waves at 3–4 intensity, 5 Hz). GI2: Single corticosteroid injection into sacrococcygeal joint or coccyx tip. Both groups: Kegel exercises, avoidance of prolonged sitting, supine positions, and cushioning for sitting.	N = 34 GI1: 17 GI2: 17 GI1: 35.88 ± NA GI2: 36.88 ± NA	VAS (0-100), SF-36, Dallas Pain Questionnaire. Follow-up: 6 months.	Both treatments were effective. ESWT showed longer-lasting effects and is recommended as an alternative for patients who refuse injections.	7
Mosaad EH et al. (2023)	To compare the efficacy of KT combined with CT, reverse Kegel exercises with CT, and CT alone in post-colonoscopy coccydynia.	GI1: CT + KT, replaced every 72 h (7 strips, 2.5 cm width, tensioned from coccyx to each PSIS). GI2: CT + reverse Kegel (3 × 10, 5 s each). GI3: CT alone (iliopsoas/piriformis stretching, clamshell exercises). 3 sessions per week for 4 weeks.	N = 42 GI1: 14 GI2: 14 GI3: 14 GI1: 44.92 ± 6.20 GI2: 43.62 ± 5 GI3: 45.78 ± 5.38	PNRS and ODI	CT combined with KT is more effective than CT combined with reverse Kegel exercises for post-colonoscopy coccydynia. Regarding functional disability, no difference in outcomes one month after treatment.	7

CG: Control Group; CT: Conventional Therapy; EG: Experimental Group; ESWT: Extracorporeal Shock Wave Therapy; IFC: Interferential Current; MRI: Magnetic Resonance Imaging; ODI: Oswestry Disability Index; PEDro: Physiotherapy Evidence Database; PPT: Pressure Pain Threshold; RCT: Randomized Controlled Trial; SF-36: Short-Form Health Survey; SWD: Shortwave Diathermy; VAS: Visual Analogue Scale

Questionnaire, the Paris Questionnaire, and the SF-36 [7, 11, 15, 16, 25, 34]. Functional disability improved in all treatment groups across these studies.

Lin et al. [34] found significantly greater improvement in ODI scores in the ESWT group compared to those receiving shortwave diathermy and interferential current. Gönen Aydın et al. [16] observed increases in quality of life in SF-36 scores at one and six months after ESWT. Ahadi et al. [11] reported functional improvements in both the Dallas and SF-36 questionnaires, with better results in the ESWT group compared to corticosteroid injections.

Maigne et al. [15] described functional gains with intrarectal manipulation, particularly in the early weeks of treatment, assessed by the Dallas and Paris questionnaires, although the effect decreased over time. Okur & Vural [25], while not using standardized scales, noted improvements in daily function based on patient-reported recovery and ability to sit.

Mosaad et al. [7] found no significant differences in ODI scores between groups at one-month follow-up, despite better pain control in the KT group.

Objective measures

Mohanty & Pattnaik [10] used the pressure pain threshold (PPT) and pain-free sitting duration to assess the effectiveness of stretching and thoracic mobilization techniques in 48 patients. The authors found significant improvements in PPT and an increase in the time participants could sit without pain.

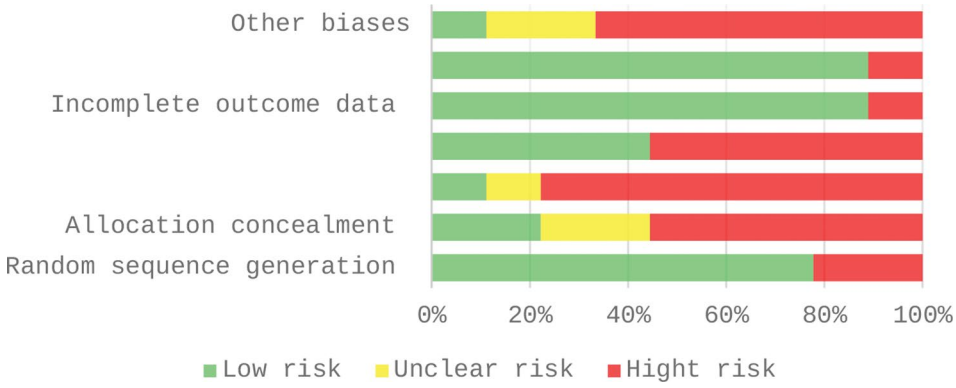
Gönen Aydın et al. [16] used MRI to assess coccygeal mobility before and after treatment with ESWT in 34 patients. The radiological findings showed an increase in coccygeal range of motion following therapy, which was consistent with the improvements observed in pain and quality of life scores.

Adherence and patient satisfaction

Treatment adherence was high across all studies, with dropout rates below 2% where reported. Although adherence was not systematically assessed using standardized tools, no significant issues with protocol compliance were noted.

Non-invasive interventions, such as ESWT and KT, appeared to be more acceptable to patients compared to intrarectal or manual techniques, as inferred from reported completion rates and patient preferences described qualitatively in some studies. For example, Okur & Vural [25] noted verbal expressions of satisfaction with manual therapy, and Ahadi et al. [29] described patients in the biofeedback group as more engaged in their care, although this did not result in superior clinical outcomes.

Table 3 Risk of bias



Discusion

Coccydynia poses a clinical challenge due to its multifactorial etiology and variability in treatment responses. This review evaluated the effectiveness of conservative physiotherapy interventions for coccydynia, including manual therapy (intrarectal massage or manipulation, pelvic floor physiotherapy, KT, and stretching) and device-based therapies (ESWT and biofeedback).

The review analyzed data from 532 patients with a treatment dropout rate of less than 2%, highlighting high adherence to conservative therapies. Non-invasive approaches, such as ESWT and KT, demonstrated greater patient acceptance compared to internal techniques, emphasizing the importance of considering psychosocial factors in treatment plans [23]. Studies such as those by Ahadi et al. (2022) and Gönen Aydin et al. (2020) highlighted the influence of emotional and environmental factors on treatment outcomes. In this context, interdisciplinary approaches that combine physiotherapy with psychological support may enhance therapeutic success.

Key study outcome analyzed included pain intensity and quality of life, assessed through various scales and questionnaires. While some studies relied on non-validated tools like the Paris Questionnaire, Wang et al. (2016) and Mohanty & Pattnaik (2017) incorporated objective measures such as PPT and magnetic resonance imaging [16], offering a more comprehensive perspective. However, the lack of uniformity in assessment tools complicates cross-study comparisons.

ESWT has shown significant efficacy in managing coccydynia, particularly for patients with a stable coccyx and chronic pain. Lin et al. (2015) compared ESWT with interferential currents in individuals suffering from coccydynia, reporting substantial pain reduction and functional improvement after four sessions of ESWT. Similarly, Gönen Aydin et al. (2020) observed clinical benefits following a minimum of four sessions, although the lack of long-term follow-up in these studies limits the ability to assess the durability of these effects.

Building on this, Ahadi et al. (2022) compared ESWT with corticosteroid injections administered to the sacrococcygeal joint or coccyx tip, combined with Kegel exercises in both groups. The study demonstrated that the ESWT group achieved more prolonged analgesic effects, emphasizing ESWT as a viable, non-invasive alternative for chronic coccydynia. These outcomes are consistent with broader findings that highlight ESWT's potential in reducing pain for coccydynia patients. However, as noted by other authors, further research is necessary to confirm these results and evaluate the long-term effectiveness of ESWT, as well as its safety in diverse patient populations [24].

Standardization of treatment parameters, such as the number of sessions, intensity, and frequency, remains a critical gap. Additionally, future studies with larger sample sizes and extended follow-up periods are essential to provide robust evidence on the sustained efficacy and broader applicability of ESWT in managing coccydynia.

Several studies have investigated the effectiveness of manual therapy in the treatment of coccydynia, particularly in cases of traumatic origin. Intrarectal techniques, including levator ani muscle massage, stretching, and coccygeal manipulation, have proven effective for patients with a hypomobile or stable coccyx and less than one year of evolution [15]. Post-isometric relaxation and manipulation aimed at realigning the coccyx have also shown benefits, though these approaches have been primarily limited to recent cases and often lack robust control groups [23, 25]. External techniques, such as sacrococcygeal manipulation and stretching of key muscles like the psoas and piriformis, have demonstrated pain reduction, although follow-up periods remain insufficient to assess long-term outcomes [10, 23]. Complementary interventions, such as combining local pericoccygeal injections with rectal manipulation or using transrectal osteopathic techniques, have reported positive results in chronic cases, particularly when addressing neuralgias through a combination of manual therapy and ganglion blocks [26–28]. While the literature

supports the use of these therapies, the lack of robust methodological designs and long-term follow-up limits the current evidence, emphasizing the need for further studies to confirm their efficacy.

Complementary interventions, such as KT, have also shown therapeutic potential. Studies have found that KT improved pain perception compared to reverse Kegel exercises, although no significant differences were observed in functional disability [7]. Biofeedback did not offer additional benefits over Kegel exercises combined with conventional treatment [29]. These findings suggest that while some complementary interventions may be beneficial, their effectiveness can vary, and treatments should be tailored to the specific characteristics of each patient. Additional studies support these observations. A recent meta-analysis demonstrated that KT significantly reduces pain intensity in patients with chronic nonspecific low back pain, showing immediate and short-term improvements [30]. Additional studies have highlighted that KT provides superior pain relief compared to minimal interventions, although its impact on functional disability is limited [31]. Furthermore, KT, when used as an adjunct to other therapies, can enhance functional mobility in patients with musculoskeletal disorders [32].

Factors such as sex and body mass index (BMI) have a significant yet underexplored impact on coccydynia in the reviewed studies. Obesity is considered a mayor risk factor, potentially predisposing individuals to coccygeal dislocations during prolonged sitting, thereby increasing the likelihood of traumatic coccydynia [33]. While some studies have documented participants' BMI, there remains a lack of in-depth analysis regarding its influence on treatment outcomes. Furthermore, coccydynia is reported to be five times more prevalent in women, as noted by Thiele (1963), likely due to anatomical and hormonal differences [8]. However, this gender disparity is not adequately reflected in the sample compositions of the reviewed studies, limiting the broader applicability of their findings to predominantly female populations.

Etiology plays an equally critical role in guiding treatment choices. Although traumatic coccydynia is the most frequent cause, studies such as those by Gönen Aydin et al. (2020) and Mohanty & Pattnaik (2017) have included patients with idiopathic coccydynia. These etiological differences may significantly influence treatment responses, underscoring the need for tailored interventions [10, 16]. Consequently, future research should aim to design studies that explicitly evaluate the characteristics of different etiologies to optimize personalized therapeutic strategies.

Regarding pain intensity, studies utilizing device-based therapies, such as ESWT, have demonstrated promising results. One study reported sustained improvements in pain intensity after four sessions, with benefits maintained up to the eighth week [34]. Another study found that the most significant improvement occurred after the fourth session [16], while further research concluded that just three sessions were sufficient, with benefits persisting for up to six months post-treatment [3, 11]. These findings underscore the effectiveness of ESWT in managing pain associated with coccydynia. However, they also highlight the need for further investigation to establish the optimal number of sessions required to maximize therapeutic outcomes and ensure long-term benefits.

Manual therapy has proven effective in reducing pain, though its outcomes seem to vary depending on the treatment's duration and the number of sessions. Moderate improvements have been observed with a few sessions, although the effectiveness tends to decrease over time without continued intervention [15]. Wang et al. (2016) supported these findings, suggesting that a greater number of sessions could prolong the positive effects. Additionally, some studies employed the PPT as an objective measure to evaluate muscle tissue sensitivity [10]. However, Suzuki et al. (2022) highlighted the importance of standardizing protocols for the use of PPT, as there are currently significant variations in its application.

Cochrane Rehabilitation highlighted the challenge of defining 'usual care' in stroke rehabilitation. Similarly, the heterogeneity in coccydynia treatments complicates standardization [35]. Future research should aim to define and compare usual care practices to improve treatment consistency.

Limitations

This review highlights several methodological limitations that affect the interpretation of findings. Firstly, the heterogeneity of the included studies, such as the use of diverse and often subjective assessment tools, complicates the comparison of results. Additionally, the small sample sizes and short follow-up periods limit the evaluation of long-term effects. As shown in Table 3, significant risks of bias were identified, particularly in areas such as the blinding of participants and personnel, as well as allocation concealment, which undermine the internal validity of the studies. While random sequence generation and handling of incomplete outcome data showed greater robustness, the variability in the origin and diagnosis of coccydynia adds complexity to the interpretation of findings.

These limitations emphasize the need to unify methodological criteria and standardize protocols in future research to enhance the quality of available evidence. Additionally, although the search strategy included terms for widely used physiotherapy techniques such as ESWT, manual therapy, and kinesiotaping, it may not have captured other potentially relevant interventions such as

general exercise, rehabilitation programs, or alternative manual approaches. This constitutes a limitation of the current review that should be considered when interpreting the results.

Conclusions

Physiotherapy interventions, particularly ESWT, have demonstrated clinically significant benefits in managing coccydynia, offering effective pain relief and functional improvement. Evidence suggests that ESWT provides longer-lasting effects compared to other conservative treatments, while manual therapy appears to be particularly beneficial in cases of recent-onset coccydynia.

This review provides a comprehensive synthesis of current evidence, identifying both promising interventions and critical gaps in physiotherapy protocols for coccydynia. The findings highlight the need for standardized treatment parameters, including session frequency, intensity, and follow-up duration, to improve clinical applicability and facilitate comparisons across studies.

Although non-invasive physiotherapy approaches show potential, variability in treatment methodologies complicates the establishment of definitive clinical guidelines. Future research should focus on large-scale RCTs with consistent methodologies, well-defined intervention protocols, and extended follow-up periods to strengthen the evidence base and support more effective clinical decision-making.

Abbreviations

BMI	Body Mass Index
CG	Control Group
CT	Conventional Therapy
ESWT	Extracorporeal Shock Wave Therapy
IFC	Interferential Current
KT	Kinesiotaping
MRI	Magnetic Resonance Imaging
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
ODI	Oswestry Disability Index
PEDro	Physiotherapy Evidence Database
PNRS	Pain Numeric Rating Scale
PPT	Pressure Pain Threshold
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomized Controlled Trial
SF-36	Short-Form Health Survey
SWD	Shortwave Diathermy
VAS	Visual Analogue Scale

Supplementary Information

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Supplementary Material 1

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Author contributions

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

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