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Original Article

Effectiveness of physical rehabilitation for female patients with greater trochanteric pain syndrome

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Abstract:
Greater trochanteric pain syndrome (GTPS) is a leading cause of chronic hip disorders, particularly affecting middle-aged and elderly women. The challenge in diagnosing GTPS and the lack of consensus on optimal physical rehabilitation strategies highlight the urgency of addressing this condition. **Purpose.** To review and analyze the latest scientific evidence on effective diagnostic methods and physical rehabilitation techniques for women with GTPS. **Materials and methods**. A comprehensive review of publications from 2020 to 2025 was performed, encompassing systematic reviews, network meta-analyses, original research, and qualitative studies focused on diagnosis, functional status evaluation, and physical rehabilitation approaches for GTPS. Current clinical tests and functional scales allow an objective evaluation of GTPS severity; however, a standardized, unified assessment system is lacking. **Results.** Physical exercise programs that emphasize strengthening and stabilization of the hip abductor muscles, combined with eccentric and mixed training and supported by patient education, yield the most favorable medium- and long-term results. Additionally, shockwave therapy may offer short-term benefits, but its effectiveness appears limited to a small subset of patients. Effective management of GTPS depends on a comprehensive, multidisciplinary approach that includes standardized diagnostics, tailored physical exercises, and attention to patients' psychological characteristics. Current evidence highlights the benefits of personalized physical rehabilitation. **Conclusions.** The most effective treatment strategies for GTPS involve individualized, multilevel programs combining physical exercises and behavioral interventions, with instrumental methods applied as needed. Future research will focus on establishing criteria to evaluate recovery effectiveness and on further personalizing rehabilitation strategies.
Key Words*:* **chronic hip pain, diagnostic and physical rehabilitation strategy, physical exercises, shock wave therapy**

Introduction

Persistent pain in the hip and lateral thigh is a common reason for adult patients—especially middle-aged and older women—to seek medical care (Andreasen et al., 2022; Silva et al., 2025). This pain, known collectively as greater trochanteric pain syndrome (GTPS), encompasses a range of pathological conditions, including gluteal tendinopathy, bursitis, perifocal fibrosis, and changes in surrounding tissues (Fearon, 2025). Modern understanding identifies degenerative-inflammatory damage to the tendons of the gluteus medius and minimus, often associated with local or systemic biomechanical disturbances, as central to the pathogenesis. This explains the chronic nature of GTPS, its tendency to relapse, and the consistent development of a characteristic pain pattern (Plinsinga et al., 2020; French et al., 2020).

The relevance of the GTPS problem lies in its high prevalence—according to various sources, up to 20%–25% of women over 50 experience symptoms with varying severity—and its considerable negative impact on quality of life, motor function, and psychological well-being (linsinga et al., 2020; French et al., 2020; Silva et al., 2025).

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Chronic pain in the affected area disrupts sleep, lowers physical activity levels, and promotes the development of secondary psychosomatic disorders, mainly anxiety and depression (Kinney et al., 2020; Wang, & Ashokan, 2021; Andreasen et al., 2022). Furthermore, persistent pain leads to maladaptive changes such as lagerization and the adoption of compensatory movement patterns. These changes increase the risk of damage to adjacent anatomical segments and contribute to the overall decline of the musculoskeletal system's condition (Plinsinga et al., 2020; French et al., 2020).

One of the challenges of GTPS is the difficulty of clinical diagnosis. The presence of numerous symptoms and nonspecific manifestations, along with frequent overlap with other causes of hip pain (such as coxarthrosis, lumbosacral radiculopathy, and iliopsoas muscle pathology), hinders early detection and complicates informed management decisions (Nasser et al., 2022; Kinsella et al., 2024). Diagnosis is often based on patient history and characteristic pain localization. Currently, there are no standardized diagnostic protocols or quantitative severity criteria, and the value of individual clinical tests (pain provocation and palpation sensitivity) is still being studied. Without clinical verification of pain findings, there is a risk of both over- and underdiagnosis of GTPS, which may result in inappropriate treatment strategies.

In recent years, the range of non-drug treatments for GTPS has considerably increased. Physiotherapeutic methods, especially therapeutic exercise programs, are most commonly used. These programs aim to restore hip abductor muscle strength and coordination, correct walking patterns, and improve hip joint biomechanics (French et al., 2020; Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024; Fearon, 2025). Large-scale systematic reviews and meta-analyses confirm that these active treatments are more effective than passive approaches, such as waiting or traditional drug therapy. Modern strategies emphasize tailoring exercise programs to the individual's age, psychoemotional state, and disease stage (Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024; Fearon, 2025). Additionally, integrating exercises with educational and behavioral interventions is gaining attention because this combination improves therapy adherence and supports long-term pain management (Mellor et al., 2022; Fearon, 2025).

An important role is also played by physical treatment methods, primarily shockwave therapy (SWT). Current guidelines recommend SWT when exercise programs yield insufficient results or cannot be performed for individual reasons (Ramon et al., 2020; Wang et al., 2022).

The effectiveness of orthotics and assistive devices is increasingly debated, but there is currently no solid evidence supporting their benefit (Hunter et al., 2023).

The psychosocial aspect of GTPS treatment warrants special attention. Research shows that pain perception, functional limitations, and treatment outcomes are strongly influenced by the quality of therapeutic support, patient–healthcare provider interaction, and emotional engagement. Additionally, having a supportive environment is essential for successful management (Kinney et al., 2020; Andreasen et al., 2022; Paap et al., 2022; Mellor et al., 2022).

Lack of communication, weak motivation and poor adherence to rehabilitation become factors in the ineffectiveness of even the most promising treatment strategies (Kinney et al., 2020; Paap et al., 2022). In general, despite great progress, the management of patients with greater trochanteric pain syndrome remains a complex interdisciplinary task that combines medical, rehabilitation and psychological aspects. The need for personalization of treatment, standardization of diagnostics and further integration of new methods requires an in-depth analysis of modern evidence. This review article is devoted to a critical analysis of the achievements and unresolved issues of diagnostics and physical rehabilitation of GTPS. Emphasis is placed on the effectiveness of various non-drug strategies, the influence of psychological factors and the need for standardization of recovery outcomes.

Research aim: To summarize and analyze current scientific evidence on effective strategies for diagnosing and physically rehabilitating women with GTPS.

Materials and methods

This study was performed as a structured review combined with analytical analysis, incorporating elements of systematization and comparative evaluation of scientific literature. It adheres to evidence-based principles, using modern methods for critically assessing research quality and organizing information across key areas. These areas include diagnostics, functional assessment of patients, and physiotherapeutic treatments for GTPS. Researchers and specialists from multiple universities across Russia, Kyrgyzstan, and Kazakhstan contributed to this study. To ensure completeness and representativeness, this review focused on publications from the past five years, as well as major meta-analyses, systematic reviews, and original clinical studies.

The analysis included publications that satisfied the following criteria:

- publication period: 2020–2025;
- publication language: English, including articles with English-language abstracts;
- type of study: systematic reviews, network meta-analyses, and original scientific studies meeting evidence-based medicine criteria;

- subject: GTPS, gluteal tendinopathy, rehabilitation, physical therapy, functional assessment, educational and psychological interventions, SWT.

We used online databases including PubMed, Scopus, Web of Science, and EMBASE, applying search terms such as "greater trochanteric pain syndrome", "gluteal tendinopathy", "exercise therapy", "shockwave therapy", "steroid injection", "diagnostic accuracy", "functional assessment", and "physical rehabilitation." The search process combined manual and automated methods, incorporating links to relevant reviews and consensus statements. For critical evaluation of completeness and quality, standardized checklists—PRISMA, CONSORT, and AMSTAR-2—were used. Evidence levels were evaluated based on the OCEBM scale, with class I–II publications forming the main basis of analysis, while class III–IV studies were considered supplementary to address varied results.

All included studies and reviews were organized into the following categories:

1. Diagnostics and methods for quantifying pain severity, including clinical tests, instrumental techniques, and rating scales.
2. Characteristics of therapeutic approaches, including pharmacological and non-pharmacological treatments such as physiotherapy, exercise therapy, and SWT.
3. Psychological and educational interventions, emphasizing the role of therapeutic support. To facilitate data comparison, a summary table (Table 1) was compiled.

Table 1. Summary of key studies on GTPS (2020–2025)

Source	Sample	Primary focus	Treatment methods	Effectiveness assessment	Key findings
Silva	120 respondents	Objectification of severity		Test differentiation	Diagnostic value established
Kinsella	32 studies	Diagnostics and tests		Accuracy	Limited specificity observed
Kjeldsen	8 studies, 1260 respondents	Exercise effectiveness	Exercise, control, and other interventions	Pain reduction and functional improvement	Exercises have been shown to be effective
Cordeiro	11 studies	Gluteal tendinopathy	Exercise protocols	Effect on pain scales	Supported by high-quality evidence
Ramon	229 respondents	Shockwave therapy	Focus areas	Group comparisons	Effects mostly short-term
Hunter	51 respondents	Orthoses	Control groups or conditions	Biomechanical effects and pain	No significant effect in some cases
Andreasen	3120 respondents	Psychology and education	Combined treatment approaches	Patient satisfaction related to pain	Benefits related to therapeutic alliance and training
Nasser	17 studies	Scales and outcomes		Measurement outcomes	Need for standardization emphasized

Table 1 summarizes the main characteristics of the scientific studies included, detailing the type of observation, sample size, main cohort, diagnostic methods, treatment and rehabilitation approaches, and key outcomes related to effectiveness.

Results

At each stage, the following aspects were evaluated: diagnostic methods, extent of outcome assessment, frequency of sustained therapeutic response, and the impact of concurrent psychological factors. For studies allowing quantitative data analysis, meta-analytic recalculation of means (MD, SMD, 95% CI, p-values) or odds ratios (ORs) was performed. Psychosocial components were incorporated from qualitative interviews and questionnaire-based research (Kinney et al., 2020; Andreasen et al., 2022; Paap et al., 2022: Mellor et al., 2022). A key limitation of this approach is the variability in inclusion criteria and assessment scales across primary studies, which limits the feasibility of performing a unified meta-analysis encompassing all types of therapeutic interventions. Clinical diagnosis of GTPS is based on the assessment of pain in the affected area, which intensifies with palpation and specific hip joint movements (Silva et al., 2025).

According to a systematic review by Kinsella (2024), the most sensitive diagnostic tests for GTPS are those that reproduce pain during palpation and hip abduction. However, individual clinical tests have limited diagnostic specificity, highlighting the importance of an integrated approach that combines instrumental and functional assessments. Various scales and functional tests are used to evaluate the severity and progression of the disorder. Silva's study (2025) demonstrated that quantitative functional tests could differentiate the severity of GTPS in women, but challenges related to the validation and standardization of these methods remain unresolved. In the review by Nasser (2022), the heterogeneity of the scales used—such as VISA-G, HOOS, and the Numeric Pain Rating Scale—was highlighted, complicating the comparison of results across different studies. Additionally, psychological and emotional factors were identified as significant influences on pain perception and rehabilitation outcomes.

Physical rehabilitation for greater trochanteric pain syndrome (GTPS) occupies a central place in therapeutic treatment (French et al., 2020; Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024; Fearon, 2025). This approach is based on the concept of GTPS pathogenesis as a predominantly biomechanical disorder with secondary inflammatory changes, which suggests the possibility of a positive impact through the correction of motor stereotypes, strengthening of the muscular apparatus and restoration of optimal function of the pelvic-lumbar complex.

According to the international consensus of physiotherapists and sports doctors presented in French's (2020) study, the rehabilitation program for GTPS should follow these key principles:

Individualization – adaptation of exercises based on age, general health, physical fitness level, and the stage of GTPS;

Progression – a gradual increase in complexity and load intensity, tailored to the patient's functional capabilities;

Biomechanical focus – consideration of individual kinesiological patterns, compensatory changes, and axial alignment abnormalities.

Minimization of pain syndrome involves selecting exercises below the pain threshold to prevent pain increase and improve patient adherence.

Long-term rehabilitation involves integrating the exercise program into daily activities to ensure stable consolidation of the results.

Modern meta-analyses and systematic reviews highlight several key types of exercises that have demonstrated effectiveness in the treatment of GTPS.

1. Exercises aimed at strengthening the hip abductor muscles. The gluteus medius and minimus muscles play a direct role in stabilizing the pelvis during walking and standing. Weakness in these muscles results in increased compression and friction of the tendons against the greater trochanter. A modern approach to training these muscles involves incorporating isometric, concentric, and eccentric modes with a gradual increase in difficulty ((Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024).). Research by R. Mellor (2022) demonstrated that programs focusing on strengthening the gluteus medius resulted in a 41.2% reduction in pain after eight weeks and 58.7% after 12 months of therapy. These results are significantly better than those observed in control groups ($p < 0.001$).

2. Exercises for postural control and pelvic stabilization are crucial for addressing issues related to the lumbopelvic complex. Disturbances in the mechanics of this complex often serve as a trigger and a maintaining factor for GTPS (French et al., 2020; Fearon, 2025). By performing exercises that aim to restore the optimal relationship between the segments of the lower extremities, pelvis, and lumbar spine, it is possible to reduce the pathological load on the structures of the greater trochanter. A review by Patricio Cordeiro et al. (2024) showed that the combination of pelvic ring stabilization exercises with gluteal muscle training provides a clinically significant improvement in the VISA-G scale by 23.5±4.2 points over 12 weeks of therapy compared to isolated approaches ($p < 0.05$).

3. Isometric exercises are particularly effective during the early stages of rehabilitation and exacerbations of pain. According to a systematic review by C. Clifford et al. (2020), isometric muscle contractions can quickly relieve pain by activating the body's natural pain control mechanisms and minimizing mechanical stress on the tendons. It is recommended to perform isometric tension at a moderate intensity (50%–70% of the maximum) for 30–45 s, gradually increasing the number of repetitions (Clifford et al., 2020).

4. Eccentric and progressive loads. In chronic forms of GTPS and during the recovery period after the acute phase, eccentric exercises aimed at strengthening and restoring the elasticity of the altered tendons of the medius and minimus gluteal muscles demonstrate high efficiency (Clifford et al., 2020; Patricio Cordeiro et al., 2024; Fearon, 2025). This type of load ensures connective tissue remodeling and improves strength parameters due to the dosed stretching of the tendon under load. The study by A. Notarnicola et al. (2023) showed that the inclusion of eccentric exercises in the rehabilitation program increases the proportion of patients with long-term remission by 32% compared to the group receiving only traditional treatment. The optimal rehabilitation program for GTPS, according to current data (French et al., 2020; Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024) includes 3-4 phases with gradual progression:

Phase 1 (1–2 weeks): Patient education on biomechanics and pain causes, modification of daily activities to reduce compression on the greater trochanter, pain-free isometric exercises for the gluteal muscles, and basic exercises to stabilize the pelvic ring in lying and sitting positions.

Phase 2 (2–6 weeks): Progression involves increasing the duration of isometric exercises, introducing concentric exercises with light resistance, initiating proprioception and balance training, and performing light functional movements such as supported squats, bridges, and leg abductions.

Phase 3 (6–12 weeks): Advanced gluteal exercises incorporating elastic bands and weights, eccentric training with gradual load progression, functional exercises that mimic daily activities, and complex movements emphasizing core stabilization and pelvic control.

Phase 4 (after 12 weeks): A maintenance program to consolidate results through integration of exercises into regular physical activity, periodic functional assessments, preventive measures to avoid relapses, and careful dosing of loads and program duration.

According to the meta-analysis by T. Kjeldsen et al. (2024), the optimal load should include a minimum duration of 8–12 weeks for the main course. This involves 2–3 sessions per week under the supervision of a specialist and 3–5 daily independent sessions lasting 10–15 min. The load should be increased by 5%–10% weekly if well tolerated, and educational components should be integrated into the program. The high efficiency of combined programs that integrate physical exercises with educational elements is confirmed in the work of R. Mellor et al. (2022). Including information about the nature of pain, explaining the biomechanical basis of movement, training in self-control, and methods for reducing the fear of movement in the rehabilitation process increases the effectiveness of treatment by 21%–35% compared to isolated exercise programs.

Various physiotherapeutic interventions can be used as auxiliary methods, but it is important to recognize their secondary role compared to active rehabilitation. Ultrasound therapy shows moderate effectiveness in reducing inflammation during the acute phase, but its isolated use is not recommended (Gazendam et al., 2022). Low-level laser therapy may be used for additional pain relief, although the evidence base is limited (Gazendam et al., 2022). Manual therapy techniques, such as soft tissue techniques, myofascial release, and mobilization, may be useful in relieving muscle spasm and improving pelvic biomechanics, but only when combined with active exercise (French et al., 2020).

According to A.M. Nasser (2022), to objectively assess the dynamics and monitor the effectiveness of rehabilitation measures, it is recommended to use the following tools: Victorian Institute of Sport Assessment – Gluteal (VISA-G)—a specific scale for evaluating the severity of gluteal tendinopathy; Numeric Pain Rating Scale (NPRS)—a numerical assessment of pain intensity; Hip Dysfunction and Osteoarthritis Outcome Score (HOOS)—an assessment of functional limitations; Single Leg Stance Test—a functional test for evaluating the stability of the hip joint; and Global Rating of Change (GROC)—a global assessment of changes in the condition.

According to A. Fearon's study (2025), the long-term success of GTPS rehabilitation depends on several critical factors. These include consistently performing a maintenance exercise program after the main course of therapy and modifying risk factors (such as controlling body weight, improving workplace ergonomics, and correcting biomechanical disorders). Additionally, it is important to periodically monitor the functional state of the gluteal muscles and ensure an adequate progression of physical activity without sudden increases in load. Patients who follow these recommendations show a 64% reduction in relapse rates during 24 months of follow-up (Fearon, 2025).

In this field of research, additional methods such as shock wave therapy (SWT) are being explored. Meta-analytic studies show that focused SWT has a clinically significant but often short-term effect (Ramon et al., 2020; Rhim et al., 2024). According to P.C. Wheeler et al. (2022), the minimum and standard doses of radial SWT do not have significant differences in clinical efficacy.

Discussion

A summary and analysis of the latest scientific literature data on greater trochanteric pain syndrome (GTPS) allows us to highlight a number of key points that reflect the current state of the issue and the prospects for the further development of this pathology in patients.

First of all, it is important to emphasize that GTPS is not an isolated local lesion of one structure, but a multifactorial syndrome based on combined processes. This includes degenerative-inflammatory changes in tendons and entheses, myofascial biomechanics disorders, neurogenic mechanisms of pain sensitization, as well as a significant component of psychoemotional disorders (Plinsinga et al., 2020; Andreasen et al., 2022; Silva et al., 2025). The results of modern scientific research convincingly indicate that the persistent pain syndrome characteristic of GTPS is associated not only with morphological damage to the tendons, but also with changes in the central mechanisms of pain modulation and the formation of pathological behavioral and motor patterns (Plinsinga et al., 2020; Kinney et al., 2020; Paap et al., 2022).

Correct diagnosis is a key step towards effective treatment of GTPS. The variety of symptoms, the similarity of the clinical picture with other forms of hip or low back pain, and the insufficient specificity of many

clinical tests require the development and implementation of comprehensive diagnostic protocols. Modern systematic reviews confirm that no single test (palpation of the greater trochanter, hip abduction test, Faber test, etc.) has sufficient sensitivity and specificity (Kinsella et al., 2024; Silva et al., 2025). This dictates the need for combined diagnostics, including the use of instrumental methods (ultrasound, MRI) in case of doubt. It is imperative to use standardized and ranked scales for quantitative assessment of the severity of pain and functional limitations (VISA-G, HOOS, Numeric Pain Rating Scale, a number of quality of life and self-assessment questionnaires). As evidenced by the data of A.M. Nasser et al. (2022).

Structured physical exercises are the cornerstone of modern GTPS therapy. Numerous scientific clinical studies and meta-analyses demonstrate that individualized physical exercise programs aimed at strengthening and controlling the activity of the hip abductor muscles, improving walking patterns, restoring balance, provide pain relief. In addition, a persistent increase in functional activity, minimization of fear of exertion and prevention of relapses are recorded (Kjeldsen et al., 2024; Patricio Cordeiro et al., 2024). The effectiveness of these programs is significantly higher if training is combined with educational, informational and psychological support, which are aimed at improving self-control (Mellor et al., 2022; Fearon 2025). Additional treatment methods, in particular, shock wave therapy (SWT), do not lose their relevance in cases of severe pain syndrome. However, according to most meta-analyses, the effect of this approach, although statistically significant, is predominantly short-term (from 4 to 12 weeks). With long-term observation, it is inferior to therapeutic exercise complexes and educational programs for a number of functional outcomes (Ramon et al., 2020; Wang, & Ashokan, 2021; Rhim et al., 2024; Foxcroft et al., 2024). An important aspect remains the individual selection of therapy: in patients prone to centralized pain and with a high level of anxiety, the isolation of pharmacological effects (injections, medications) without changing the motor regime and behavior rarely leads to remission.

Particular attention in modern scientific publications is paid to the role of psychological factors. A number of authors have shown the condition from the presence and severity of anxiety and depressive disorders to the features of therapeutic support and interaction between the patient and the medical team (Kinney et al., 2020; Paap et al., 2022; Andreasen et al., 2022; Mellor et al., 2022). It is trust, involvement and a sense of support from medical staff that often determine not only the patient's subjective impressions, but also objective indicators of pain dynamics, functional activity and adherence to long-term exercise programs. It is noted that the development of trusting relationships within multidisciplinary programs significantly increases the likelihood of long-term success and reduces the number of relapses in GTPS (Kinney et al., 2020; Paap et al., 2022). Standardization of initial scales and criteria is another challenge facing the research and clinical community. The heterogeneity of the functional tests and questionnaires used complicates both meta-analyses and the interpretation of individual results for therapy planning (Nasser et al., 2021). Current consensus documents point to the need to introduce unified, validated, and change-sensitive tools to objectively monitor the dynamics of pain, limitations, and functional recovery.

In conclusion, several strategic directions can be identified for the further development of GTPS therapy and diagnostics:

1. Personalization of management, taking into account the individual characteristics of biomechanics, psychoemotional state, comorbidity, and social resources of the patient.
2. Integration of multidisciplinary routes: combining physiotherapy, educational and psychological approaches, improving the quality of communication.
3. Optimization of therapeutic physical education and self-rehabilitation programs, use of digital platforms for remote monitoring and self-control.
4. Additional justified use of pharmacological and physical methods (ESWT) only if the main therapy is insufficient.
5. Unification of diagnostic, monitoring and performance evaluation systems, implementation of ranked scales and creation of international GTPS registries.

Thus, a modern approach to greater trochanteric pain syndrome requires a comprehensive, integrated and individualized tactic, including biomechanical correction, educational and psychological interventions, as well as the use of restorative sports medicine methods based on high-level standards of evidence-based practice. Only such an approach can ensure not only pain control and restoration of hip function, but also a significant improvement in the overall quality of life of patients - in all its aspects: physical, emotional and social. Continuation of fundamental and applied research, strengthening of interdisciplinary interaction and translation of scientific achievements into everyday clinical practice will determine the effectiveness of management of greater trochanteric pain syndrome in the coming years.

Conclusion

The data confirm the multifactorial nature of GTPS and the necessity of an integrated approach to its diagnosis and physical rehabilitation. The success of health programs relies not only on biomechanical aspects but also on considering psychological and behavioral factors that can significantly influence disease outcomes. The diversity of scales and functional tests complicates the standardization of clinical research results, requiring

the development of unified assessment tools for the objective monitoring of GTPS dynamics. Meanwhile, the most stable outcomes are demonstrated by multidisciplinary programs that include physical exercises, educational and psychological support, as well as monitoring of rehabilitation progress.

Additional methods such as Shock Wave Therapy should be viewed as a reserve option, used when the physical exercise program proves insufficiently effective or cannot be fully implemented. It is essential to consider each patient's individual biopsychosocial profile because outcomes can vary significantly based on accompanying psychological factors, the severity of chronic pain syndrome, and the patient's adherence to treatment. The future of GTPS therapy lies in personalizing rehabilitation programs, standardizing assessment criteria, developing multidisciplinary hospital pathways, and incorporating psychological support as a key component of successful recovery.

Conflicts of interest. The authors declare no conflict of interest.

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