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REVIEW

Therapeutic Exercise Progression in Patients with Nonspecific Low Back Pain: A Systematic Review

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Objective: This systematic review aimed to identify and synthesize the objective and subjective criteria currently used to guide the progression of therapeutic exercise during the rehabilitation of adults with nonspecific low back pain (NSLBP). A secondary objective was to determine whether the use of those progression criteria enhances the effectiveness of exercise interventions compared to protocols without specific criteria.

Methods: A comprehensive search was performed across three electronic databases and supplemented by a manual reference screening. Eligible studies were randomized controlled trials (RCTs) including adults (>18 years) with NSLBP where at least one group received therapeutic exercise with defined progression criteria. Study selection and full-text screening were followed by risk of bias assessment using the Cochrane Risk of Bias 2 tool.

Results: A total of 47 RCTs met the inclusion criteria. Due to the heterogeneity of included studies, a qualitative synthesis was conducted. Progression criteria were found to be both subjective and objective. Overall, intervention groups using predefined progression criteria showed greater short- and medium-term improvements than controls. However, only a subset of low-risk-of-bias studies confirmed these effects, and long-term benefits were rarely reported.

Conclusion: Exercise progression based on specific criteria appears to offer promising benefits, particularly in the short-term reduction of pain and improvement in function. However, limitations persist regarding the direct applicability of these findings to clinical practice. Future research should aim to further standardize methodologies and establish measurable, clearly defined progression criteria for exercise-based interventions in patients with NSLBP.

Keywords: non-specific low back pain, therapeutic exercise, progression criteria, rehabilitation, clinical outcomes, systematic review

Introduction

Background

Low back pain (LBP) is one of the most common musculoskeletal disorders worldwide and a leading contributor to years lived with disability.[1,2] It is defined as "pain located below the costal margin and above the inferior gluteal folds, with or without leg"[3] and affects up to 84% of the population at least once in a lifetime.[4] Although most episodes are self-limiting, approximately 10% evolve into chronic low back pain (CLBP), imposing substantial economic and psychosocial burdens on individuals and healthcare systems.[5]

Most LBP cases – up to 90% – are classified as nonspecific low back pain (NSLBP), a diagnosis of exclusion applied when no specific pathological cause (eg, fracture, tumour, infection, or radiculopathy, discopathy) can be identified.[6–10] Despite its favourable prognosis in many cases, NSLBP remains a complex clinical condition due to its multifactorial nature and heterogeneous presentations, complicating diagnosis, treatment, and prognosis.[2,11]

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Current clinical guidelines recommend a multimodal and biopsychosocial approach for NSLBP management, emphasizing education, reassurance, and physical activity, often combined with manual therapy and therapeutic exercise.[12–15] Within this framework, exercise therapy is considered a cornerstone of the rehabilitation process. It encompasses a broad range of modalities, including motor control exercises,[16] mobility-focused interventions,[17] aerobic[18–22] and resistance training.[23] While extensive evidence supports the clinical utility of exercise in reducing pain and improving function,[24–28] substantial uncertainties persist regarding the optimal parameters for its delivery—particularly concerning the type, dosage, and progression of exercise interventions.

A critical and underexplored issue in this context is the lack of standardized, evidence-based criteria to guide exercise progression in patients with NSLBP.[29,30] The absence of clearly defined parameters limits the reproducibility of interventions, reduces the ability to tailor treatments effectively, and may compromise clinical outcomes. Moreover, this gap poses a significant barrier to translating research findings into everyday clinical practice.

Objective

The primary objective of this systematic review was to identify the criteria currently adopted in the literature for exercise-based interventions in adults with NSLBP. The secondary objective was to determine whether the whether the use of such criteria is associated with superior clinical outcomes compared to interventions lacking defined progression protocols.

Methods

This systematic review was conducted in line with the PRISMA Statement guidelines[31] and was registered in the PROSPERO database (CRD42024497282).[32]

Eligibility Criteria

Search methods for Inclusion of Studies

An electronic search was conducted from November to December 2023, using PubMed, Scopus, and Web of Science databases. Search strings were developed using a combination of Medical Subject Headings (MeSH) and free-text terms, tailored to each database's specifications. To ensure comprehensive coverage, manual searches of reference lists from the full-text articles were also performed to identify additional relevant studies not captured in the initial search. The search strategy was guided by the PICOS framework (Participants, Intervention, Comparison, Outcomes, and Study design).[33] Full search strategies for each database are detailed in Appendix A.

Study Selection and Data Extraction

Duplicates were removed using Rayyan.ai.[34] Two reviewers (A.T., V.B.) independently screened titles and abstracts, followed by full-text assessment against inclusion criteria. Disagreements were resolved by a third reviewer (L.S). Data were independently extracted into a standardized table, including study design, participant characteristics, interventions, progression criteria, outcomes, and results.

Risk of Bias Assessment

Risk of bias was assessed using the Cochrane Risk of Bias 2 tool,[35] evaluating randomization, deviations from intended interventions, missing data, outcome measurement, and selective reporting. Studies were rated as "low risk", "some concerns", or "high risk."

Data Analysis

Due to substantial heterogeneity in interventions, progression criteria, and outcomes, a meta-analysis was not feasible; instead, a qualitative synthesis was conducted to summarize the criteria employed for exercise progression in NSLBP management.

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Results

The electronic database search yielded 4,278 records, with 9 additional articles identified through manual searches. After duplicate removal and title/abstract screening, 395 full-text articles were assessed, of which 47 RCTs met the inclusion criteria and were included in the systematic review (Figure 1).

Study Characteristics

The 47 included studies encompassed a total of 3,942 participants with NSLBP, with sample sizes ranging from 30 to 300 and a mean age of 40.3 years. Intervention groups received therapeutic exercise with defined progression criteria, compared to standard exercise, usual care, or placebo. Most studies reported follow-up periods between 4 weeks and 12 months. Data were extracted into a standardized table (Appendix B), including study characteristics such as author, year, objective, population, intervention type, progression criteria, outcome measures, and main findings.

Risk of Bias

Of the 47 included studies, 29 were rated as having a high risk of bias,[36–63] while 18 were assessed as having a low risk of bias.[64–81] The most frequent methodological limitations included inadequate randomization, incomplete outcome reporting, and insufficient blinding of outcome assessors (Figure 2).

Progression Criteria

Both subjective and objective criteria for exercise progression were reported. Subjective criteria frequently included patient-reported outcomes such as perceived exertion and pain levels, while objective criteria involved measurable parameters like strength, endurance, or range of motion. The subjective criteria reported in the studies encompassed: "patient performing specific exercises successfully or easily";[36,40,52,62,65–67,71,81] "contracting the transverse abdominis and multifidus for ten seconds and being able to repeat it ten times for all exercises in the phase the patient is in";[37,41,80] "approval of a specific exercise by the patient and/or physical therapist";[38,69] "pain";[38,43,53,62,65,68,69,71,72,78,81] "perceived

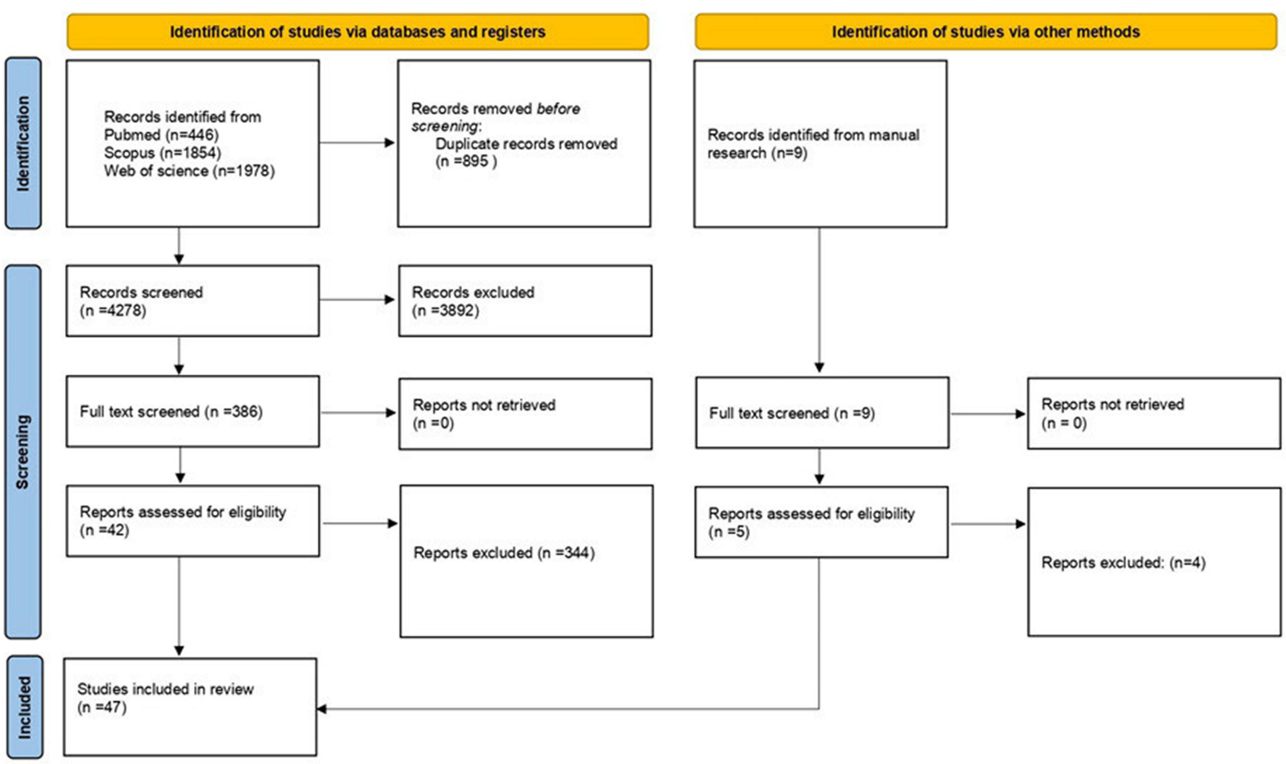

Figure 1 Flow diagram.

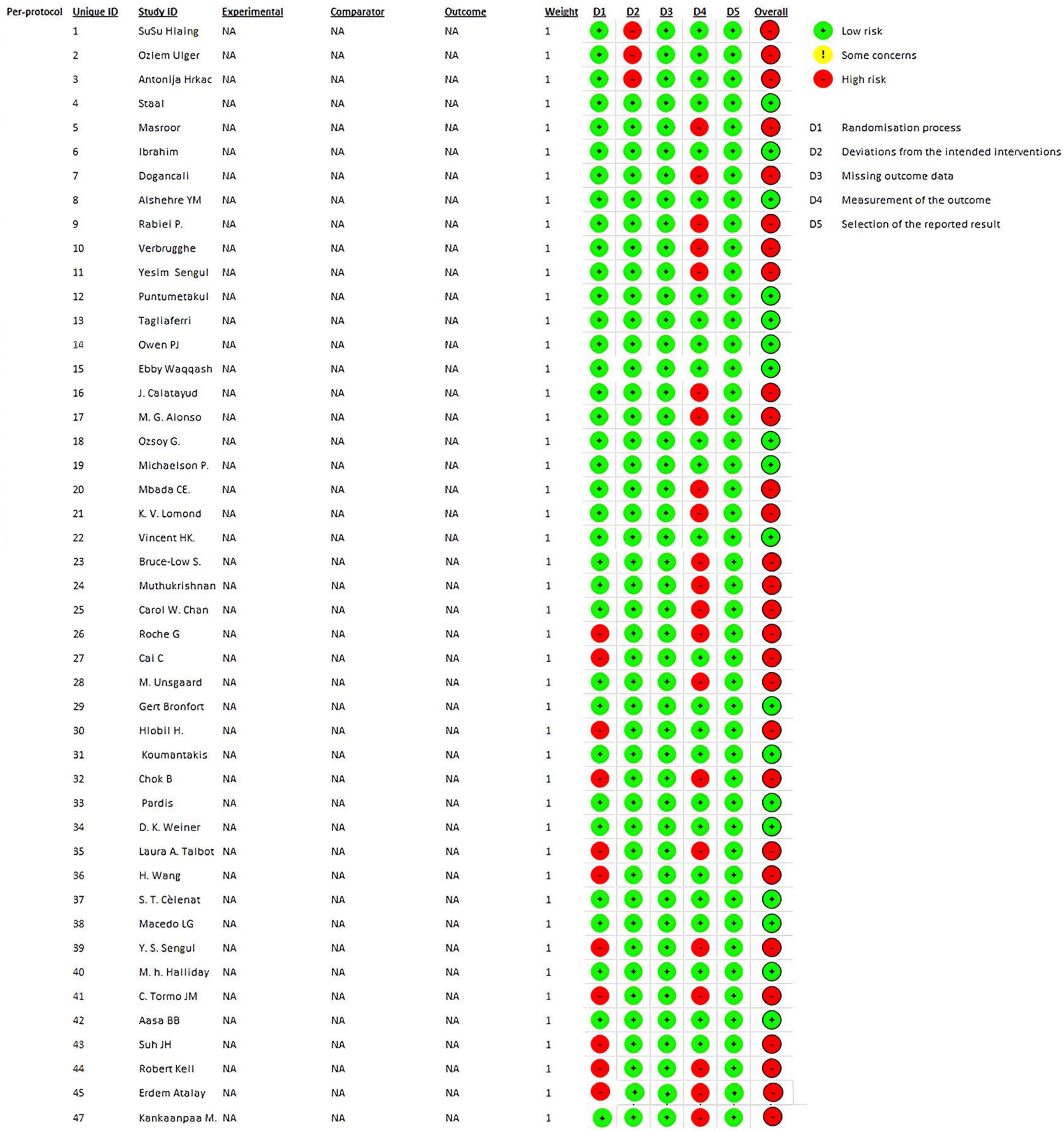

Figure 2 Risk of bias across the included studies.

fatigue or exertion";[4,39,43,53,55,58,65,71,78] "exercise tolerance";[55,66,79] "ability to activate abdominal muscles, assessed manually";[42] "contracting the target muscles in different positions, 10 times for 10 seconds";[49] "isolated contraction of the transverse abdominis";[53,80] "patient's ability";[59] and "progression at the patient's discretion".[60] Objective criteria included: "time";[41,43,44,47,49–51,54,56,60,62,68–70,74,76–78,80] "increased load when the patient could perform more than 10 repetitions in two consecutive training sessions";[41] "when the patient managed to perform more than 12 repetitions, the weight was increased by 5%";[48] and "progression when the patient managed to perform the maximum number of repetitions and sets".[74]

Effectiveness of Progression-Based Interventions

Twelve studies demonstrated statistically significant improvements in pain reduction and functional outcomes in groups receiving progression-based exercise compared to control groups.[38,40,44,48,55,58,62,63,73,76–78] Notably, six of these studies were assessed as having a high risk of bias.[38,44,48,55,58,63] Regarding long-term outcomes, two studies reported sustained benefits at follow-up periods exceeding six months, with significant differences favoring the intervention groups.[62,77]

Discussion

The aim of this systematic review was to analyse the criteria currently used to guide the progression of therapeutic exercise in adults with NSLBP and to determine whether their adoption enhances the effectiveness of exercise-based interventions compared to protocols that do not incorporate such criteria. Overall, both subjective and objective criteria for exercise progression were found and criteria-based exercise interventions demonstrated potential benefits – particularly in short-term pain reduction and functional improvement.

Objective and Subjective Criteria

Subjective criteria varied consistently across the included studies. Specific criteria, for instance, "isolated contraction of the transverse abdominis"[61,76] and "contraction of the transverse abdominis and multifidus for ten seconds, with the ability to repeat the task ten times"[67,72,82] are limited to the rational of all "stabilization exercises" which may not be in line with the existing literature about therapeutic exercises in LBP scenario.[47,67,72,77,79,82,83] Furthermore, "progression at the patient's discretion" or "approval of a particular exercise by the patient and/or physical therapist" may lack of reliability, reproducibility and standardization – given their dependence on individual clinical contexts, expectations and training. Regarding pain as a progression criterion, a critical limitation is the absence of a clearly defined pain threshold or standardized pain response to exercise. Despite the variability in pain perception depends on contextual, individual and clinical factors, establishing consistent pain response patterns during exercise is essential. Moreover, a lack of systematic evaluation of patient responses during and after exercise (eg, hours or days post-exercise) further complicates the reliability of pain as a progression indicator in NSLBP.

Among objective criteria, "time" was the most common criteria. While exercise duration may reflect increased spinal load capacity and tolerance, this metric lacks direct correlation with key clinical outcomes such as pain reduction, disability, psychosocial factors and quality of life. Furthermore, also parameters based on specific number of repetitions and sets, or RM were adopted. Even though such parameters may be the most quantifiable and clinically feasible, especially in fitness contexts and post-surgery rehabilitation, it must be considered that they cannot be directly transferred in clinical practice as a stand-alone decision-making criterion for exercise prescription and progression, without accounting for pain intensity, functionality and pain mechanisms.

Pain Mechanisms and Irritability

Most included studies did not consider underlying pain mechanisms. However, nociplastic, neuropathic, and mixed pain mechanisms may require different therapeutic approaches and, accordingly, distinct progression and cessation criteria for exercise-based interventions.[82–84] Then, accurate patient profiling in this regard is therefore essential.[6–8,83] Nociceptive pain, often load-dependent, typically more localized and mechanically reproducible on examination, with symptoms that tend to respond to anti-inflammatory or analgesic medication and frequently showing a more coherent temporal pattern of onset — although chronic nociceptive presentations may persist — requires vigilant post-exercise monitoring, especially in highly irritable or acute-phase presentations, where symptom consistency over time may guide decisions regarding exercise cessation. Conversely, nociplastic pain, frequently observed in NSLBP, shows weak or inconsistent associations with mechanical load and is often influenced and modulated by psychosocial factors, frequently presenting with more diffuse or shifting pain distribution, heightened sensitivity to non-mechanical stimuli (eg, stress, fatigue), and limited or short-lived response to conventional analgesics. In such cases, time-contingent progression may be preferable to pain-contingent models. Mixed pain presentations incorporate elements of both nociceptive and nociplastic processes, further complicating the clinical assessment and demanding an individualized, context-sensitive approach to exercise progression.

Effectiveness of Progression Criteria

Overall, the adoption of both subjective and objective criteria seems to be more effective than their absence. Eleven studies reported no statistically significant differences in short- and medium-term outcomes; six of these were at high risk of bias.[47,50,54–57] Studies with low risk of bias employed criteria including "time",[70,75,77] "isolated contraction of the abdomen"[80] and "progression when the patient was able to perform the maximum number of repetitions and sets".[74] Though, as previously noted, the higher quality of evidence of studies addressing such criteria alone may be insufficient to draw definitive conclusion.

Twelve studies reported statistically significant between-group differences favoring progression-based exercise. Half of these were rated at high risk of bias and employed criteria such as "time", "pain", "performance", "disability", "range of motion", "strength", "endurance", and "function".[38,44,48,55,58,63] The six low-risk-of-bias studies integrated subjective and objective measures including disability, pain, catastrophizing, time, exercise tolerance, and fatigue.[62,65,73,76–78] These studies demonstrated significant short- and medium-term benefits associated with progression criteria. Only two studies reported sustained long-term benefits at six and twelve months, respectively.[62,77]

Consistency

To the best of the authors' knowledge, this is the first systematic review focusing specifically on progression criteria in therapeutic exercise for NSLBP. Then, the consistency is inevitably limited. However, our findings align with broader evidence supporting the efficacy of multimodal therapeutic exercise in NSLBP management.[85–90] Also, epidemiological data confirm that LBP affects a wide range of populations, including adolescents, general population and older adults, and athletes,[91–97] highlighting its pervasiveness across age, activity level, and functional status. This widespread burden, coupled with increasing lifetime prevalence trends, reinforces the need for precise, evidence-informed clinical frameworks—especially in relation to exercise, which is considered a core therapeutic strategy. Furthermore, recent evidence emphasizes that patients' adherence to self-managed physical rehabilitation is strongly influenced by factors such as self-efficacy, motivation, intention and social support.[98] Therefore, when evaluating the effectiveness or applicability of exercise progression criteria, these psychosocial determinants should be considered as potential moderators of adherence and clinical response. In this light, future frameworks for progression design may benefit from incorporating individual patient attitudes and behavioral predictors alongside physiological parameters, enhancing both clinical relevance and consistency with real-world self-management dynamics. Furthermore, given the global epidemiological weight of NSLBP, future research must prioritize the development of standardized, adaptable, and outcome-relevant progression protocols capable of responding to this major health challenge.

Strengths and Limitations

This systematic review has several strengths, such as the comprehensive search strategy and the strict adherence to PRISMA guidelines. Importantly, this review addresses a clinically relevant yet underexplored aspect of NSLBP management, preliminarily filling critical gap in current literature.

However, several limitations must be acknowledged. The considerable heterogeneity among included studies, particularly regarding patient's characteristics (age and chronic or acute pain condition as prognostic factors), intervention protocols, progression criteria and outcome measures, substantially limits the generalizability of our findings. Additionally, a high prevalence of methodological shortcomings, including risks of bias in many studies, further constrains the robustness of conclusions. Finally, the variability and inconsistency of reported data precluded a meta-analytical synthesis, restricting our ability to quantitatively estimate the overall effect of progression-based exercise criteria.

Conclusions

This review demonstrates that progression criteria for therapeutic exercise in NSLBP encompass both subjective and objective measures. Although progression-based protocols show promising benefits, particularly for short-term reductions in pain and functional gains, the marked heterogeneity in study designs and progression frameworks precludes definitive conclusions.

Implications for Practice and Proposed Preliminary Algorithms

The adoption of criteria for exercise prescription and progression seems to be more effective than their absence in exercise-based interventions and should be individualized on both patient's clinical characteristics and subjective and objective criteria. Although current evidence remains insufficient to formulate definitive progression standards, the synthesis of findings from this review allows for the delineation of a preliminary, mechanism- and irritability-based algorithm that may guide clinical reasoning in exercise prescription as outlined below.

Step 1 — Patient profiling

a) Pain Mechanism: (probable): nociceptive/nociplastic /mixed;
b) Irritability: high / moderate / low (based on symptom intensity, latency, flare duration, night pain, ADL impact);
c) Key moderators: fear-avoidance/self-efficacy and/or any other psychosocial factor, baseline function, comorbidities.

Step 2 — Progression model selection

1) Predominantly nociplastic with variable irritability

a) Strategy: time-contingent progression with small pre-set increments; prioritize exposure/consistency over symptom-driven decisions;
b) Guardrails: stop only for severe/prolonged flare; apply pacing and brief hold/step-back rules;
c) Criteria mix: subjective markers (tolerance, exertion, next-day recovery) determine cadence; objective markers (time, reps, task completion) confirm consistency rather than drive change;

2) Predominantly nociceptive with low irritability

a) Strategy: objective performance-based progression (time under tension, reps/sets, load, task quality) with planned minor overloads;
b) Monitoring: stay within acceptable symptom window; confirm return-to-baseline before progressing;
c) Criteria mix: objective rules lead while subjective markers (pain/exertion/recovery) maintain safety.

3) Predominantly nociceptive + moderate/high irritability

a) Strategy: hybrid pain-monitoring model with conservative increments;
b) Monitoring: systematic post-exercise check at 24–48 h (soreness, stiffness, night pain, ADL impact);
c) Hold/step-back: regress if flare is disproportionate/prolonged or movement quality deteriorates.

Step 3 — Stop/Go rules

a) Subjective: exertion/fatigue, in-session pain behaviour, 24–48 h response, fear/avoidance shifts;
b) Objective: time under tension, reps/sets, load increments, task quality/range;
c) Progress (Go): criteria achieved within acceptable symptom window and adequate recovery;
d) Hold/Regress: deterioration in movement quality or prolonged flare Documentation: record applied criteria and decision at each session for reproducibility.

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Implications for Research

Future investigations must develop and validate standardized, reproducible progression criteria that accommodate individual variability, pain mechanism, objective and subjective principles. High-quality RCTs with rigorous methodologies, standardized progression criteria, accurate patient-profiling and extended follow-up are essential to determine the long-term effectiveness of progression-based exercise-interventions.

Disclosure

The authors report no conflicts of interest in this work.

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