PREVENTION OF INTERVERTEBRAL DISC HERNIATION: EVIDENCE-BASED APPROACHES TO REDUCING THE RISK OF DISC DEGENERATION AND CLINICALLY SIGNIFICANT LOW BACK PAIN

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https://doi.org/10.5281/zenodo.18543542

ARTICLE INFO

Qabul qilindi: 05-fevral 2026 yil
Ma'qullandi: 07-fevral 2026 yil
Nashr qilindi: 09-fevral 2026 yil

KEYWORDS

intervertebral disc herniation, disc degeneration, prevention, low back pain, physical activity, ergonomics, risk factors, therapeutic exercise, secondary prevention, self-management.

ABSTRACT

Intervertebral disc herniation is often the clinical endpoint of degenerative disc changes combined with adverse biomechanical, behavioral, and occupational factors. Although disc degeneration is partly driven by aging and genetic determinants, a substantial proportion of risk is associated with modifiable factors, including physical inactivity, excess body weight, smoking, poor work organization, repetitive flexion–rotation loading, vibration exposure, and prolonged static sitting. Psychosocial stressors and maladaptive pain beliefs (fear-avoidance) also contribute to symptom persistence and chronicity. Contemporary clinical practice guidelines for low back pain emphasize "active" strategies: maintaining activity, therapeutic exercise, and self-management education; when indicated, multidisciplinary programs incorporating cognitive-behavioral components.

Introduction

Intervertebral disc herniation is among the most clinically relevant manifestations of degenerative spine disease and is frequently associated with radiculopathy, reduced activity, and temporary or persistent work disability. Three points are essential:

1.structural disc changes (protrusions/herniations) are common even in asymptomatic individuals;

2.clinical symptoms emerge when morphological changes coincide with inflammatory/neurogenic pain mechanisms and unfavorable biomechanics;

3.prevention should target not only "avoiding a herniation on MRI," but also reducing the risk of clinically meaningful pain episodes, recurrences, progression of functional limitation, and chronic pain.

Modern low back pain guidelines systematically shift the focus from passive and invasive strategies toward active, behavioral, and rehabilitation approaches: staying active, regular physical activity, and symptom self-management. This provides a methodological foundation for preventing disc-related disorders, including herniations.

Pathophysiological Rationale and Prevention Logic

The intervertebral disc functions as a shock absorber and load distributor. Degeneration involves reduced nucleus pulposus hydration, micro-damage to the annulus fibrosus, changes in vertebral endplates, and impaired diffusion-based nutrition. Against this background, repetitive flexion–rotation loads, sudden heavy lifting, vibration exposure, and prolonged static sitting in non-physiological postures can increase the likelihood of annular fissures and disc material migration.

Therefore, prevention rests on four core pillars:

1.load management (ergonomics, movement technique, dosing);

2.increasing functional capacity (strength/endurance—especially trunk "core," spinal extensors, and general aerobic fitness);

3.control of modifiable risk factors (body weight, smoking, sleep, stress);

4.reducing the risk of pain chronicity (belief correction, maintaining activity, early rehabilitation during acute episodes).

Evidence Base: What Works in Practice

1) Exercise as the cornerstone of prevention

Evidence specifically for "preventing herniation" is limited; however, the evidence for preventing episodes and recurrences of low back pain is substantially stronger. Systematic reviews and meta-analyses indicate that regular exercise (strength training, aerobic exercise, stretching, stabilization) reduces the risk of low back pain episodes and related disability; the most effective programs combine strengthening with stretching and/or aerobic components 2–3 times per week. For chronic low back pain, exercise improves pain and functional outcomes compared with usual care or no treatment.

Practical implication: exercise is the most universal and transferable prevention component because it improves biomechanics, motor control, load tolerance, and psychosocial aspects of pain.

2) "Stay active" and self-management

Clinical recommendations emphasize avoiding unnecessary immobilization and maintaining daily activity within tolerable limits. This is particularly important during first episodes of pain: early activation reduces the risk of chronicity and secondary deconditioning (loss of strength/endurance).

3) Multidisciplinary and psycho-educational components

Syntheses of recent guidelines highlight active care and interventions targeting psychosocial factors (stress, catastrophizing, fear of movement) that increase the likelihood of chronic pain. NICE considers manual therapy only as part of a package that must include exercise (and, when needed, psychological therapy).

4) WHO guidance for chronic primary low back pain

WHO recommendations promote non-invasive, evidence-based interventions in primary/community care and discourage routine use of low-value approaches, emphasizing rehabilitation, activity, and self-management. For disc-related prevention, this provides an important systems-level frame: minimizing cycles of passive care and activity avoidance reduces the risk of chronicity and recurrent episodes.

Risk Factors for Disc Herniation and Targets for Prevention

Key risk categories and modifiable intervention points include:

Biomechanical and occupational factors

repeated lifting/carrying, especially with trunk flexion and rotation;
prolonged static sitting without posture variation;
vibration exposure (e.g., drivers of heavy machinery);
insufficient breaks and low movement variability.

Prevention: workplace ergonomics, training in safe lifting and carrying, micro-breaks, alternating postures, use of mechanization/assistive devices.

Individual modifiable factors
low physical activity, weakness of the core/gluteal/spinal extensor muscles;
excess body weight (increased axial load and systemic inflammation);
smoking (associated with poorer tissue trophism and less favorable outcomes);
sleep disturbance and chronic stress.

Prevention: structured exercise program + weight management + smoking cessation + sleep hygiene and stress management.

Psychosocial factors
fear-avoidance beliefs, catastrophizing, avoidance behavior;
low job satisfaction, chronic psychosocial strain, depressive symptoms.

Prevention: education, cognitive-behavioral elements, and supported return to activity/work using graded exposure principles.

Primary Prevention: Measures for the General Population and High-Risk Groups

1) Minimal "prevention standard" for physical activity

A practical framework consistent with the evidence on exercise prevention:

2–3 times/week: strength training (20–40 min), focusing on core, gluteal, back, and leg muscles;

2–5 times/week: moderate-intensity aerobic activity (walking, cycling, swimming) 20–40 min;

daily: 5–10 minutes of mobility/stretching (hips, thoracic spine, hamstrings).

Prevention is not about "perfect posture," but about regular, varied loading and gradual increases in load tolerance.

2) Principles of "safe lifting" and daily load handling
avoid lifting from deep trunk flexion with simultaneous rotation;
keep the load close to the body's center of mass;
use legs and gluteal muscles rather than "jerking" with the lower back;
split heavy carrying into several smaller bouts;
for frequent handling tasks—use carts, straps, and team lifts.

3) Ergonomics for sedentary work
change position every 30–45 minutes (1–2 minutes of movement);
support lumbar lordosis (lumbar roll/ergonomic backrest);
set monitor at eye level; arrange keyboard/mouse to avoid thoracic "collapse";
avoid prolonged neck flexion with phone/laptop.

Ergonomics does not "cure the disc," but reduces monotonous stress and supports habitual micro-movement.

4) Weight management and smoking cessation

These measures represent background prevention: they reduce systemic load and support tissue recovery. They are particularly important in sedentary individuals with low activity levels.

Secondary Prevention: For Individuals With Low Back Pain Episodes or Prior Protrusions/Herniations

1) The main principle—early activation and interrupting the fear-avoidance cycle

Guidelines consistently support staying active and using exercise as the foundation of recovery rather than substituting it with passive modalities.

2) A structured 12-week exercise program

Goal: restore movement control, strength endurance, and confidence with loading.

Weeks 1–4: stabilization (gentle core exercises), breathing, neutral spine control, walking;

Weeks 5–8: strength progression (gluteals, low-load pulling patterns), increased aerobic dose;

Weeks 9–12: functional integration (lifting technique practice, carrying tasks, resistance training, graded return to sport/work).

For chronic low back pain, exercise has demonstrated benefits for pain and function.

3) Education + psychological support when chronicity risk is high

If a person avoids movement, "protects the back" for months, and anxiety increases, chronicity becomes more likely. In such cases, combining exercise with cognitive-behavioral approaches within self-management programs is justified.

4) Work organization and graded return to load

A graded return reduces relapse risk:

temporary task modification (limiting bending/lifting),

frequent short breaks,

gradual progression of load and work volume.

Cautions and Indications for Medical Assessment

Preventive recommendations do not replace diagnosis. Urgent in-person evaluation is required for "red flags": progressive leg weakness, bladder/bowel dysfunction, saddle anesthesia, fever, history of malignancy, major trauma, persistent severe night pain, and similar warning signs.

Practical Prevention Algorithm (brief)

1.Risk screening: job demands (lifting/vibration/sitting), activity level, body weight, smoking, stress, history of pain episodes.

2.A 12-week baseline plan: 2–3 strength sessions + 2–5 aerobic sessions + daily mobility.

3.Ergonomics and load technique: micro-breaks, lifting training, mechanization.

4.If pain episodes occurred: prioritize activation, exercise, self-management; if chronicity risk is present, add psycho-educational components.

5.Outcome monitoring: load tolerance, sleep quality, flare-up frequency, functional performance.

Conclusion

In an evidence-based paradigm, preventing intervertebral disc herniation is not about identifying the "one correct" movement or imposing blanket restrictions. Rather, it is systematic risk management through regular physical activity, strengthening, load dosing, ergonomics, and prevention of pain chronicity. International low back pain guidance

consistently prioritizes active strategies (exercise, staying active, self-management) and limiting low-value passive interventions. Comprehensive primary and secondary prevention is especially relevant for occupational risk groups and individuals with recurrent low back pain, as it can reduce flare-up frequency, accelerate return to work, and improve quality of life.

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