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Chiropractic management of L5-S1 disc protrusion in an elite speed skater: a case report

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Objective: *To describe clinical outcomes and return-to-play following multimodal chiropractic management of an elite speed skater with acute L5-S1 disc protrusion and S1 radiculopathy.*

Clinical Features: *A 20-year-old male elite speed skater presented with sudden-onset severe lumbosacral pain and S1 dermatomal symptoms during ice training. Assessment revealed positive straight leg raise at 40 degrees, diminished reflexes, and motor weakness consistent with S1 radiculopathy. Day 3 MRI confirmed mild L5-S1 disc protrusion with S1 nerve root impingement.*

Intervention: *McKenzie-based directional preference exercises with lumbar extension movements demonstrating centralization phenomenon. Treatment included progressive loading rehabilitation with sport-specific movement patterns through structured phases, McKenzie exercises performed 3-4 times daily (3-5 sets*

La gestion chiropratique de la protrusion discale L5-S1 chez un patineur de vitesse d'élite: un rapport de cas

Objectif: *Décrire les résultats cliniques et le retour au jeu à la suite d'une gestion chiropratique multimodale d'un patineur de vitesse d'élite présentant une protrusion discale aiguë L5-S1 et une radiculopathie S1.*

Caractéristiques cliniques: *Un patineur de vitesse élite âgé de 20 ans s'est présenté avec une douleur lombo-sacrée sévère d'apparition soudaine et des symptômes du dermatome S1 pendant l'entraînement sur la glace. L'évaluation a révélé un relèvement de jambe droite positif à 40 degrés, des réflexes diminués et une faiblesse motrice compatible avec une radiculopathie S1. La résonance magnétique du jour 3 a confirmé une légère protrusion du disque L5-S1 avec une compression de la racine nerveuse S1.*

Intervention: *Exercices de préférence directionnelle basés sur la méthode McKenzie avec des mouvements d'extension lombaire démontrant le phénomène de centralisation. Le traitement comprenait une réhabilitation par charge progressive avec des mouvements spécifiques au sport à travers des phases*

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of 10-12 repetitions), and coordinated multidisciplinary care with physiotherapy, massage therapy, and strength coaching.

Outcome: *Complete return to competitive speed skating within 4.8 months with sustained participation without symptom recurrence at 12-month follow-up. Notable 5-second personal best improvement in week 9 of rehabilitation.*

Conclusion: *Conservative chiropractic management utilizing McKenzie-based protocols within a coordinated multidisciplinary framework achieved excellent outcomes in this elite athlete with lumbar disc herniation and radiculopathy, including successful return to competitive performance with enhanced outcomes.*

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KEY WORDS: intervertebral disc displacement, radiculopathy, elite athlete, speed skating, McKenzie method, exercise therapy, return to sport, chiropractic, multidisciplinary care

structurées, des exercices McKenzie effectués 3 à 4 fois par jour (3 à 5 séries de 10 à 12 répétitions), et des soins multidisciplinaires coordonnés avec la physiothérapie, la massothérapie et l'entraînement en force.

Résultat: *Un retour complet à la vitesse de patinage de compétition dans les 4,8 mois avec une participation soutenue sans récurrence des symptômes lors du suivi à 12 mois. Une amélioration notable de 5 secondes du meilleur temps personnel lors de la semaine 9 de réhabilitation.*

Résumé: *La gestion chiropratique conservatrice utilisant des protocoles basés sur la méthode McKenzie dans un cadre multidisciplinaire coordonné a obtenu d'excellents résultats chez cet athlète d'élite souffrant d'une hernie discale lombaire et de radiculopathie, notamment un retour réussi à la performance compétitive avec des résultats améliorés.*

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MOTS CLÉS : déplacement du disque intervertébral, radiculopathie, athlète d'élite, patinage de vitesse, méthode McKenzie, thérapie par l'exercice, retour au sport, chiropratique, soins multidisciplinaires

Introduction

The management of lumbar disc herniation (LDH) in elite athletes presents unique therapeutic challenges. Conservative treatment approaches, including multimodal non-operative management with exercise therapy, manual therapy, activity modification, and progressive loading protocols, yield successful return-to-play rates of 79% in athletes, with an average timeframe of 4.8 months from treatment commencement.[1] However, limited data exists regarding performance levels following return to competition, particularly in elite populations where biomechanical demands substantially exceed general athletic activities.

Recent systematic reviews demonstrate no significant difference in return-to-play rates between operative and non-operative management of lumbar disc herniation in elite athletes.[2,3] Professional athletes diagnosed with lumbar disc herniation successfully return to play at high rates with productive careers following treatment.[4] Nevertheless, the specific therapeutic protocols that optimize both return-to-play timeframes and post-injury performance remain underreported.

The McKenzie Method of Mechanical Diagnosis and Therapy (MDT) demonstrates effectiveness in treating lumbar disc herniation through exercises that promote disc centralization while avoiding peripheralization.[5,6] The centralization phenomenon, defined as the progressive migration of referred pain toward the spinal midline, serves both as a diagnostic indicator and prognostic factor for conservative management success.[7] However, application of McKenzie-based protocols in elite athletic populations with documented centralization has not been previously reported in the literature.

Elite athletes present unique management challenges due to extreme biomechanical demands, compressed recovery timelines for competitive preparation, and performance expectations that exceed pre-injury levels. Systematic review of the literature reveals no published

case reports documenting chiropractic management of elite athletes with acute disc herniation and radiculopathy achieving return to competition with performance enhancement. This evidence gap limits clinical decision-making for practitioners managing similar cases.

Speed skating imposes distinctive biomechanical stresses on the lumbar spine through prolonged flexion positioning combined with rotational forces and asymmetric loading patterns. These repetitive high-magnitude forces, particularly during training phases involving five to six sessions weekly for two to six hours per session, create substantial disc loading that may predispose athletes to annular disruption and subsequent radiculopathy.[8]

This case presents the application of conservative chiropractic management protocols within a multidisciplinary framework in an elite speed skater with documented progression from acute S1 radiculopathy to successful competitive performance with enhanced performance outcomes.

Case presentation

A 20-year-old male elite speed skater competed at Class 4 level under the Iwamoto sport-classification system (elite national standard). Clinical findings supported a working diagnosis of left L5-S1 disc protrusion with associated S1 radiculopathy, with pain intensity rated as severe (verbal NPRS 8/10) during weight-bearing activities.". The athlete maintained regular training schedules of five to six sessions weekly, averaging two to four hours per session, and had joined the national development program in May 2019 with ice training commencing in July 2019.

Medical History

The patient reported occasional mild mechanical lumbosacral pain described as dull and achy, which had never previously affected training capacity. No history of significant spinal trauma, fractures, or surgical interventions existed. Family and medical history were unremarkable.

Presenting Complaint

Sudden onset of sharp, intense left-sided lumbosacral pain with radiation to the superior gluteal region extending toward the lateral gluteal fold. Pain onset occurred during multiple skating drill repetitions mid-session, representing the most severe pain the athlete had experienced. He described inability to weight-bear normally and difficulty transitioning from seated to standing positions.

Clinical Findings

Initial on-site assessment revealed an antalgic lean toward the right with truncal forward flexion, requiring arm support to achieve standing position. Active lumbar range of motion was significantly restricted, with flexion limited to 30 degrees reproducing pain, left lateral flexion to 30 degrees, and extension to 10 degrees but remaining painless. Pain intensity was initially rated at 5/10 verbal Numeric Pain Rating Scale (vNPRS) but escalated to 8/10 within four hours post-injury, accompanied by worsening antalgic lean and development of left leg weakness requiring assistance for ambulation. Comprehensive neurological examination confirmed S1 radiculopathy with specific motor deficits, diminished reflexes, and positive neural tension signs. Detailed clinical events, assessment findings, interventions, and outcome measures at each time point are summarized in Table 1.

Diagnostic Assessment

Clinical findings supported a working diagnosis of left L5-S1 disc protrusion with associated S1 radiculopathy, with pain intensity rated as severe (verbal NPRS 8/10) during weight-bearing activities.

The differential diagnosis included L4-L5 disc herniation with L4 radiculopathy, excluded by preserved L4 myotome function (ankle dorsiflexion 5/5) and absence of anterior thigh dermatomal symptoms despite absent left patellar reflex; multi-level disc disease affecting both L4-L5 and L5-S1 levels, ruled out by MRI showing isolated L5-S1 pathology; and central disc herniation with bilateral neural compromise, made unlikely by the asymmetric symptom pattern, unilateral motor deficits, and imaging demonstrating unilateral subarticular protrusion. Mechanical low back pain, facet joint syndrome, piriformis syndrome, and sacroiliac joint dysfunction were excluded based on dermatomal referral patterns, positive neural tension signs, neurological deficits, absence of extension-related pain exacerbation, and negative Patrick-FABER testing.

The mixed neurological presentation (L4 reflex loss with S1 symptom pattern) reflects established clinical patterns. The patellar reflex tests spinal cord segments L2-L4; however, evidence demonstrates that altered

Table 1.
Timeline of clinical events and interventions

Time Point	Clinical Event/Assessment	Intervention	Outcome Measures
Day 0 (Injury onset)	Acute symptom development during ice training session	Training cessation	Immediate functional limitation requiring training cessation
Day 0 (4 hours post-injury)	Comprehensive assessment revealing S1 radiculopathy with severe pain intensity (vNPRS 8/10) during weight-bearing	Neurological examination; Provocative testing; Functional movement assessment	vNPRS escalated to 8/10; Antalgic lean worsened; Left leg weakness requiring assistance for ambulation; Symptoms improved to vNPRS 3-4 in recumbent position
Day 0 (Treatment initiation)	McKenzie assessment with prone press-up trials	Prone press-up exercises (11-12 repetitions); Three consecutive sets; Positioning recommendations (90/90 hip-knee flexion)	Centralization phenomenon demonstrated: Gluteal pain reduction from vNPRS 3-4 to 2; Proximal symptom migration
Day 3	MRI examination performed	Imaging assessment	Confirmed mild L5-S1 disc protrusion with left subarticular nerve root impingement
Weeks 1-4	Progressive symptom monitoring and functional assessment	Progressive McKenzie-based extension exercise protocol performed 3-4 times daily (3-5 sets of 10-12 repetitions each session); coordinated multidisciplinary care with frequency adjusted based on rehabilitation phase	Progressive symptom resolution; Pain levels reduced to manageable levels (vNPRS ≤ 3); Return to pain-free sitting and standing positions
Weeks 5-8	Continued rehabilitation and functional improvement	Sport-specific movement pattern introduction; Progressive loading rehabilitation; Strength and conditioning program modification with daily communication with coaching staff	Restoration of normal lumbar range of motion; Elimination of neurological deficits; Normal reflexes, motor strength, and sensory function restored
Week 9	Competitive return assessment	Multidisciplinary clearance for Canadian National competition participation; On-site vNPRS monitoring every 30 minutes during skating sessions	Return to Canadian National competition; Personal best improvement of 5 seconds achieved
Weeks 9-16	Graduated return to sport activities	Skating-specific movement patterns reintroduced with systematic loading tolerance assessment	Graduated return to ice training activities; Progressive loading tolerance achieved; Skating-specific postures tolerated
Week 19 (4.8 months)	Return to competition assessment	Full return to competitive training and competition	Complete return to elite-level competition
Month 12	Long-term follow-up	Continued competitive participation monitoring	Sustained competitive participation without symptom recurrence or performance degradation

knee jerk expression occurs in 30.3% of L5 monoradiculopathy patients.[9] This phenomenon involves impairment of proprioceptive drive from pretibial muscles to spinal premotor excitatory interneurons[9].

The consolidation of positive straight leg raise with S1 dermatomal distribution, diminished Achilles reflex, and imaging confirmation supported the S1 radiculopathy diagnosis despite some conflicting signs.

The clinical diagnosis was established through systematic neurological examination, provocative testing, and functional movement assessment. McKenzie-based directional preference testing demonstrated centralization phenomenon with lumbar extension movements[10], providing both diagnostic and prognostic information.

MRI examination performed Day 3 post-injury confirmed mild degenerative disc changes at L5-S1 with shallow broad-based disc protrusion in the left subarticular zone resulting in mild impingement of the descending left S1 nerve root.

The apparent incongruence between "mild" MRI findings and significant neurological presentation reflects established clinical patterns. Disc herniation of the same size may be asymptomatic in one patient and lead to severe nerve root compromise in another.[11] MRI accuracy for detecting disc containment demonstrates only 70% overall accuracy.[12] The mild imaging findings may inadequately represent the inflammatory cascade severity or individual anatomical susceptibility.

Conservative management and rehabilitation protocol

Conservative management utilizing McKenzie Method principles with emphasis on directional preference and centralization phenomenon formed the primary intervention approach.[10,11] Initial assessment confirmed lumbar extension as the preferred movement direction, with prone press-up exercises producing consistent symptom centralization and intensity reduction. The exercise protocol consisted of repeated prone press-up exercises performed to end-range lumbar extension, performed three to four times daily with 10 to 12 repetitions per set (3-5 sets each session). The specific repetition count was determined through real-time symptom monitoring as centralization typically occurred at the 11th to 12th repetition. Three consecutive sets were performed during the initial treatment session, demonstrating progressive symptom improvement.

Treatment frequency was applied within established clinical protocols: chiropractic visits twice weekly for the first four weeks then weekly thereafter, physiotherapy twice weekly including manual therapy and dry needling, massage therapy weekly, and daily communication with coaching staff for activity modification[13,14]. This frequency was based on clinical protocols for athletic populations requiring rapid return to competition while ensuring adequate healing time.

Treatment advanced through graduated phases incorporating postural education, movement re-education, and progressive loading strategies specific to speed skating biomechanics, as rehabilitation protocols for athletes with lumbar disc herniation must address the unique demands of sport-specific conditioning programs. Initial management included specific positioning recommendations such as 90/90 hip-knee flexion for symptom relief and activity restrictions to prevent symptom exacerbation while promoting disc healing, with progressive return to skating-specific positions implemented based on symptom response and functional capacity improvements. Treatment frequency and intensity were adjusted based on centralization response and functional improvement markers, maintaining the McKenzie principle of preferential loading in the extension direction throughout rehabilitation[15], with exercise progression guided by symptom behaviour.

Multidisciplinary Team Approach

Management involved collaborative coordination between chiropractic care, physiotherapy (including manual therapy, fascial release, and dry needling), massage therapy, strength and conditioning coaching, and skating coaching. The primary chiropractic intervention focused on McKenzie-based directional preference, while adjunctive passive therapies addressed secondary musculoskeletal restrictions. Critical to treatment success was the coordinated restriction of flexion-based training activities, with strength programming modified to maintain neutral spine positioning while targeting sport-specific energy systems. Daily communication between the primary clinician and head coach ensured ice training loads were adjusted based on the athlete's flexion capacity and symptom monitoring. On-site symptom monitoring using vNPRS scores every 30 minutes during skating sessions determined training continuation or modification. This integrated approach combining expertise in sports physiology, chiropractic care, physiotherapy, and strength conditioning enabled optimal loading management during the critical rehabilitation phases. Chiropractors provided directional-preference exercise prescription, spinal loading advice, and daily symptom monitoring, roles supported by previous sports-chiropractic integration models. Follow-up and outcomes are noted in Table 2.

Table 2.
Follow-up and outcomes summary

Time Period	Functional Outcomes	Pain/Symptom Measures	Neurological Status	Activity Level	Performance Measures
Within 24 hours	Restored ability to achieve standing position independently; Persistent antalgic lean present	Symptom centralization: vNPRS 3-4 to 2 (recumbent); vNPRS 7/10 during weight-bearing activities	S1 radiculopathy symptoms present; Motor weakness persisting	Activities of daily living limited; Weight-bearing restricted	No athletic activity; Training cessation
Weeks 1-8	Normal lumbar range of motion restored; Pain-free sitting and standing achieved; Independent mobility restored	Pain reduced to vNPRS ≤ 3 during ADLs; Centralization maintained; Symptom-free positioning achieved	Complete resolution of neurological deficits; Normal reflexes restored; Motor strength 5/5 bilateral; Sensory function normal	Full activities of daily living; Unrestricted mobility; Preparation for sport return	No competitive activity; Rehabilitation exercises only
Weeks 9-16	Skating-specific movement patterns tolerated; Progressive loading capacity; Sport-specific posture tolerance	Pain-free during skating movements; No symptom recurrence; Extension preference maintained	All neurological deficits resolved; Straight leg raise normalized bilaterally; No symptom reproduction	Graduated return to ice training; Progressive training loads; Sport-specific activities	Gradual return to training intensity; Movement quality assessment; Biomechanical optimization; 5-second personal best achievement at international competition, September 2019
4.8 months	Complete functional restoration; Full training capacity; Normal biomechanical patterns	Pain-free during all activities; No symptom recurrence; Normal pain responses	Complete neurological recovery; Normal reflex responses; Full motor function	Full training loads (5-6 sessions/ week, 2-6 hours/ session); Competitive participation	Return to elite-level competition; National and international competition; Pre-injury performance levels exceeded
12 months	Sustained functional capacity; No activity restrictions; Long-duration training tolerance	Sustained pain-free status; No symptom recurrence; Normal pain thresholds	Stable neurological status; No residual deficits; Normal examination findings	Unrestricted training and competition; Full competitive schedule; No modifications required	Sustained competitive performance; No performance limitations; Continued elite-level participation

Discussion

This case demonstrates successful chiropractic management of lumbar disc herniation in an elite athlete using McKenzie-based protocols within a coordinated multidisciplinary framework. The successful outcome achieving both rapid return-to-play and sustained competitive performance provides evidence for conservative management effectiveness in this population.

The McKenzie method demonstrates effectiveness in treating lumbar disc herniation through exercises that promote disc centralization while avoiding peripheralization.[10,11] The documented centralization phenomenon in this case provided both diagnostic confirmation and therapeutic direction, supporting the theoretical framework underlying directional preference treatment.

Recent evidence confirms that McKenzie-based interventions can produce measurable reductions in disc herniation size as documented through magnetic resonance imaging. McKenzie method enriched with manual techniques shows significant reduction in disc herni-

ation size on MRI, with 85% improvement in disability scores.[15]

Multidisciplinary Management Considerations

The successful outcome in this case highlights the importance of coordinated multidisciplinary care in elite athlete rehabilitation. The integration of chiropractic directional preference techniques with complementary passive therapies (massage, physiotherapy including dry needling and fascial release) addressed both primary disc pathology and secondary musculoskeletal adaptations. Crucially, the collaborative approach between healthcare providers and coaching staff enabled sport-specific load modification while maintaining training specificity for competitive preparation.

The achievement of a five-second personal best improvement at a Canadian National competition in week 9 demonstrates that appropriate multidisciplinary management can not only facilitate safe return to competition but can potentially enhance performance outcomes. This improvement was potentially achieved through the removal of suboptimal functioning associated with a chronically deteriorating disc lesion. This suggests that the systematic approach to load management, combined with targeted therapeutic interventions, may optimize both injury recovery and competitive readiness.

Conservative versus Surgical Outcomes

Current systematic reviews demonstrate no significant difference in return-to-play rates between operative and non-operative management of lumbar disc herniation in elite athletes.[16] This case supports conservative management as a viable first-line approach, particularly when centralization phenomenon is present.

The 4.8-month return-to-play timeline aligns with established averages for conservative management in athletic populations, demonstrating that non-operative approaches can achieve timely return to competition. Athletes with lumbar disc herniation show 79-82% return-to-play rates with conservative treatment, with average career lengths of 3.4 years post-treatment.[4,17]

The athlete's positive response to multidisciplinary chiropractic care can be attributed to several factors: the documented centralization phenomenon (studies show 58-91% prevalence of centralization in lower back pain, with 67-85% displaying directional preference for spinal extension)[7,18], age-related healing advantages; inflammatory resolution through natural disc resorption mechanisms[16]; and the extension-based approach successfully countering speed skating's prolonged flexion positioning demands.

Given the athlete's age (20 years), documented centralization response, and complete neurological recovery, the prognosis is favourable for sustained athletic participation. McKenzie method demonstrates sustained improvements in pain and disability at 12-month follow-up.[17,18] Recent systematic reviews show no significant difference in return-to-play rates between operative and non-operative management in elite athletes, supporting the conservative approach utilized.[15]

Study limitations

This single case report limits generalizability to broader athletic populations. Follow-up assessments at 4.8 months and 12 months were conducted via verbal confirmation of symptom-free status due to pandemic-related restrictions, limiting comprehensive physical re-examination. The multidisciplinary nature of care makes it difficult to isolate the specific contribution of individual interventions to the overall success. Future research should include control groups receiving alternative treatments, objective functional assessment tools specific to speed skating performance, blinded outcome assessors, standardized treatment protocols with defined progression criteria, and multiple treatment sites.

Clinical implications

The successful outcomes achieved through this conservative management support multimodal management approaches containing McKenzie-based protocols within multidisciplinary frameworks as effective first-line treatment for lumbar disc herniation in elite athletes. This approach is particularly indicated when centralization phenomenon is present.

Future research should focus on identifying predictive factors for conservative management success and developing standardized protocols for specific athletic populations. Controlled studies comparing conservative and surgical approaches in elite athletes would provide valuable evidence for clinical decision-making. Additionally, investigation into the optimal coordination of multidisciplinary teams and the specific contributions of individual

interventions within comprehensive care models warrants further study.

Unique Contribution to Literature

Systematic literature review reveals this represents the first published case report documenting:

- Chiropractic management of acute disc herniation with radiculopathy in an elite national-level athlete
- McKenzie-based centralization phenomenon application in speed skating biomechanics
- Complete return to elite competition with documented performance enhancement following acute disc herniation
- Detailed multidisciplinary protocol coordination between chiropractic care and elite athletic training programs

This evidence gap has limited clinical decision-making for practitioners managing similar cases. The documented protocol provides a replicable framework for conservative management in elite athletic populations.

Patient Perspective

The athlete was highly satisfied with the conservative multidisciplinary McKenzie approach, particularly valuing the active self-management component. Understanding the rationale behind exercises enhanced adherence and recovery confidence. Education about symptom centralization provided reassurance during early treatment when pain remained high, and the ability to control symptoms through movement reduced injury-related anxiety. The coordinated team approach provided confidence in the comprehensive nature of care delivery and facilitated clear communication regarding training modifications and progression.

Summary

This case demonstrates that conservative chiropractic management utilizing McKenzie-based principles within a coordinated multidisciplinary framework can achieve excellent outcomes in elite athletes with lumbar disc herniation and radiculopathy. The successful return to competitive performance within 4.8 months with enhanced performance outcomes including a 5-second personal best achievement supports multidisciplinary chiropractic management as an effective first-line approach for appropriate cases.

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