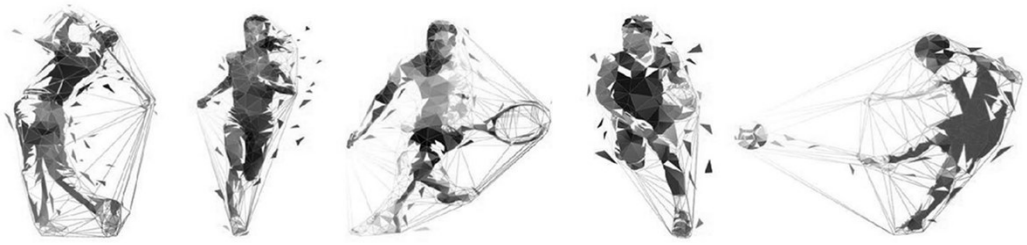

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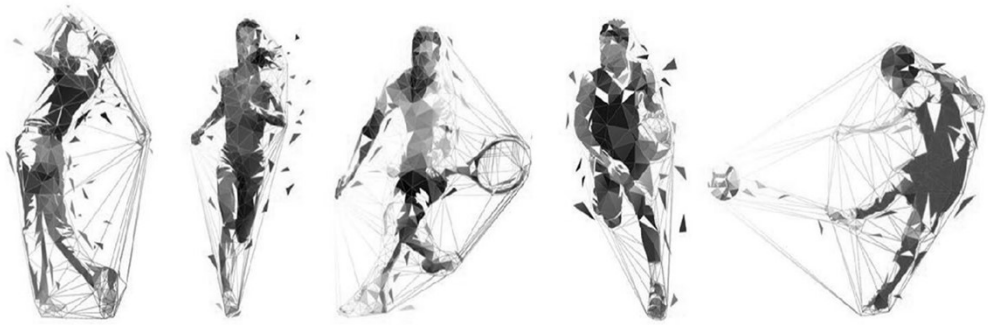


Low Back Pain in the Golfing Athlete

Considerations in Prevention and Rehabilitation

WHAT WE'LL COVER TODAY

1. **Common LBP Injuries in Golfers**
   What we see clinically — diagnoses, prevalence, presentation
2. **Causes & Risk Factors**
   Physiological & swing-related contributors to lumbar overload
3. **Prevention**
   Evidence-based exercise programs that reduce LBP risk
4. **Treatment**
   From conservative care to interventional & surgical options

SECTION 1

Common LBP Injuries in Golfers

What we see in the clinic — diagnoses & prevalence

HOW COMMON IS LBP IN GOLFERS?

2.5

injuries per 1,000 rounds of golf[1]

8.5×

higher injury rate in professionals[1]

#1

site of injury in professional golfers

LBP accounts for 25–36% of all golf injuries — the most commonly injured region in the sport

[1] *Kuitunen & Ponkilainen (2024). Injury incidence in golf — systematic review & meta-analysis. Irish J Med Sci.*

MEN vs. WOMEN: WHAT DOES THE RESEARCH SHOW?

Sex differences in golf injuries — and specifically low back pain

OVERALL GOLF INJURIES

Women	Men
2.6	**1.4**
per 1,000 AE	*per 1,000 AE*

No statistically significant difference

Wide overlapping CIs (0.7–9.6 vs 0.4–5.2). Men have higher rates in team sports — golf differs.[1]

LOW BACK PAIN SPECIFICALLY

Women	Men
22–27%	**25–36%**
LBP incidence	*LBP incidence*

Slightly higher in men

LBP is the #1 injury site in men, #2 in women — who see proportionally more upper-extremity injuries.[2]

[1] Kuitunen & Ponkilainen 2024 · [2] Lindsay & Vandervoort 2014; McHardy 2007 · Caveat: ~80% of golfers (and most published research) are men.

COMMON DIAGNOSES

~40%	~25%	~20%	~10%	~5%
Muscle Strain / Ligament Sprain	**Disc Herniation / Degenerative Disc**	**Facet Joint Syndrome**	**Spondylolysis / Spondylolisthesis**	**Sacroiliac Joint Dysfunction**
Paraspinals, quadratus lumborum; acute overload	L4–L5, L5–S1; axial + radicular sx	Extension-loaded; reproduced with rotation	Pars stress; more common in juniors	Rotational asymmetry; often misdiagnosed

Most cases respond to conservative care — but disc and pars pathology must be excluded

THE LEAD-SIDE PATTERN

Golf injuries are not symmetric.

The lead side (left in right-handed players) bears disproportionate stress.[1]

Lead Hip	More morphological MRI findings (CAM/pincer) on lead side
Lead Knee	Higher incidence of meniscal and ligamentous injury
Lead Wrist	Most prevalent wrist injuries reported on European Tour
Lead Shoulder	Greater rates of impingement and labral pathology
Lumbar Spine	Asymmetric facet/disc loading from repetitive rotation

[1] *Kuitunen & Ponkilainen (2024) — narrative synthesis*

SECTION 2

Causes & Risk Factors

Why does the golf swing hurt the lumbar spine?

THE GOLF SWING: MECHANICAL LOADS

Why the lumbar spine takes such a beating

900°/sec	>7×	~8×
Rotational velocity at impact	Compressive spinal force (× body weight) per swing[2]	Lateral shear force (× body weight) at downswing

These forces are repeated dozens of times per round, every round.

[2] *Watson et al. (2026). Sports Medicine. doi:10.1007/s40279-025-02391-3*

LOAD ACROSS THE SWING

Where in the swing does the spine take the most stress?

01	02	03	04
BACKSWING	**DOWNSWING**	**IMPACT**	**FOLLOW-THROUGH**
Hip-shoulder separation; thoracic rotation builds	Peak lumbar shear & compression	Ground reaction force transmission	Hyperextension & lateral flexion

Skilled golfers generate higher GRF and faster weight transfer — increasing both clubhead speed AND lumbar load.[2]

[2] *Watson et al. 2026*

PHYSIOLOGICAL RISK FACTORS

Body-side factors that make golfers vulnerable to LBP

Limited hip IR	Reduced lead-hip rotation forces compensatory lumbar rotation
Reduced thoracic mobility	T-spine stiffness shifts rotation demand to the lumbar segments
Weak lead hip ER	Gluteus medius/maximus stabilize the pelvis during downswing
Poor core endurance	Reduced trunk stability associated with LBP development
Hamstring/hip flexor tightness	Pelvic tilt asymmetry; alters lumbar load distribution
Prior LBP / disc disease	Strongest single predictor of recurrence

[3] Hamada et al. 2025 — most physiological factors are modifiable with training

SWING-RELATED RISK FACTORS

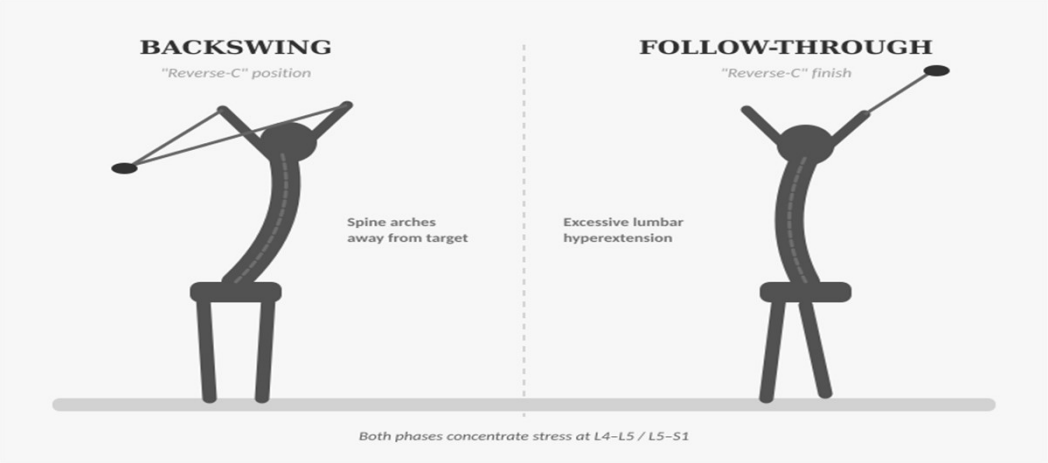
Technique and behavioral factors that overload the lumbar spine

Reverse-C finish	Excessive lumbar hyperextension at follow-through
Over-swinging	Driving past safe rotational range with arms
Inefficient weight transfer	CoP variability higher in less-skilled players[2]
Excessive practice volume	Repetitive load without adequate recovery
Inadequate warm-up	Pre-game programs significantly reduce LBP[3]
Premature return after injury	High recurrence without full rehabilitation

[2] Watson et al. 2026 | [3] Hamada et al. 2025

REVERSE-C: BACKSWING & FINISH

An exaggerated S-shape spine — common in older instructional traditions



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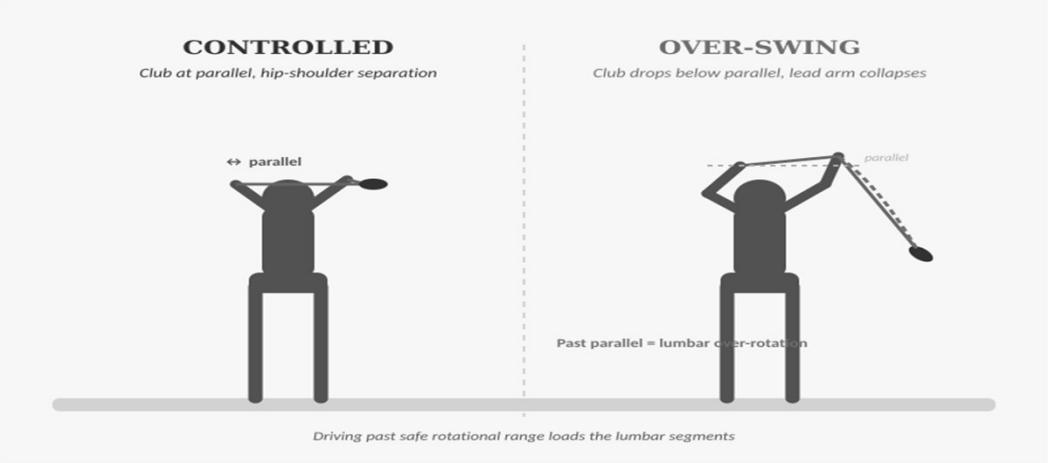
REVERSE-C — EXPLAINED

Why this swing pattern is hard on the lumbar spine

WHAT IT IS	An exaggerated arch in the lower back — at the top of the backswing the spine bends away from the target, and at the finish the trunk bends back toward the target with the hips pushed forward.
WHY IT HURTS THE BACK	This concentrates compression and shear at L4–L5 and L5–S1 with every swing. The lumbar facets are forced into repeated end-range hyperextension, which is a known driver of facet pain and pars stress.
THE FIX	Coach a softer, more vertical finish — chest tall, ribs over pelvis, a level pelvis at impact rather than thrust forward. Address tight hip flexors that often drive the compensation.

OVER-SWING

Going past parallel — most often a strength or mobility issue, not a power move



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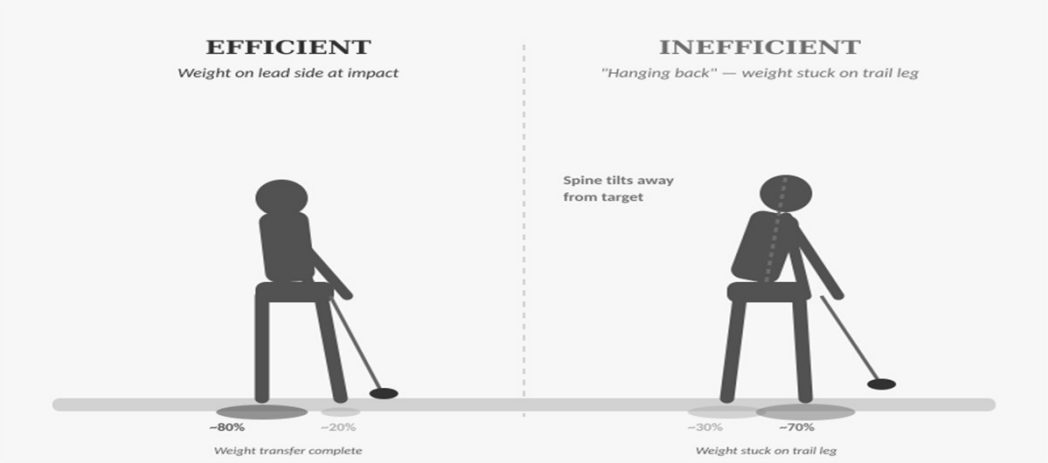
OVER-SWINGING — EXPLAINED

Why "longer is not stronger" for the lumbar spine

WHAT IT IS	The club drops below parallel at the top of the backswing — usually because the lead arm collapses or the trunk rotates beyond the safe limit of hip-shoulder separation.
WHY IT HURTS THE BACK	Past a certain point, the body has no more thoracic or hip rotation to give, so the extra movement comes from the lumbar segments. Lumbar rotation has a small range (~5° per side) — exceeding it strains discs and facets.
THE FIX	Build thoracic mobility and lead-arm strength so the golfer doesn't *need* to over-rotate to feel "loaded." A shorter, more controlled backswing typically generates the same or higher clubhead speed.

INEFFICIENT WEIGHT TRANSFER

"Hanging back" — weight stays on the trail leg through impact



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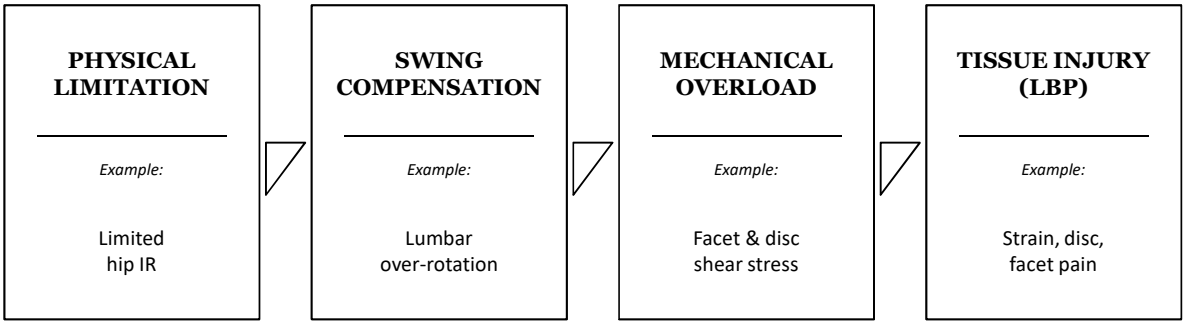
INEFFICIENT WEIGHT TRANSFER — EXPLAINED

What ground-reaction-force research tells us

WHAT IT IS	At impact, weight should be ~80% on the lead leg with the pelvis cleared. "Hanging back" means the trail leg stays loaded and the spine tilts away from the target to compensate.
WHY IT HURTS THE BACK	The compensatory side-bend places asymmetric shear on the lumbar discs and facets — this is what GRF/CoP studies link to higher injury risk.[2] Less-skilled players show higher CoP variability and worse weight transfer.
THE FIX	Drill weight shift in isolation (step-throughs, pump drills) and address lead-side hip mobility & glute strength — limited hip IR is a common cause of inability to clear the lead side.

THE BODY-SWING CONNECTION

Physical limitations drive swing compensation. Swing compensation drives spinal load.



Effective prevention and treatment work upstream — at the body level, not just the symptoms.

SECTION 3

Prevention

Evidence-based programs to keep golfers playing

DOES PREVENTION WORK?

The strongest evidence comes from a recent randomized controlled trial.

HAMADA et al. 2025 — RCT

Golfers' Low Back Pain Exercise Prevention Program (GLEP)

- Double-blind, randomized, sham-controlled
- 45 adolescent competitive golfers
- 12-week pre-game warm-up protocol
- 6 dynamic exercises performed before each round

Published in BMC Sports Science, Medicine and Rehabilitation (2025)

[3] *doi:10.1186/s13102-025-01287-z*

GLEP TRIAL — KEY RESULTS

What did 12 weeks of pre-game warm-up actually do?

p = .017	+15%	↑ ROM	= performance
Significant interaction effect: lead hip ER strength	Lead hip external rotator strength gain at 12 weeks	Hip IR/ER mobility and trunk endurance both improved	No reduction in clubhead speed, ball speed, or carry

A structured pre-round warm-up improves the exact functions linked to LBP — without harming performance.

[3] *Hamada et al. 2025*

MOBILITY & STABILITY EXERCISES

Restoring movement quality and trunk control

HIP MOBILITY	T-SPINE MOBILITY	CORE STABILITY
90/90 Hip Stretch	**Thoracic Rotation**	**Bird-Dog**
Hip IR/ER mobility · both hips on the floor	*T-spine mobility · quadruped position*	*Opposite arm & leg extended · neutral spine*

All exercises map to the GLEP intervention[3] — pre-round warm-up and off-course training

STRENGTH & CONTROL EXERCISES

Building the muscular foundation that protects the spine

GLUTE STRENGTH	ANTI-ROTATION	ANTI-LAT FLEX
Single-Leg Deadlift	**Pallof Press**	**Side Plank**
Glute/hip strength · level hips & shoulders	*Anti-rotation hold · resist cable pull*	*Anti-lateral flexion · hips off the floor*

Together: hip mobility + hip ER strength + anti-rotation core + thoracic rotation = the four pillars of prevention

BANDED HIP THRUST

GLUTE STRENGTH · LEAD HIP DRIVE

SIDELYING PLANK W/ HIP ER

ANTI-LATERAL FLEXION + HIP ER

HIP INTERNAL ROTATION STRETCH

TRAIL OR LEAD HIP MOBILITY

THORACIC MOBILITY

HOW TO PROGRAM IT

PRE-ROUND WARM-UP

10 min · before play

- Hip mobility (90/90, lunges)
- Dynamic glute activation
- Thoracic rotation drills
- Light progressive swings

OFF-COURSE TRAINING

2–3×/week · 30–40 min

- Anti-rotation core work
- Hip strengthening (SLDL)
- Thoracic mobility
- Build over 8–12 weeks

TECHNIQUE & VOLUME

ongoing

- Address reverse-C with PGA pro
- Track practice volume
- Optimize equipment fit
- Annual TPI movement screen

Based on GLEP protocol[3] + TPI Body-Swing Connection framework

SECTION 4

Treatment

When prevention falls short — getting golfers back to play

THE TREATMENT PATHWAY

A stepped approach — most golfers never need to leave the first tier.

TIER 1

Conservative Care

70–80% resolve here

Detailed in next slides

TIER 2

Interventional

When tier 1 plateaus

Detailed in next slides

TIER 3

Surgical

<5% of cases

Detailed in next slides

Each tier explored individually in the slides that follow.

CONSERVATIVE CARE — ACUTE PHASE

DAYS 1–14 · CONTROL PAIN AND PROTECT THE TISSUE

1. **Relative rest**
   Avoid aggravating swing motions; no full swings
2. **Pain control**
   Ice/heat cycling; NSAIDs as appropriate
3. **Manual therapy**
   Joint mobilization and soft tissue work
4. **Activity modification**
   Putting and chipping only — keep golfer engaged with the game

Goal: pain ↓ and full ROM tolerated by week 2

CONSERVATIVE CARE — SUB-ACUTE PHASE

WEEKS 2–6 · RESTORE MOVEMENT AND BUILD CAPACITY

1. **Lumbar stabilization**
   Bird-dog, dead bug — neutral spine activation
2. **Hip mobility restoration**
   Focus on internal rotation, the most commonly limited motion
3. **Aerobic conditioning**
   Aqua therapy or stationary cycling — maintain fitness without spinal load
4. **Begin half-swing**
   Short irons (PW–9i) by week 4 if asymptomatic

Goal: pain-free with daily activities; tolerating half-swing without flare

CONSERVATIVE CARE — REHAB & RETURN

WEEKS 6–12+ · SPORT-SPECIFIC PREPARATION

1. **Anti-rotation training**
   Pallof press progressions — sport-specific core demand
2. **Hip & glute strengthening**
   Single-leg deadlift, hip thrust — power for the swing
3. **Swing retraining**
   PGA professional or TPI-certified coach addresses compensations
4. **Graded return to play**
   Volume-tracked progression following the RTG protocol

Same tools used in prevention[3] — rehab and prevention share the same toolkit

TIER 2: INJECTION-BASED OPTIONS

Image-guided procedures used when conservative care plateaus (typically 6–8 weeks)

Epidural Steroid Injection

Indication: *Disc herniation with radicular symptoms*

Outcome: 60–80% short-term relief; supports rehab progression

Facet Joint Injection / MBB

Indication: *Suspected facetogenic axial pain*

Outcome: Diagnostic + therapeutic; guides RFA selection

SI Joint Injection

Indication: *When SI joint confirmed as pain generator*

Outcome: Often missed in golfers due to rotational asymmetry

Typically performed under fluoroscopic or ultrasound guidance

TIER 2: PROCEDURAL & EMERGING OPTIONS

More definitive interventions and biologics for selected cases

Radiofrequency Ablation (RFA)

Indication: *Confirmed chronic facet pain (positive MBB)*

Outcome: 6–18 months relief; evidence-supported in axial LBP

PRP / Regenerative Biologics

Indication: *Soft-tissue injury or early disc pathology*

Outcome: Emerging evidence; limited high-quality RCT data

Patient selection is critical — particularly for biologics where evidence remains evolving

TIER 3: SURGICAL CONSIDERATIONS

WHEN TO CONSIDER SURGERY

- ≥6 months failed conservative care
- Progressive neurological deficit
- Cauda equina syndrome (absolute)
- Persistent radiculopathy + imaging
- Mechanical instability
- Symptomatic active pars defect

PROCEDURES & RTG TIMELINE

Microdiscectomy	Excellent outcomes for HNP + radiculopathy
Pars Repair (direct)	Young athletes with active spondylolysis
Lumbar Fusion	Last resort — affects rotation
Discectomy RTG	≈ 4–6 months to full play
Fusion RTG	≈ 12+ months; rotation may not fully return

RETURN-TO-GOLF: PAIN CRITERIA

PAIN MUST BE CONTROLLED BEFORE PROGRESSION CAN BEGIN

Resting pain	**VAS / NRS ≤ 1/10**
Pain with full lumbar ROM	**0/10 — no provocation**
Test swing (mid-iron, 50%)	**≤ 2/10 with full resolution within 24 h**
Radicular symptoms	**Absent for ≥ 14 consecutive days**

Pain monitoring is the foundation — any flare halts progression

RETURN-TO-GOLF: MOBILITY CRITERIA

MOBILITY MUST BE RESTORED TO PROTECT THE SPINE

Hip IR (passive, prone)	**≥ 35° bilaterally · L-R asymmetry < 10°[4]**
Hip ER (passive, prone)	**≥ 30° bilaterally**
Thoracic rotation (seated)	**≥ 45° each side · symmetrical**
Lumbar flexion (FFD)	**Within 5 cm of pre-injury baseline**

[4] Hip IR < 35° linked to LBP in golfers (Murray 2009; Vad 2004)

RETURN-TO-GOLF: STRENGTH & ENDURANCE CRITERIA

THE FOUNDATION THAT MUST BE REBUILT BEFORE FULL PLAY

Lead hip ER (HHD)	**≥ 0.35 N/kg · symmetric to trail (within 10%)[3]**
McGill side-bridge endurance	**≥ 60 sec each side · L–R within 5%**
McGill flexor:extensor ratio	**Approximating 1.0 (normalized)**
Single-leg squat / glute activation	**Symmetric, no Trendelenburg**

[3] Hip ER strength target derived from GLEP RCT (Hamada et al. 2025)

RTG: WEEK-BY-WEEK SWING PROGRESSION

Stage	Activity	Effort	Swings/session	Sessions/wk	Pain ceiling
Stage 1 Wk 1–2	Putting & chipping only	**30–50%**	20–30 chips + putting	2–3	**≤ 2/10**
Stage 2 Wk 2–3	Half-swing wedge / 9-iron	**50%**	20 → 40	3	**≤ 2/10**
Stage 3 Wk 3–4	¾ swing, short irons (PW–8i)	**60–70%**	40 → 60	3	**≤ 2/10**
Stage 4 Wk 4–6	Full swing, mid-irons (7–6i)	**75–85%**	60 → 80	3	**≤ 1/10**
Stage 5 Wk 6–8	Long irons + hybrids; 9 holes walking	**85–90%**	80–100 (+ on-course)	3	**0–1/10**
Stage 6 Wk 8+	Full bag, 18 holes, unrestricted	**100%**	Pre-injury volume	Pre-injury	**0/10**

Hold ≥ 1 fully asymptomatic week before advancing — see next slide for monitoring rules.

RTG: PAIN & PROGRESSION RULES

These rules govern the entire return-to-golf protocol.

The 24-Hour Rule

Pain must return to baseline within 24 hours of any session. If not, step back one stage.

Asymptomatic Week

Hold at each stage for at least one full week without symptoms before advancing.

Re-Warm-Up

GLEP warm-up before every session. Mobility and glute activation prior to each round.

Flare Criteria

Recurrent pain >3/10, neurological symptoms, or stiffness >48 hours → return to clinician.

KEY TAKEAWAYS

01 LBP is the #1 golf injury — pooled incidence 2.5/1,000 rounds; pros 6–7× higher risk than amateurs.[1]

02 The lumbar spine sees compressive forces >7× body weight per swing — driven by hip, thoracic, and core function.[2]

03 Causes are body AND swing — physical limitations drive swing compensation, which drives spinal load.

04 PREVENTION works: a structured pre-game program (GLEP) significantly improves hip ER strength and reduces LBP risk — without hurting performance.[3]

05 TREATMENT is stepped: 70–80% of golfers respond to conservative care. Surgery is rare but indicated for the few who need it.

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