AMATEUR and professional golfers are at risk for injuries to the low back, shoulders, elbows, wrists and hands, and the knees. The lumbar spine is particularly susceptible to injury, due to the shear, compression, rotation, and lateral bending forces created during each golf swing. The combination of these forces contributes to golfers experiencing more injuries to the low back than any other region of the body.

The golfer’s lumbar spine experiences compressive loads during each swing that are approximately 8 times one’s bodyweight.

The purpose of this report is to present a functional rehabilitation program for golfers who have chronic low back pain (LBP). Athletic trainers and therapists should consider the patient’s preinjury fitness level and strength and conditioning training habits, as well as the forces exerted upon the lumbar spine by the multiplanar nature of the golf swing, when prescribing rehabilitative exercises.

Potential Risk Factors

Research evidence and clinical experience suggest that golfers who suffer from LBP demonstrate dysfunctional trunk flexibility and inadequate core strength and endurance. There are a few published research reports that have identified predictors of low back injury in golfers. Hypomobility has been reported among golfers with LBP. Vad et al. conducted a cross-sectional study of hip and spine range of motion in both healthy and previously injured male golfers. Golfers who had previously experienced LBP (for a period of at least 2 weeks) demonstrated a statistically significant association between injury occurrence and decreased lead hip internal rotation, decreased lead hip FABERE distance (FABERE position measurement of the distance from the knee to table surface), and decreased lumbar extension. A golfer with an inadequate amount of lead hip internal rotation will compensate during the golf swing by excessively rotating through the lumbar spine. This compensatory swing pattern increases the stress imposed on the lumbar spine, especially if spinal mobility is limited. Golfers with LBP have also demonstrated increased trunk flexion at ball address and excessive leading side flexion during the backswing.

Key Points

Successful return of a golfer with low back pain to sport depends on identification of core dysfunctions and implementation of exercises that address them.

A comprehensive rehabilitation approach for golfers with low back pain should include the prescription of functional core exercises.

Referral to a professional golf instructor may be necessary to eliminate faulty swing mechanics that contribute to back pain.
When a golfer sustains a low back injury, muscle inhibition associated with the injury does not necessarily resolve with the cessation of LBP.\textsuperscript{10-12} Golfers with LBP have been found to have difficulty activating the transverse abdominis (TrA) muscle.\textsuperscript{5} Evans et al.\textsuperscript{5} evaluated the endurance capacity of the TrA muscle in 20 male golfers with a history of LBP and found that it was significantly lower than that measured in a cohort of golfers who had no history of back pain.\textsuperscript{5} Lindsay et al.\textsuperscript{8} found that golfers with LBP demonstrated significantly less trunk rotator endurance capacity than that of healthy golfers and control subjects. A longitudinal prospective study determined that professional golfers were at risk of sustaining a low back injury if they demonstrated a lateral endurance test performance difference greater than a 12.5 seconds between sides, body mass index less than 25.7 kg/m\textsuperscript{2}, and reduced hip flexor length.\textsuperscript{6}

### Evaluating Functional Core Strength and Initial Treatment Strategies

A thorough musculoskeletal examination should be performed to identify each patient’s unique functional limitations. To evaluate a golfer’s core endurance capacity, the core endurance functional tests as advocated by McGill\textsuperscript{13} are recommended. Core endurance capacity is assessed by timing the golfer’s ability to maintain each of three test positions: (a) the lateral musculature test performed on each side, (b) the flexor endurance test, and (c) the back extensor test. Total endurance capacity and ratios between the tests help to identify dysfunctional components.\textsuperscript{1}

McGill\textsuperscript{13} advocates an initial rehabilitation strategy to improve the endurance capacity of the core musculature in those who have suffered a low back injury. Along with development of fatigue resistance, immediate rehabilitation interventions should be focused on normalization of any side-to-side flexibility difference. Table 1 presents the components of the initial phase of a return to golf rehabilitation program that is designed to improve core musculature endurance capacity and achieve optimal ratios between groups of muscles. A guide for progression is to first teach awareness of spine position and specific muscle activation, followed by implementation of stabilization activities that build core musculature endurance and establish motor activation patterns and then reinforcing proper muscle activation patterns during functional activities.\textsuperscript{13}

<table>
<thead>
<tr>
<th><strong>Table 1. Initial Core Endurance Program to Improve Core Endurance Capacity</strong></th>
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<tbody>
<tr>
<td>Bird dog</td>
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<tr>
<td>Side planks</td>
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<tr>
<td>Crunches</td>
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<td>Front planks</td>
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### Functional Golf Core Training

Once the patient demonstrates improved core endurance scores (Table 2), progression can be made to a functional core conditioning program. Inclusion of functional core exercises is a key to optimal recovery. The golfer’s core muscles are responsible for dual roles of creating torso rotation and stabilizing (protecting) the spine from injurious forces.\textsuperscript{14} A variety of exercises should be performed, because trunk stabilization requires proper activation of multiple muscle groups.\textsuperscript{15} The exercises utilized in this phase of the rehabilitation program should reproduce functional movement patterns. Some exercises are not appropriate for all individuals. Discretion should be used based on the individual athlete when selecting exercises for golf performance and rehabilitation.

Exercises that challenge a golfer’s ability to stabilize his or her spine while incorporating functional movement patterns include the lunge twist, the prone twist (Figure 1), the Russian twist (Figures 2 & 3), and kettle ball squats (Figures 4 & 5). Table 3 presents a sample advanced functional core rehabilitation program and Table 4 presents a description of each exercise.

### Including Plyometrics in a Strength Training Program

When the golfer’s symptoms have resolved and endurance and strength have been restored, plyometric training should be included in the rehabilitation program. Research has demonstrated that the integration of plyometrics increases club head velocity (CHV) and driving distance (DD).\textsuperscript{16,17} Plyometric training may also help to protect the body from potentially injuri-