Golf: a contact sport. Repetitive traumatic discopathy may be the driver of early lumbar degeneration in modern-era golfers

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In 2018, we watched golf’s most dominating player unexpectedly return to the competitive arena. Following three lumbar laminotomy and microdiscectomy procedures, beginning in 2014, Tiger Woods, now 43 years old, succumbed to years of incapacitating back pain and spasms and underwent an L5–S1 anterior lumbar interbody fusion in April 2017. Seven months later, the winner of 14 major golf championships and 79 Professional Golfers’ Association (PGA) events returned to tournament play, claiming to be finally pain free and a “walking miracle.” Swinging the golf club at measured speeds of 129 mph at the April 2018 Master’s Tournament—as fast as any other player on the tour—Woods appeared to be back in full physical capacity. His victory at the Tour Championship may be considered one of the greatest comebacks in all of sports history.

As spine surgeons, we appreciate golf’s impact on spinal health, given that there are nearly 32 million golfers in the United States (2017 statistic), or 1 in 10 people.15 Among professional and amateur golfers, back disorders remain the most common injury, comprising 55% and 35% of injuries in these groups, respectively.7,8,13 Likewise, an increasing number of young professional golfers are experiencing low-back pain and degenerative disc disease at ages much younger than those of the general adult population.5 To understand why this is occurring, one needs to take a closer look at how the modern golf swing has changed in recent decades.

While seemingly innocuous at first glance, the forces necessary to generate swing speeds that allow golfers to hit the ball at their current distances are significant and place extraordinary loading and torsional stress vectors on the lumbar spine. Some estimates indicate that professional golfers experience about 7500 N of compressive force on the spine during the downswing, which is about eight times the average human body weight and comparable to forces calculated for football linemen while striking a blocking sled.10,12 Considering that the average golf player takes more than 300 swings per day, the long-term effects are not trivial, particularly for a sport that allows for decades of participation.

As technology has propelled driving distances forward, so too has the focus on creating swing paths that produce the most power. To achieve the acceleration required for club head speeds greater than 100 mph in one-fifth of a second, a slow deliberate backswing is followed by an explosive rotational downswing. By rotating their hips, shoulders, and hands backward, players generate wound-up, spring-like potential energy that is then released in a concentric movement as the club comes back down. During this phase, the hips slide forward (hence the phrase “leading with the hips”) and both hips and shoulders twist toward the target to pull the club into the follow-through. This takes advantage of the stretch-shorten cycle of muscle fibers to maximize energy output.2

Modern golf instruction has focused on maximizing rotation of the thorax relative to the hips to store up elastic potential energy, which is unleashed during the downswing. Three-dimensional swing-tracking software has shown that the greater the angle created by shoulder rotation (a line through the acromion of each shoulder) and hip rotation (a line connecting the hips), the greater the club speed generated, a concept known as the “X-factor” because these lines form the shape of an X (Fig. 1 upper).14 In addition to the X-factor, players are taught to keep arms tight into their body during the downswing, shifting and translating the hips, while explosively twisting the torso and shoulders around the center of mass as the ball is struck. This creates an immense amount of lateral bend-
FIG. 1. Schematic drawings demonstrating the local effects of the modern golf swing on the lumbar spine (example shown at the L4–5 level), contributing to RTD. **Upper:** During the backswing, maximal rotation of the golfer’s shoulders relative to the hips creates wound-up potential energy known as the “X-factor,” while also creating a supramaximal amount of torsional axial rotation of the lumbar spine. **Lower:** During an explosive downswing, lateral flexion results in a “crunch” of the trailing side of the spine, asymmetrically loading the disc and facet joints. © 2018 Barrow Neurological Institute. Used with permission.