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ORIGINAL RESEARCH

Association Between Rotation-Related Impairments and Activity Type in People With and Without Low Back Pain

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Abstract

Objective: To determine whether people with low back pain (LBP) who regularly participated in a rotation-related activity displayed more rotation-related impairments than people without LBP who did and did not participate in the activity.

Design: Secondary analysis of data from a case-control study.

Setting: Musculoskeletal analysis laboratory at an academic medical center.

Participants: A convenience sample of participants with LBP (n=55) who participated in a rotation-related sport, back-healthy controls (n=26) who participated in a rotation-related sport, and back-healthy controls (n=42) who did not participate in a rotation-related sport. Participants were matched based on age, sex, and activity level.

Interventions: Not applicable.

Main Outcome Measures: The total number of rotation-related impairments and asymmetrical rotation-related impairments identified during a standardized clinical examination.

Results: Compared with the back-healthy controls who do not play a rotation-related sport group, both the LBP and back-healthy controls who play a rotation-related sport groups displayed significantly more (1) rotation-related impairments (LBP, $P<.001$; back-healthy controls who play a rotation-related sport, $P=.015$), (2) asymmetrical rotation-related impairments (LBP, $P=.006$; back-healthy controls who play a rotation-related sport, $P=.020$), and (3) rotation-related impairments with trunk movement tests (LBP, $P=.002$; back-healthy controls who play a rotation-related sport, $P<.001$). The LBP group had significantly more rotation-related impairments with extremity movement tests than both of the back-healthy groups (back-healthy controls who play a rotation-related sport, $P=.011$; back-healthy controls who do not play a rotation-related sport, $P<.001$).

Conclusions: The LBP and back-healthy controls who play a rotation-related sport groups demonstrated a similar number of total rotation-related impairments and asymmetrical rotation-related impairments, and these numbers were greater than those of the back-healthy controls who do not play a rotation-related sport group. Compared with people without LBP, people with LBP displayed more rotation-related impairments when moving an extremity. These findings suggest that impairments associated with extremity movements may be associated with having an LBP condition.

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Low back pain (LBP) affects 60% to 80% of the U.S. population during adulthood.[1,2] Activities involving repeated movements of the trunk during work and sports have been found to be associated with LBP development.[3-11] However, not everyone exposed to these activities develops LBP. A possible reason that some people develop LBP while others do not may be related to the strategies a person adopts while performing specific activities. The strategies

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are proposed to (1) develop as the result of repeated trunk movements in specific directions (eg, flexion, extension, or rotation associated with an activity), and (2) become generalized across several activities used during the day.[11-16] Repeated use of these strategies is believed to contribute to musculoskeletal and neural adaptations that result in direction-specific movement impairments that are evident during a clinical examination.[12] Typically, the impairments are characterized by early movement of 1 or more lumbar joints in a specific direction relative to movement of other lumbar joints and other regions, such as the thoracic spine or hip.[15-18] Repeated use of the same movement strategies is proposed to contribute to subfailure magnitude loading in specific tissues and localized concentrations of tissue stress.[19] The effect of the stress accumulates rapidly because the (1) lumbar spine moves more readily than other regions during activities,[12,14,15,18,20-23] and (2) patterns are used repeatedly across multiple activities throughout the day. The proposed result is insufficient rest for normal tissue adaptation. Repetitive loading of the same tissue could also alter the tissue's tolerance over time, accelerate the rate of mechanical injury, and potentially lead to tissue degeneration.[11,12,19]

We have developed a standardized examination that includes tests to assess direction-specific movement impairments adopted by a person with LBP.[24] The examination includes tests of movements of the trunk and extremities. Tests of extremity movements are included because they transfer loads to the lumbar region. For example, 1 test requires the person to flex his/her knee while prone. During the knee flexion motion, the examiner focuses on the lumbopelvic region. Given the assumption that the spine should remain relatively stable during the lower extremity movement, the test would be positive for a trunk rotation–related impairment if the participant's lumbopelvic region rotated early during flexion of the knee.[11,12] Asymmetry of lumbar region movement impairments also are assessed because of the documented increased risk of LBP associated with asymmetrical trunk movements.[17,18,25] An impairment is considered asymmetrical if the participant displays the impairment on only one side of the body. For example, if a participant displays early lumbopelvic rotation with right knee flexion but not left knee flexion, he/she would display asymmetry of lumbopelvic rotation.

The purpose of this secondary analysis was to examine whether people with LBP who regularly participated in a rotation-related sport (LBP) displayed more trunk rotation-related impairments than people without LBP who (1) participated in a rotation-related sport, and (2) did not participate in a rotation-related sport. We hypothesized that the LBP and back-healthy controls who play a rotation-related sport groups would display more (1) rotation-related impairments and (2) asymmetrical rotation-related impairments than the back-healthy controls who do not play a rotation-related sport group. We also hypothesized that the LBP group would display more rotation-related impairments than the back-healthy controls who play a rotation-related sport group. Impairments that are consistently identified across a variety of movement tests can provide insight into the direction-specific activities that may contribute to a person's LBP.

List of abbreviations:

ANOVA analysis of variance
LBP low back pain

Methods

Participants

Study participants were divided into 3 groups: LBP, back-healthy controls who play a rotation-related sport, and back-healthy controls who do not play a rotation-related sport. The back-healthy controls who play a rotation-related sport group will be referred to as the rotation-sport control group and the back-healthy controls who do not play a rotation-related sport group will be referred to as the nonrotation-sport control group. Inclusion criteria required all participants to be between the ages of 18 and 40 years and able to understand and sign an informed consent form. Participants were matched based on age, sex, and activity level. Participants in the LBP group had to have chronic or recurrent LBP[26] and play a rotation-related sport that the participant reported was associated with an increase in LBP symptoms. Chronic LBP was defined as the presence of LBP on more than half the days in a year in a single period or in multiple episodes.[26] Recurrent LBP was defined as the presence of LBP on less than half the days in a year, occurring in multiple episodes over the year.[26] A rotation-related sport was defined as a sport that involved repeated rotational movements of the trunk and hips during participation in the activity. The LBP group was required to participate in the rotation-related sport on a regular basis, defined as a minimum of 1 to 2 times per week. Participants were included in the rotation-sport control group if they (1) reported no history of LBP that limited performance of daily activities for >3 consecutive days or for which they sought medical or allied health treatment,[27] and (2) participated in a rotation-related sport at least 1 to 2 times per week. Participants were included in the nonrotation-sport control group if they (1) reported no history of LBP that limited performance of daily activities for >3 consecutive days or for which they sought medical or allied health treatment,[27] and (2) did not participate in rotation-related sports on a regular basis. Exclusion criteria included a history of spinal fracture or surgery, spinal stenosis, osteoporosis, disk pathology, etiology of LBP other than lumbar spine (eg, hip joint), previous lower extremity surgery, a systemic inflammatory condition, current pregnancy, or other serious medical condition. Participants for all groups were recruited from the St. Louis metropolitan region. In particular, we targeted university- and community-based athletic centers, and varsity, club-level, and intramural racquet sports teams in the region.

Initially, 130 participants (LBP, n=61; rotation-sport control, n=26; nonrotation-sport control, n=43) were enrolled in the study. After preliminary screening of participant characteristics, 7 of the participants did not meet our inclusion criteria and were not included in the secondary analysis. Reasons for exclusion included the following: (1) plantar fasciitis rather than LBP (n=1); (2) LBP caused by trauma from a motor vehicle collision (n=1); (3) a history of back surgery (n=1); and (4) refusal to complete the clinical examination (n=4). Our final sample included 55 participants in the LBP group, 26 participants in the rotation-sport control group, and 42 participants in the nonrotation-sport control group. The study was approved by the Institutional Review Board at Washington University School of Medicine. All participants provided written informed consent for study participation.