The Relationship Between Clinical Instability and Endurance Tests, Pain, and Disability in Nonspecific Low Back Pain

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Abstract

Objective: The aims of this study were (1) to investigate the relationship between clinical tests detecting spinal instability and the perceived pain and disability in nonspecific low back pain and (2) to investigate the relationship between endurance and instability tests.

Methods: Four instability tests (aberrant movements, active straight leg raising, prone instability test, and passive lumbar extension test) and 2 endurance tests (prone bridge test [PBT] and supine bridge test [SBT]) were performed on 101 participants. Their results were compared with the Numerical Rating Scale and the Oswestry Disability Index evaluating pain and disability, respectively.

Results: A low to moderate significant relationship between pain, disability, and all tests with the exception of PBT was observed. A low to moderate significant relationship between endurance tests and instability tests was also shown. The results of PBT and SBT were significantly related to the duration of symptoms ($P = .0014$ and $P = .0203$, respectively).

Conclusion: The results of endurance and instability tests appear to be related to the amount of pain and the disability in nonspecific low back pain. The persistence of pain significantly reduces anterior and posterior core muscle endurance. (J Manipulative Physiol Ther 2016;39:359-368)

Key Indexing Terms: *Joint Instability; Musculoskeletal Diseases; Physical Examination; Low Back Pain; Physical Endurance*

Spinal functional instability was defined by White and Panjabi[1] as the loss of the spine ability to limit its movements under physiological loads such that neurological disturbances, deformation, or pain is prevented. Panjabi[2] stressed the contributions of 3 subsystems (the passive, the active, and the control subsystem) on spinal stability, enlarging a previous concept of joint stability that mainly considered the passive stabilization system (bones, ligaments, and joint capsules). The presence of clinical instability is most evident on midrange spinal movements, where the loss of control of neutral zone may become manifest.[2] Clinical instability is considered one of the low back pain (LBP) subgroups[3,4] and can be recognized using tests evaluating lumbar stabilization during active or passive movements or tests measuring muscle endurance.[5–8]

Reduced muscle endurance in persons with LBP may be related to an altered proportion between different muscular fibers. Compared with healthy controls, the muscles of the LBP patients show a significantly higher proportion of type IIB (fast-twitch glycolytic) fibers than type I (slow oxidative) fibers. Therefore, in symptomatic persons, the relative area of the muscle occupied by type IIB fibers appears higher, and that by type-I fibers appears lower.[9] Pathologic changes in the multifidus muscle following LBP also include a moth-eaten appearance of type I fibers[9] and a smaller cross-sectional area.[10,11]

The tests most commonly used to detect lumbar instability are the aberrant movements (AMs) test, detecting the presence of anomalous movement during lumbar active motion; the active straight leg raise (ASLR) test, which assesses the ability to control the loads transfer between the trunk and the pelvis; and the passive lumbar extension

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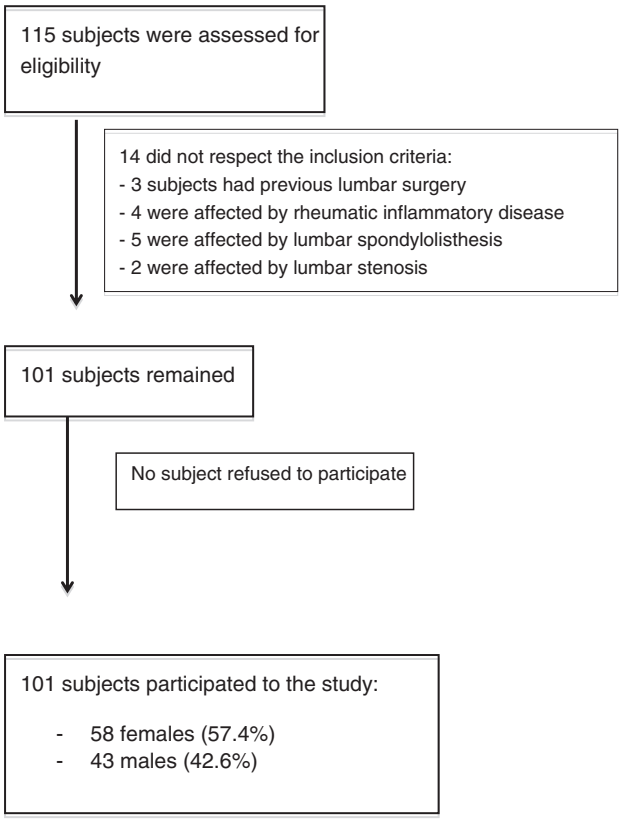

Fig 1. *Study flowchart.*

Fig 2. *Aberrant movements (with permission from Ferrari et al[14]).*

(PLE) and the prone instability (PIT) tests, using passive movements or palpation techniques to determine if a mobile segment is responsible of the patient's symptoms.

One of the most common tests assessing the isometric endurance of trunk extensor muscles is the Sorensen test, which consists of measuring the amount of time a person can hold the unsupported upper body in prone position with the lower body fixed.[12] Two other tests frequently used to detect the lumbar muscles endurance are the prone bridge test (PBT) and the supine bridge test (SBT), which assess the anterior and the posterior core muscles stability respectively.[13]

A recent systematic review confirmed that AMs, ASLR, PLE, PIT, PBT, and SBT tests may be recommended to evaluate clinical instability and muscular endurance.[14] However, at the current state of knowledge, a complete investigation of their diagnostic accuracy is still needed. For example, it is not clear if these tests simply reveal the presence of a clinical instability or if the results are also related to the amount of perceived pain and disability.

Moreover, the relationship between clinically diagnosed instability and reduced muscle endurance and the relationship between characteristics of pain (duration, frequency, etc) and test outcomes may be further studied. A recent study on symptomatic spondylolisthesis (SPL) showed a significant relationship between instability tests and disability and only a weak relationship between instability tests and pain.[15] Moreover, several studies investigated the relation between changes in pain and changes in muscular endurance but did not prove a clear relationship between clinical outcome and exercise performance.[16] As a consequence, we do not know if, in nonspecific LBP, a relationship between changes in lumbar stability and changes in clinical outcomes exists.

Therefore, the aims of this study are (1) to investigate the relation between the results of the main clinical tests to detect muscle spinal impairments (instability and endurance) and the perceived pain and disability in participants with nonspecific LBP and (2) to investigate the relationship between endurance and instability tests.

Methods

This study involved an outpatient rehabilitation center and 2 affiliated physical therapy clinics. The Ethics Committee of Bologna-Imola (Italy) Health Care Institutions approved this trial (code 14038).

Participants

All the participants with nonspecific LBP referred by orthopedic doctors or medical physicians to the physical therapy facilities to receive conservative treatments were eligible for the study (n = 115). The inclusion criteria, all to be met, were age higher than 18 years, LBP with or without referred pain, and ability in spoken and written Italian. Exclusion criteria were any previous lumbar surgery or