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Critical Review
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Do Changes in Transversus Abdominis and Lumbar Multifidus During Conservative Treatment Explain Changes in Clinical Outcomes Related to Nonspecific Low Back Pain? A Systematic Review

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Abstract: **Previous research describes an inconsistent relation between temporal changes in transversus abdominis or lumbar multifidus and temporal changes in clinical outcomes. Unfortunately, a relevant systematic review is unavailable. As a result, this systematic review was designed to summarize evidence regarding the association between temporal changes in muscle morphometry and activity in response to treatment, and temporal changes in clinical outcomes. Candidate publications were identified from 6 electronic databases. Fifteen articles were included after scrutinization by 2 reviewers using predetermined selection criteria. The methodological quality of these articles was appraised using a standard tool. These methods revealed strong evidence that temporal alterations in transversus abdominis thickness change during contraction (as measured by B-mode or M-mode ultrasound) or feedforward activation of transversus abdominis (assessed via electromyography, tissue Doppler imaging, or M-mode ultrasound) were unrelated to temporal changes in low back pain (LBP)/LBP-related disability. There was limited evidence that temporal changes in transversus abdominis lateral sliding or lumbar multifidus endurance were unrelated to temporal changes in LBP intensity. Conflicting evidence was found for the relation between temporal changes in lumbar multifidus morphometry and temporal changes in LBP/LBP-related disability. This review highlights that temporal changes in transversus abdominis features tend to be unrelated to the corresponding LBP/LBP-related disability improvements, whereas the relation between multifidus changes and clinical improvements remains uncertain.**

Perspective: ***This systematic review highlighted that changes in morphometry or activation of transversus abdominis following conservative treatments tend not to be associated with the corresponding changes in clinical outcomes. The relation between posttreatment changes in characteristics of lumbar multifidus and clinical improvements remains uncertain.***

Key words: *Transversus abdominis, lumbar multifidus, temporal changes, low back pain, ultrasound imaging.*

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Low back pain (LBP) is a common musculoskeletal disorder[55] with a reported lifetime prevalence of approximately 80%.[52,106] Although 70 to 90% of LBP patients will recover in 2 to 6 weeks,[15,105] approximately 60 to 86% of patients with a first episode of LBP will relapse within a year,[64] whereas 6 to 10% of patients develop chronic LBP.[82] The high prevalence of LBP is associated with enormous socioeconomic burdens[22,71]

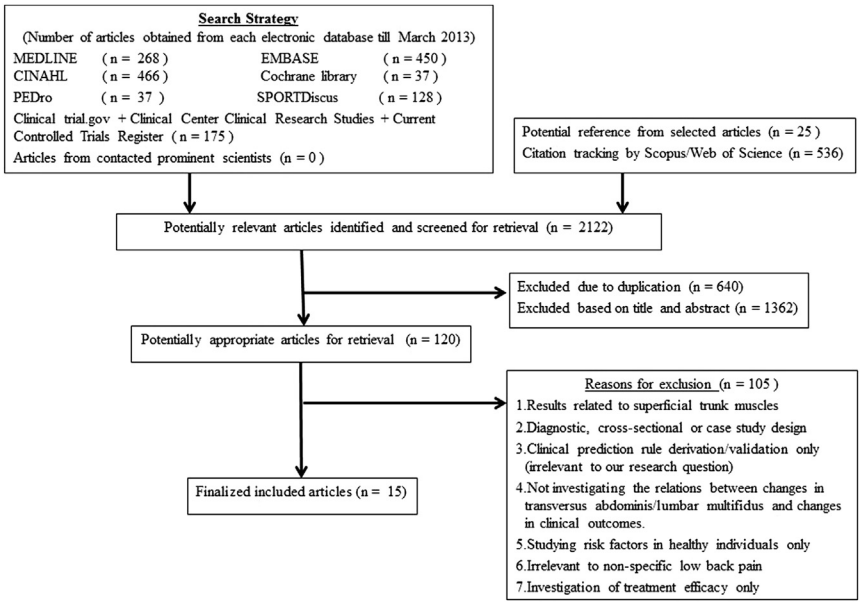

Figure 1. A flow diagram of the literature search.

and disability.[104] Notwithstanding current diagnostic technology, the cause of LBP remains unknown in approximately 90% of patients (ie, nonspecific LBP),[34] which in turn hinders effective treatment and prevention of LBP.

Although the precise cause of LBP remains elusive, previous research has found that patients with LBP demonstrated neuromuscular, morphometric, or histologic changes in transversus abdominis (TrA) or lumbar multifidus (LM).[6,18,24,26,43,47,48,51,56,59,69,72,93,107] Compared with asymptomatic individuals, patients with LBP displayed reduced TrA/LM thickness change during contraction,[16,19,58,59,107] delayed feedforward activation of TrA/deep LM during trunk or limb movement,[45,46,70,75,84] and fat infiltration and muscle atrophy in LM.[81,84] Given the anatomic positions of TrA/LM[8,28,40,54] and the impairments of these muscles in LBP patients, TrA/LM are postulated to play an important role in maintaining intervertebral stiffness/stability and preventing LBP recurrence.[28,41]

Specific conservative interventions have been designed to restore the morphometry, histology, and activation of TrA/LM in patients with LBP, which may improve the clinical outcomes and prevent LBP recurrence.[77,85,97] In other words, these variables are targeted by various treatments and are therefore hypothesized to create changes in clinical outcomes.[108]

Although a prior systematic review has summarized that baseline characteristics of TrA/LM may not predict future clinical outcomes of LBP,[115] there are conflicting findings regarding the relation between temporal changes in morphometry/feedforward activation of these variables and changes in clinical outcomes during treatment or at discharge. One study found that increased TrA and decreased obliquus internus contraction thickness ratios measured with B-mode ultrasound imaging (USI) in response to 8 weeks of various exercise interventions explained 18% of the variance in temporal LBP reduction.[102] On the contrary, another study showed that the improvement of LBP-related disability following 9-week motor control exercises was associated with neither temporal changes in TrA contraction ratio nor temporal changes in feedforward activation of deep abdominal muscles (including TrA) measured with USI.[73] Similarly, improvements in functional scores of patients with LBP following 2 sessions of spinal manipulative therapy were unrelated to the corresponding alterations in LM percent thickness change measured with B-mode USI.[31,79] Collectively, knowing which variables can predict treatment outcomes would help clinicians apply TrA/LM-targeted treatments with improved confidence and may help design interventions to increase success. However, to our knowledge, a relevant systematic review has yet to be conducted.

Given the above, the primary objective of this systematic review was to summarize published evidence regarding an association between temporal changes in TrA/LM muscles treated with conservative interventions and temporal changes in clinical outcomes of patients with nonspecific LBP. The secondary objective was to review whether the relation between changes in TrA/LM and clinical outcomes was affected by age, gender, and LBP chronicity.

Methods

The review protocol was registered with PROSPERO (CRD42013003860). The review followed the suggested methodological and reporting guidelines of the Preferred Reporting Items of Systematic Reviews and Meta-analyses (PRISMA)[78] and the Meta-analysis of Observational Studies in Epidemiology (MOOSE).[90]

Identification of Studies

Relevant literature in English, Chinese, French, and Portuguese was identified by a systematic search of MEDLINE, EMBASE, PEDro, SPORTDiscus, CINAHL, and the Cochrane Library (from inception to March 2013).