CAN CHANGES IN DEEP TRUNK MUSCLES PREDICT POST-TREATMENT CLINICAL OUTCOMES IN NON-SPECIFIC LOW BACK PAIN? A SYSTEMATIC REVIEW.

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Introduction

Previous research has found that patients with low back pain (LBP) demonstrated abnormal neuromuscular, morphometric or histological changes in transversus abdominis (TrA) or lumbar multifidus (LM).1-3 Various conservative treatments have been developed to restore the deficits of these muscles in order to prevent persistent and recurrent LBP.4-5 Although this premise is prevalent, prior studies have revealed conflicting findings regarding the relation between temporal changes in these muscles and the corresponding outcomes of LBP. However, to our knowledge, no systematic review has been conducted to summarize evidence regarding this relation.

Objectives

Our primary objective was to summarize evidence regarding the association between temporal changes in neuromuscular, morphometric or histological features of TrA/LM and temporal changes in clinical outcomes of LBP among conservatively treated patients. The secondary objective was to review whether the relation between temporal changes in TrA/LM and temporal changes in LBP clinical outcomes was affected by types of treatments.

Methods

Relevant articles were identified from MEDLINE, EMBASE, PEDro, SPORTDiscus, Cochrane Library (from inception to March 2013) using keywords with mapping of subject headings: “multifidus”, “transversus abdominis”, “changes”, “associate”, “predict” and “low back pain”.

Only longitudinal studies investigating the relation between temporal changes in TrA/LM and corresponding changes in LBP clinical outcomes were eligible for this review. The corresponding authors of the included articles and 10 prominent researchers who have published more than 5 articles in this area were contacted to identify additional papers. Additionally, the corresponding authors of articles that reported both temporal changes in TrA/LM characteristics and temporal changes in clinical outcomes without examining the relation between the two domains were contacted to seek relevant information. Last, bibliographies of the selected articles were screened to identify additional publications (Figure 1).

Study selection

Stage 1: Two reviewers (AW and MF) independently screened the titles and abstracts of potential citations according to the selection criteria using a standard form. Articles denoted as eligible by either reviewer were included for the second-stage screening.

Stage 2: The full-text articles of the potentially eligible studies were screened using the aforementioned procedures. If consensus could not be reached following the joint review process, a third reviewer (EP) arbitrated the final agreement. The inter-reviewer reliability at each screening stage was examined by percent agreement and Kappa coefficients.

Results

Selected studies

Fifteen articles from 12 patient cohorts were included (Figure 1 & Table 2). Eleven studies9,10,11,12,13,14,15,16,17,18 investigated the temporal changes in TrA and five investigated that of LM.19,20,21,22 Ultrasound imaging, electromyography, and magnetic resonance imaging were used to assess TrA in these studies. The inter-reviewer percentage agreement at Stage 1 and 2 were 84.8% and 90.3%, respectively.

Risk of bias assessment

The two reviewers independently assessed the risk of bias of the included studies using a modified assessment tool.14 The modified tool consists of seven assessment areas: patient population, muscle variables, intervention, outcome measurement, study attrition/follow-up, confounders, and statistical analysis. The maximum score of this tool was 19. The cut-off point for defining bias was 13/19. The study was of no risk bias if the inter-reviewer reliability for risk of bias assessment was analyzed by percent agreement and intraclass correlation coefficient (ICC, model 3.1) of the final score. The discrepancy in scores rated by the two reviewers was resolved through a consensus meeting.

Risk data extraction and statistics in clinical outcomes of LBP among conservatively treated patients. The secondary objective was to review whether the relation between temporal changes in TrA/LM and temporal changes in LBP clinical outcomes was affected by types of treatments.

Discussion and Conclusion

There was strong evidence that temporal changes in TrA thickness change during contraction or feed-forward activation of TrA were unrelated to temporal changes in LBP/LM-related disability. There was limited evidence that temporal changes in TrA lateral sliding or LM endurance were unrelated to temporal changes in LBP intensity. Conflicting evidence was found for the relation between temporal changes in LM morphometry and temporal changes in LBP/LM-related disability (Table 2).

Our findings are in accordance with prior research that showed no significant relation between temporal changes in other physical parameters (e.g. back muscle strength or spinal stiffness) and temporal changes in clinical outcomes. The negative results may be ascribed to the heterogeneity of muscle activation strategies in patients, diverse causes of non-specific LBP, and heterogeneous methodologies and treatments.

Although motor control exercises is generally thought to result in the restoration of motor control of TrA/LM in patients with LBP, the included studies that solely investigated motor control exercises did not support the relation between temporal changes in these muscles and temporal changes in clinical outcomes (Table 3).

Since participants in all included studies except one22 should be classified as chronic LBP patients, our findings may not be generalizable to patients with acute/subacute/recurrent LBP.

Of the included articles, only two10,16 adjusted for psychological factors that may affect the prognosis of patients with LBP.

Since many included studies did not show significant temporal changes in TrA/LM features, future longitudinal studies with longer treatment duration are warranted to allow more change to be detected on both the muscle variables and clinical outcomes. Future studies should also adjust for potential confounders in order to unveil the potential association between temporal changes in TrA/LM and the corresponding changes in LBP outcomes.

Acknowledgements

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Citations


Table 1. Criteria for evidence synthesis

Table 2. Subgroup analysis on the effects of treatment types on the relation between temporal changes in muscle variables and temporal changes in clinical outcomes

Table 3. Level of evidence

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Strong</th>
<th>Moderate</th>
<th>Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence synthesis</td>
<td>Consistent (at least 75%) from at least 2 high quality studies</td>
<td>One high quality study and consistent findings (at least 75%) in one or more low quality studies</td>
<td>Limited findings in one high quality cohort or consistent results (at least 75%) among low quality studies</td>
</tr>
<tr>
<td>No study identified</td>
<td>No</td>
<td>No</td>
<td>No</td>
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