THE SHORT EFFECTS OF ABDOMINAL HOLLOWING ON MUSCLE RECRUITMENTS AND LUMBAR CURVATURE WHILE AXIAL LOADING IN MEN WITH NON-SPECIFIC CHRONIC LOW BACK PAIN

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SUMMARY
The aim of current study was to investigate short effects of Abdominal Hollowing (AH) training on changing of lumbar curvature and muscle recruitment in men with Non Specific Chronic Low Back Pain (NS-CLBP) during two static functional tasks : with and without axial loading (12kg).

INTRODUCTION
Back pains cause a loss of working days and impose heavy costs on society, 80% of chronic low back patients are Non Specific Chronic Low Back Pain (NS-CLBP) [1, 2, and 3]. Due to confirmed muscle dysfunction in this population, Core or stabilization training is the most common use exercise therapies for them [4]. One approach is isolated low intensity contraction of transversus abdominis with minimal activity of global muscle that is called "drawing in" or Abdominal Hollowing (AH) maneuver [5, 6]. Some of advantages of this training contains reduction of pain and disability are mentioned in previous studying but there is any study that investigated short effects of this training on lumbar curvature in NS-CLBP patients along with axial loading on spine column. One of spinal curvature is lumbar lordosis that is important factor in healthy of lumbar spine in performing of activity of daily living (ADL) and effective device for clinical management [7]. Some factors as sex, age and change center of mass (COM) such as pregnancy, obesity and may be muscle imbalance effect on lumbar lordosis [8]. Some of researchers have opinion that there is no difference in lumbar lordosis between health people and LBP but other claim that there is a significant difference between two groups [9, 10, and 11].

Regarding the approval of muscle imbalance in LBP patients, research question of this study was: whether short effect training can change of muscle recruitment and subsequent lumbar curvature?

METHODS
With randomized clinical trial (RCT) and case control design and convenient sampling method, 40 men with NS-CIBP (age 27.5 ± 3.5 years, height 173.9 ± 6.1 cm, weight 66.3 ± 7.5 kg, duration of LBP 4.4 ± 3.1 years and pain intensity with visual analog scale (VAS ) 2.9 ± 0.98 ) participated in this study. In beginning of test session, after attachment of electrodes parallel to muscle fiber of rectus abdominis (RA), oblique external (OE) and transversus abdominus/ internal oblique (TrA/IO) , erector spine ( ES) and multifidus (MF) Maximum Voluntary Contraction (MVC) was obtained [12]. For minimize of muscle fatiguem (min) rest period was given. In order to measurements of lumbar curvature, Inclinometer was used in current study. A paired electronic tilt sensors attached to T11 and S1 spine process, that software calculate difference between of two sensors angle (thorax and pelvic) as lumbar lordosis. EMG and Inclinometer synchronized and recorded data for 7 second in standing posture with and without axial loading by a vest which had symmetrical pockets for axial loading to spine (12 kg). For pre-test data, 3 trials with 2 minute rest between each one, were performed in axial loading and the same set was repeated for blank vest as no axial load. After pre-test measurements, AH was thought to subjects based on Richardson and Jull concepts in crock lying poison. Subjects trying to pull their navel in and up with minimal global muscle activity. Pressure biofeedback unit (PBU) and biofeedback EMG was used for control of back movements and contraction intensity. When investigator was sure that patient perform correctly this maneuver, asked him to perform 3 set with 10 repeating while hold each one for 10 seconds and 2 minute rest between each set [13, 14]. After techniques, post-test measurements were repeated Same as pre-test.

EMG were sampled at 1000 Hz over a bandwidth of 20–450 Hz, gain 500 microvolt and DC current remover automatically using the EMG setting product by Biometrics company. Data were analyzed using Biometrics software. RMS amplitudes from raw data were normalized to MVC amplitude for each muscle with time windows 150 ms and intensity was based on micro volt. All Data analyzed with SPSS 16.

RESULTS AND DISCUSSION
Finding of this study showed that significant increase EMG activity of TrA/IO and MF muscles after AH training in No loading task (P<0.05) while with axial loading only TrA/IO had significant decreased recruitment ( P<0.05) (Figure 1). No loading task, significantly increased lumbar lordosis (about 2 degree), but after axial loading , this decrease were not significant (Table 1). It should be noted that there was no correlation between increased local muscle activity and lumbar lordosis. In the control group there was no significant changes in EMG and lumbar lordosis in any of two tasks (P>0.05).

Current study showed that the effects of short training of AH on lumbar lordosis not only were seen in crook-lying that it is posture of achieving maneuver ,but also the changes were seen in standing posture with axial load so this training is not specific to posture as other mentioned [15]. Because there are no correlation between of local muscle recruitment and increased lumbar curvature, It seems that the correction...
of muscle activity pattern indirectly could effect on lumbar posture and close it to the posture with normal lordosis. Our study showed one session training can enable muscle imbalance correction with increase local and decreased global muscle activity as control group, also it could create normal lordosis and subsequent increased ability of spine column to deal with the various load. May be it is important for management of LBP.

**Figure 1:** comparison of EMG activity in both of two Tasks: with and without axial loading 12 kg (RA rectus abdominus, EO external oblique, TrA/IO transversus Abdominus/ internal oblique, ES erector spine, MF multi fidus)

**CONCLUSIONS**

The findings of current study confirmed transfer of short training effects to nonspecific posture, which can be with correction of abdominal and back muscle recruitments. This training can changes lumbar posture to normal state and so decreased pain and disability of LBP population. We suggested evaluation of long effects of AH and other core exercise on lumbar lordosis.

**REFERENCES**


**Table 1:** Comparison of lumbar lordosis angle between control and case groups in two tasks (with and without axial load 12kg) (** show significant value)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Initial Thotrax Tilt Angle (degree)</th>
<th>Initial Pelvic Tilt Angle (degree)</th>
<th>Lumbar Lordosis → Without Axial Loading</th>
<th>Lumbar lordosis → With Axial Loading (12 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n= 20)</td>
<td>-13 ± 4.6</td>
<td>9 ± 2.6</td>
<td>-21 ± 4.9</td>
<td>-21.7 ± 4.9</td>
</tr>
<tr>
<td>Abdominal Hollowing (n= 20)</td>
<td>-12.7 ± 5</td>
<td>9.3 ± 4.1</td>
<td>-21.5 ± 6.2</td>
<td>-23.3 ± 6.1**</td>
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