Original Article

EVIDENCE BASED PROGRESSIVE CORE STABILIZATION EXERCISE FORMATION FOR LOW CORE ENDURANCE INDIVIDUALS

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ABSTRACT

Low back pain (LBP) is the commonest pain among individuals affecting more than half of the population. Segmental stabilization exercises gaining popularity among many treatment choices available to the therapist. Transverses abdominis (TA) and Multifidi (MF) are the two core muscles that were affected by LBP. This descriptive partial review study examines how various exercises recruits TA and MF? Then how do one to prognoses them progressively over short period of time? And what is the dose, volume needed? This review put an attempt to solve the above questions based on recent evidence based practice. Finally we have given exercise schedule for physiotherapists to follow.

KEYWORDS: Low Back Pain, Transverses abdominis, Multifidi, Evidence based Physiotherapy, EBM.

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INTRODUCTION

Low back pain (LBP) is most commonly affected the individuals with a lifetime prevalence 60–70%[1]. There are various treatment approaches available to LBP. Recently, lumbar core stabilization gaining the more significant emphasis even though recent research suggests otherwise [2,3]. Typically, during the implementation of the specific stabilization exercise protocol, the patient is taught to recruit the deep muscles of the spine and gradually reduce unwanted over-activity of other muscles. Although recent research, has advocated the importance of a few muscles (in particular, the transverses abdominis (TA) and multifidi (MF)), all core muscles are needed for optimal stabilization and performance.

The "core" has been described as a box with the abdominals in the front, paraspinals and gluteals in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom. The abdominals serve as a vital component of the core.

Panjabi (1992) redefined spinal instability in terms of a region of laxity around the neutral position of a spinal segment called the 'neutral zone' which is influenced by the interaction between passive, active and neural control systems[4]. Passive stiffness is imparted to the lumbar spine by the osseoligamentous structures. Active stability is imparted on the lumbar spine by contraction of the diaphragm and increasing intra-abdominal pressure. The thoracolumbar fascia acts as "nature's back belt. To acquire this co-contraction, precise neural input and output (which has also been referred to as proprioceptive neuromuscular facilitation) are needed.

The onset of activity of the deep abdominal muscle, transverses abdominis (TA), is delayed in people with recurrent episodes of low back pain [5,6]. Atrophic changes have been identified in multifidus (MF), a deep paraspinal muscle, after episodes of low back pain [7,8,9]. This is emphasis the need for creating an exercise program to strengthen, actually endurance, these two muscles. Available literature so far has inconsistent in exercise program that is too without scientific base. Thus, the aim of the present study was to formulate the progressive exercise program based on recent scientific literature.

Rational for selection of exercises:

Simple 'drawing-in' (stage 1) would result in hypertrophy of TA and internal oblique (IO) [10,11]. Abdominal hollowing along with bracing while performing abdominal curls (stage 1) improves the activation of TA and IO throughout the activity with least spinal compression[12,13]. The hollowing in quadruped position, that recruit IO, provides a relatively low-loaded, non-anti-gravity posture in which good balance can be easily achieved when a neutralspine position is maintained and should be used in earlier part of training (stage 1). [14,15,16]

Daneels et al., (2001) concluded the static hold between the concentric and eccentric phase of the dynamic exercises was critical to inducing hypertrophy of the MF[17]. Bird dog exercise (stage 1) shows better ipsilateral MF and contralateral IO activity when it compared with two other variations[18]. Hicks et al., 2005 used both bird dog exercise and bridging (stage 1) in their core stabilization program for low back patients[19]. Ultra sound thickness ratio (contraction/rest ratio) of transverse abdominis for abdominal drawing-in maneuver, abdominal crunch, bird dog exercise (stage 1) are reported to be 1.73, 1.74 and 1.59 respectively [20]. Manual contact in the form of tactile contact (stage 1) or swiss ball (stage 2 and 3) reported to increase the MF, TA cross sectional area improvement. [21]

It is believed that increasing the instability of the surface and human body interface will stress the neuromuscular system to a greater degree than stable resistance training methods performed on solid ground [22]. Ludmila et al. (2003) study on effect of physioball and conventional floor exercises on early adaptations in back and abdominal core stability and balance found that short term core exercise program using the physioball resulted in greater gains in torso balance and EMG neuronal activity as compared to exercises on floor (stage 2)[23]. Lehman et al., (2005) reported that exercise performed at stage 2, supine bridge (on swissball without leg rise), resulted in higher erector spinae muscle activity than prone bridge and almost 10% higher MVC% than same exercise performed at stable surface[24]. Martuscello 2012 in his systematic review reported that ball stability exercises were equal or superior to traditional core exercises or core stability exercises[25]. However their final conclusion of free exercise as most superior form of exercise to activate TA and MF was refuted by Akuthota and Nadler (2004) who says these exercise increase the compression loading of the core there by increase the chances of injury.[26]

Vera-Garcia et al., 2000 reported that among four variation of abdominal curl exercises, the exercise performed at stage 3 abdominal curl (on swissball with hands behind head) caused maximum co-contraction of external oblique muscle with rectus abdominus (RA) as well as better lower RA activity than upper RA[27]. Stevens et al., 2006 reported relative MF muscle activity was increased from stable bridging (stage 1) to physioball bridging (stage 2) and intermediate response with bridging with unilateral leg raise (stage 3). Similar trend also found in IO muscles with minimal RA muscle[28]. Marshall and Murphy (2005) concluded that quadruped exercise (as stage 1) train according to local stability system with minimal activity of RA and addition of swissball (as stage 3) further enhancing the core stability training.[29]

Progressive core endurance exercise-procedure:

Total 6 weeks duration was divided into 3 stages with each stage lasting for 2 weeks. The segmental approach we have devised develops through three stages of segmental control, with each stage exposing the individual patient to increasing challenges to her joint protection mechanisms [30,31,32,33]. Table 1 shows the type of exercises performed at each stage of the progression. Before starting each exercise

Stage	Name	Static	Dynamic
Stage I	Core Control	1. Abdominal 'tuck in' in crook lying position 2. Abdominal 'tuck in' in sitting position with tactile cue on back 3. Abdominal 'tuck in' in quadruped position	1. Bridging on the floor without leg extension 2. Bird dog exercise in quadruped position 3. Abdominal crunches on floor (hands behind head)
Stage II	Core stabilization	Abdominal 'tuck in' in sitting position	1. Back bridging on swiss ball without leg rise 2. Wall squat with swiss ball 3. Abdominal crunches on swiss ball (hands over chest)
Stage III	Core strengthening	Abdominal 'tuck in' in standing against the wall	1. Back bridging on swiss ball with leg rise 2. Bird dog exercise on swiss ball 3. Abdominal crunches on swiss ball (hands behind head)

Table 1: Progressive core strengthening exercises.

session warm up session of about 5 min in the form of jogging was given. Duration of each session was around 45-60 min in a day. Frequency of exercise was 5 times a week for 6 weeks. Subjects were allowed 2 days rest period after completion of 5 sessions of exercise in order to provide adequate rest from exercise. The abdominal drawing-in manoeuvre was performed in conjunction with each of the dynamic exercises because of its ability to facilitate co-activation of the TA and MF muscles when stabilizing the trunk and its clinical use as a foundational basis for lumbar stabilization exercises. In dynamic exercises each exercise was of 10 repetitions (2 sec concentric contraction with expiration, 8 sec hold with normal breathing, 3 sec eccentric contraction with inspiration with 5 sec rest) per set and 3 sets per session (total 30 repetitions). Whereas static exercises were on 10 sec hold (30-40 % of maximal voluntary contraction as intensity) followed by 5 sec rest for 10 repetitions per set and 3 sets per session (total 30 repetitions) [3]. There was a 60 sec interval between sets and 3 min rest between each exercise [19,34,35,36,37].

CONCLUSION

Based on the above discussion, it could be concluded that exercise program given in this study could be used for improving the endurance of the low core endurance individual.

Abbreviation:

IO- Internal oblique
LBP- Low back pain
MF- Multifidi/multifidus
RA- Rectus abdominus
TA- Transverses abdominis

Conflicts of interest: None

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