Exploring the Significance of Abdominal Drawing-in and Segmental Stabilisation Training (SST) for Low Back Pain Management

Rasim ul Hasanat[1], Farooq Azam Rathore[2]

Abstract

Segmental Stabilisation Training (SST) a programme initially conceived by Carolyn Richardson and her team, serves as a specialised approach tailored to alleviate mechanical low back pain. Built upon decades of rigorous research, this exercise model rests upon the foundational principles of core stability. SST is unique due to its singular focus on addressing the root cause of low back pain, thereby presenting a promising avenue for averting the frequent relapses characteristic of this condition. Many fitness regimens that emphasize core stability incorporate the Abdominal Drawing-in manoeuver. However, the efficacy of this technique often remains unrealized due to a lack of awareness regarding its correct execution. It is imperative to note that the true benefits of the Abdominal Drawing-in manoeuver manifest only when performed accurately, ensuring the activation of deep core muscles and, in turn, preventing the recurrence of low back pain. The SST programme offers clear and precise guidance, enabling both clinicians and patients to acquire the requisite skills for its correct implementation. This mini-review highlights the significance of SST in low back pain management and also elucidates the crucial role of precise technique execution.

Keywords: Low Back Pain, Exercise Therapy, Core Stability, Exercise Movement Technique, Physical Therapy Specialty, Physical and Rehabilitation Medicine.

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Introduction

Low back pain (LBP) stands as one of the most prevalent musculoskeletal conditions globally, affecting a vast portion of the population.[1] Clinicians frequently encounter patients grappling with the challenges that LBP presents. This is especially true for people with demanding jobs and routines requiring long hours of sitting, standing or repeatedly bending their backs. The profound impact of LBP compels affected individuals to seek rapid alleviation, often resulting in the reliance on analgesics as an apparent solution. However, in most instances, this approach proves ineffective as pain recurrently manifests. Overlooked in this persistent cycle of recurrences is the underlying aetiology of LBP, perpetuating frequent relapses and, in many cases, leading to the development of chronic pain. Therefore, a comprehensive solution is needed that, in addition to providing immediate pain relief, also addresses the fundamental causative factors, thereby averting the long-term recurrence of LBP.

[1]Private physiotherapy practitioner, Karachi, Pakistan; [2]Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi, Pakistan.

Correspondence: Farooq Azam Rathore. e-mail: farooqrathore@gmail.com
ORCID ID: 0000-0002-4759-0453

Fortunately, such a solution exists in the form of a self-administered exercise programme, known as Segmental Stabilisation Training (SST). This exercise programme was primarily developed by Carolyn Richardson and colleagues and was specifically designed to alleviate mechanical low back pain.[2] This exercise model is based on the fundamental concepts of core stability which have evolved over decades of research.[3,4] This programme is unique in the sense that it purportedly targets the root cause of low back pain, thereby preventing the relapses which characterise this condition.

The effectiveness of the SST

The hallmark of this distinctive exercise programme is an essential technique known as the abdominal drawing-in manoeuver, often referred to as the "tummy tuck-in." This technique ensures engaging the deepest core muscles within the body, effectively reducing low back pain. Through a series of experiments, Richardson and colleagues traced the origins of the low back pain to the deep para-spinal region. They established that weakness and atrophy of deep local muscles such as multifidi, were largely responsible for the low back pain (as opposed to more global muscles such as erector spinae).[3] To stimulate and induce the awakening of these dormant muscles, they devised an exercise programme involving co-contraction of the lumbar Multifidus via voluntary isometric contraction of Transversus abdominis.[3]

This ingenious approach capitalizes on the intricate neuronal connections within the spinal cord, which enable the activation of these deep core muscles without the need for extraneous tactile or electrical stimulation. It is through these neural connections that the active contraction of the transversus abdominis, presumably linked to the multifidus via intrinsic neuronal connections of the spinal cord, triggers simultaneous contractions in the multifidus.

Equally fascinating is the near-instantaneous alleviation of pain, often observed with just a few repetitions of this exercise.

The remarkable efficacy of this approach was reaffirmed in a recent longitudinal study conducted in Karachi, Pakistan.[5] In this study, not only was low back pain instantly diminished, but also its recurrence was effectively prevented. Following the exercise session, a notable reduction in both pain intensity and its affective component (unpleasantness) was observed, and these improvements persisted throughout the follow-up assessments. Many patients, initially suffering from significant low back pain, reported minimal or no pain at the conclusion of the exercise session. Furthermore, substantial enhancements in the performance of routine daily activities were noted, translating into reduced disability. Additionally, the study revealed a simultaneous increase in pressure pain threshold (PPT) levels at various locations across the lower back post-exercise. Given its inverse correlation with pain levels, this increase in PPT served as an objective indicator of overall improvement in the condition (Table).[5] The existing body of literature echoes similar outcomes from analogous core stability interventions, collectively highlighting the potent effect of submaximal voluntary contractions of the abdominal muscles.[6,7]

Table: Descriptive analysis of outcome variables before and after the exercise (SST).

	Session-1		Session-3		Session-6	
	Mean/ Median	SD/IQR (Q1-Q3)	Mean/ Median	SD/IQR (Q1-Q3)	Mean/ Median	SD/IQR (Q1-Q3)
Pain intensity						
Pre-exercise	31.3	17.3-47.5	11.5	3.3-37.1	9.9	9.0
Post-exercise	12.5	4.5-33.5	9.5	2.8-21.8	5	5.2
Pain affect						
Pre-exercise	41.8	21.5-66.5	23.8	25.5	4.5	1.8-5
Post-exercise	14.5	4-35.5	6	2.4-25.1	4.4	5.6
Pressure pain threshold pre-exercise						
L4	4.90	4-5.7	4.40	3.1-6	6.50	2.7
L2	5.10	1.4	4.60	3.4-5.4	6.00	2.4
2L5R	4.50	3.6-5.7	5.10	2.2	6.60	2.8
2L3L	4.80	3.6-6.4	5.50	3.6-7.8	7.30	2.8
2L1R	4.80	3.9-5.7	5.50	2.2	6.70	2.7
2L5L	4.20	3.4-5.8	5.40	2.1	6.80	3
2L3R	4.90	1.9	5.60	2.4	6.50	2.6
2L1L	4.80	3.7-5.9	5.70	2.1	6.80	2.4
5L1R	4.40	3.2-4.9	4.10	3.5-6.3	6.10	2.9
5L3L	4.00	3-4.9	4.90	2	6.60	2.6
5L3R	4.00	3-5.1	4.90	2	6.40	2.2
5L1L	4.00	3.1-5.1	5.00	2	6.30	2.7
Pressure pain threshold post-exercise						
L4	3.70	3-4.4	4.60	3.3-5.8	6.00	2.8
L2	4.00	3.2-5.1	4.80	3.8-6.4	6.60	2.6
2L5R	4.00	3-5.8	5.40	2.3	6.70	3
2L3L	4.80	1.8	6.10	3.5-7.5	6.40	3.5
2L1R	4.80	2	5.50	2.3	7.20	2.2
2L5L	4.50	1.9	5.30	2.3	6.80	2.9
2L3R	5.00	1.9	5.90	3.4-7.6	6.90	2.5
2L1L	5.00	1.8	5.60	2.1	7.40	2.2
5L1R	4.50	1.6	5.20	2.2	6.50	2.5
5L3L	4.50	1-5	5.20	2.2	6.90	2.6
5L3R	4.20	2.9-5.3	5.00	2.1	6.80	2.6
5L1L	4.20	3.2-5.2	5.20	2.1	7.00	2.5
Disability rating index (combined score)	36.20	20.9-58.4	28.9	5.3-44.2	8.1	4.2-35.9

The underlying phenomena

One of the most intriguing facets of this exercise programme lies in its adaptability. Once individuals acquire proficiency in the abdominal drawing-in manoeuver, they can perform it in virtually any posture, effectively transforming that very stance into an exercise opportunity. Mastering this technique allows an individual to realign the pelvis to its neutral position simply by making a brief contraction of the abdomen. This capability offers a means for individuals to promptly correct their lower back posture. This particular attribute extends its utility to acute flare-ups[8] as well as to radiculopathies[9] since keeping a neutral pelvis restores the natural configuration of the lumbar spine, which can, in theory, relieve foraminal compression. Better outcomes of this exercise reported in previous studies conducted on diagnosed cases of spondylolysis and spondylolisthesis substantiate this observation.[10]

Furthermore, what sets this exercise programme apart is its capacity to yield benefits without imposing exertion or fatigue, a characteristic uncommon among most physical exercises since it only requires submaximal levels of voluntary muscle contraction.[3] Another reason which affords it this property is that these deep core muscles constitute red or slow twitch fibres (type-1 fibres)[11,12] which are abundant in mitochondria. This, in turn, allows these muscles to utilise pyruvic acid for energy production more efficiently and prevent the release of lactic acid (an end product of anaerobic metabolism) into intercellular (interstitial) spaces. This very chemical is capable of activating nociceptors (via H+) and contributes towards muscle fatigue and ensuing post-exercise muscle aches.[13] This property of not producing muscle fatigue also serves as an indicator for the correct execution of the drawing-in manoeuvre, as the incorrect pattern of recruitment can lead to activation of already overworked erector spinae muscles, and consequently to muscle aches in the lower back.

Richardson et al have suggested different indicators for the identification of such incorrect patterns, which were termed substitution strategies. These strategies include actions such as abdominal bracing, breath-holding, and rib

elevation.[2,3] The same authors have also put forth specific markers to ensure the correct execution of the abdominal drawing-in manoeuver, including drawing in the upper abdomen, lowering the lower ribs, and the appearance of a horizontal line/fissure just above the navel.[2,3] The presence of any of these indicates that the multifidus and transversus abdominis are not being appropriately recruited. Richardson and Jull also suggested using gentle manual pressure on these muscles to identify and facilitate the precise muscle action required for the co-contraction. In addition to these precautions, the directions given to the patient must be very specific as they affect the recruitment of the right muscles. 'Pulling or bringing navel towards spine' is a staple verbal cue that should be used frequently while teaching this exercise. Readers are encouraged to refer to the original works of Richardson, Jull, Hodges, and Hides for a more detailed description.[2,3]

Conclusion

The abdominal drawing-in manoeuver, often referred to as the "tuck-in," is a familiar concept for many of us, frequently incorporated into fitness exercise programmes emphasizing core stability. Yet, due to a lack of awareness regarding its precise execution, the full potential of this exercise is often left untapped. It is the correct performance of this manoeuver that ensures the activation of deep core muscles, thereby serving as a preventive measure against the resurgence of low back pain. The developers of the SST programme have provided clear and precise instructions, facilitating the correct learning and execution of this technique.[3]

Considering the inherent advantages offered, this form of exercise can be particularly useful in a densely populated country such as Pakistan where the pressure on the healthcare sector is ever mounting. A self-administered treatment such as SST for a highly prevalent condition i.e., low back pain, can help relieve burden from the healthcare sector and allow reallocation of resources for an effective and equitable provision of healthcare to the masses.

As conventional therapies for backaches, such as painkillers, joint manipulations, and electro-physical modalities, face growing scepticism regarding their long-term effectiveness, there is an increasing demand for a more reliable mode of self-administered treatment rooted in scientific plausibility. In this context, the promising results exhibited by SST strongly advocate for its adoption as a standard treatment modality for low back pain. Emerging evidence steadily reinforces this perspective, signalling a growing consensus in prioritizing therapeutic exercise for the management of common somatic pain conditions.

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