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DNS Plays to Core Strengths

By Jessica Heath and Neal Goulet

Twenty-five years ago, art imitated life in minor league baseball with the release of the movie "Bull Durham."

The romantic comedy features fuzzy-cheeked pitcher Ebby Calvin LaLoosh, nicknamed "Nuke," as in nuclear meltdown. Still learning the mental side of the game, he is told to breathe through his eyelids like the lizards on the Galapagos Islands.

As fanciful and funny as that scene is, breathing is at the heart of a real-life concept that is gaining currency in baseball.

A modern-day Nuke LaLoosh – or at least the physician and physical therapist tending to his low back pain – might want to know about dynamic neuromuscular stabilization, or DNS.

At the core of DNS is the body's core and its role in breathing and posture.

Developed by Dr. Pavel Kolar at The Prague School in the Czech Republic, DNS is a rehabilitative technique that focuses on precise coordination of core muscles: abdominals, spinal extensors and gluteals, as well as intra-abdominal pressure regulation by the central nervous system.

Key to this technique is the diaphragm, a muscle that assists in breathing, posture and stability. These roles are important for movement, especially in athletic performance. The dome-shaped diaphragm resides below the lungs.

A baby's reaching to turn over is the same pattern that a pitcher uses for throwing.

Dr. Hans Lindgren, a disciple of Kolar, called the diaphragm the "ignored key to core stabilization."

Lindgren explained that when we breathe in, the lower ribs should not move up (as in expanding the chest) but rather expand laterally.

DNS focuses on lumbopelvic postural stability with extremity movements. The idea is that a balance must exist between the thoracic region, diaphragm, pelvic floor and abdominals in order to provide stability when arms and legs move.

If coordination does not exist, a breakdown will occur in the kinetic chain (a term used to describe systems – including nervous, muscular and skeletal – working together in a chain to create a movement or event) that can lead to overuse or injury of a particular region.

For a pitcher, that "chain" starts from push off and ends with follow through. Each throw requires strength, flexibility and range of motion in the foot, ankle, knee, thigh, core, thoracic spine, shoulder, elbow and forearm.

BABY STEPS

The DNS approach has gained wide popularity in rehabilitation facilities: A physical therapist evaluates a patient's movements and compares them to the ideal pattern. These are based on the developmental positions and ideal movement patterns of a healthy baby.

Based on developmental kinesiology, DNS looks at how a baby develops. If a baby has a normal brain, it will develop ideally because the brain controls the muscles, which figure prominently in skeletal formation and development.

During the first year of life, a baby's normal development leads to muscle activation and

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stability in the spine; movements in rotation and new movement patterns develop. Those basic patterns are used as an adult. For example, reaching to turn over is the same pattern performed when standing to throw.

When a balance of muscle use is lost, dysfunction that may lead to pain follows.

Dr. Alena Kovesova of The Prague School said DNS provides a set of dynamic tests that allow clinicians to search for key dysfunctions. Then the challenge becomes how to fix the dysfunction.

"I have to guide the patient with my hands, I have to utilize verbal instruction, and I have to teach the patient how to restore ideal stereotypes to deal with his pain himself," she said.

A therapist practicing DNS when evaluating a baseball player with shoulder pain such as rotator cuff tendonitis not only treats the shoulder joint with range-of-motion and rotator cuff strengthening but also asks why the injury occurred.

An assessment of the throwing motion provides details on the entire kinetic chain to include scapular stability, lower extremity flexibility, endurance, lumbopelvic stability, and proprioception. The therapist examines each region closely to identify any dysfunction. If one "link" in the chain is not functioning correctly, the entire event is affected. It is important for the therapist to treat the entire chain.

BASEBALL EMBRACES

Ken Crenshaw, athletic trainer for the Arizona Diamondbacks, calls DNS "a revolutionary approach." The key to its effectiveness, he said, is in understanding an athlete's dysfunction and correcting it.

"Baseball is kind of a dysfunctional sport to an extent," he said. "It's very repetitive. There's some incredibly high forces about the shoulder and elbow. Probably (the) highest known human movement is about the throwing shoulder in the professional baseball player. That in itself creates a lot of asymmetry, a lot of overuse, a lot of dysfunction."

Likewise, the Los Angeles Dodgers have taken to DNS concepts. Sue Falsone is the team's athletic trainer and physical therapist and works at Athletes' Performance in Phoenix. DNS concepts, she said, have enabled therapists and clinicians to help athletes with their performance.

"If you don't have that central stability, your ability to create power is going to be so decreased," she said.

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Q&A

Dynamic Neuromuscular Stabilization

By Alicia Bettis and Jeremy Ansbach

WHAT IS DYNAMIC NEUROMUSCULAR STABILIZATION?

DNS is a manual rehabilitative approach that is based upon the developmental principles of kinesiology (DK). DK follows predictable patterns or programs of development. For example, an infant lifts his head, grasps a toy, rolls over, creeps, then crawls.

DNS involves using these same patterns with an activation of the deep neck flexors, diaphragm, abdominal wall, and pelvic floor in order to promote proper function and movement.

WHAT IS A MYOFASCIAL SLING?

A myofascial sling is a fibrous functional connection of several individual muscles composed of the trunk, upper extremity, and lower extremity.

The sling produces a "line of pull," producing a strain and the contractile tension that is required to create a movement.

The link between the upper extremity and lower extremity is the trunk, also referred to as the core. The core provides the stability that allows the body to function as a comprehensive unit.

HOW DO PHYSICAL THERAPISTS DETERMINE THAT DNS SHOULD BE INCORPORATED INTO TREATMENT?

They must identify faulty movement patterns that appear to be related to improper core stabilization. They must evaluate the patient as a whole and incorporate functional activities into the exam. For a soccer player who is having low back pain, for instance, a therapist would look at the entire motion that takes place during a kick. The therapist might notice that the patient has an increase in lumbar spine extension with an elevated rib cage, poor abdominal strength, and limited range of motion in the hip. The therapist would conclude that lumbopelvic stability during the kick is compromised.

HOW DO PHYSICAL THERAPISTS INTEGRATE DNS?

Along with addressing range-of-motion and strength deficits, the therapist incorporates DNS into the treatment by first training the patient on appropriate rib and diaphragm positions. As the patient's activation of core musculature improves to include abdominals and gluteals, functional activities are included in the program. These foundational movements then are integrated into total body movements.

CASE STUDY

Abdominal Stabilization Methods

By Alicia Baughman

PATIENT HISTORY

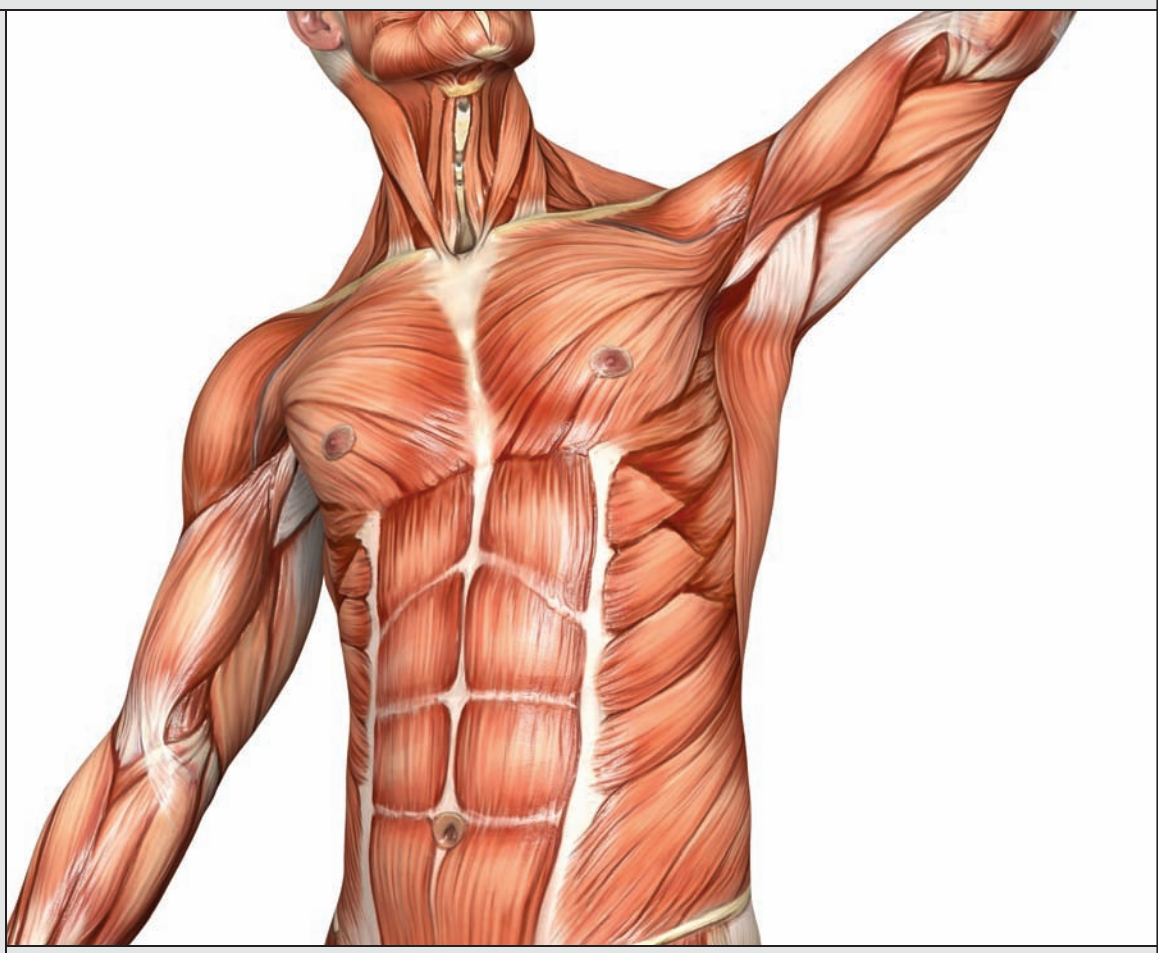
An 18-year-old male presented to physical therapy complaining of low back pain when carrying his backpack, bending, extending, rotating and pitching during baseball. A high school senior, the patient had committed to playing college baseball.

Diagnostic images were negative at the time he was seen. This was the second time he had undergone physical therapy for low back pain related to pitching, with the first episode approximately three years prior and consisting of repeated lumbar extension.

ASSESSMENT

An analysis of the patient's posture revealed a flat thoracic spine. He exhibited a significant increase in thoracic and lumbar paraspinal tone and a decrease in bilateral gluteal tone. Trunk range of motion was 60 degrees of flexion and 10 degrees of extension, with increased motion at a transition zone. Side bending was 15 degrees to the right and 10 degrees to the left, with increased motion at a transition zone. Bilateral hip extension was significantly limited: minus 29 degrees from neutral on the right and minus 21 degrees from neutral on the left.

A strength assessment revealed poor transversus abdominal recruitment and bilateral gluteal strength less than 3/5. A simulation of the patient's pitching motion caused low back pain as well as an increase in recruitment of paraspinal musculature.



A strength assessment revealed poor transversus abdominal recruitment and bilateral gluteal strength less than 3/5.

It was determined that the patient's primary cause of low back pain was poor lumbopelvic stability with extremity motions.

TREATMENT

Initial treatment consisted of manual techniques to normalize muscle imbalances around the lumbopelvic region. This consisted of increasing hip flexor flexibility and performing lumbar spine paraspinal soft tissue massage. These two techniques helped to decrease compressive forces through the lumbar spine.

The patient was taught abdominal stabilization methods that incorporated dynamic neuromuscular stabilization (DNS). In a supine position, the patient was cued to lower his ribcage and contract his oblique, pelvic floor and transverse abdominal muscles. While maintaining this contraction, the patient performed extremity movements. The level of resistance, position and difficulty were increased and challenged as the patient progressed.

The exercises gradually progressed to upright standing. Once stabilization techniques in upright position were done well, functional tasks were integrated to include throwing and pitching drills.

OUTCOME

Upon discharge, the patient was able to return to baseball and pitching without pain. All trunk movements were pain-free. The patient demonstrated improved gluteal strength and lumbopelvic stabilization with extremity movements.

RESEARCH ABSTRACT

Function of Diaphragm During Postural Tasks

By Dr. Irene Davis

INTRODUCTION

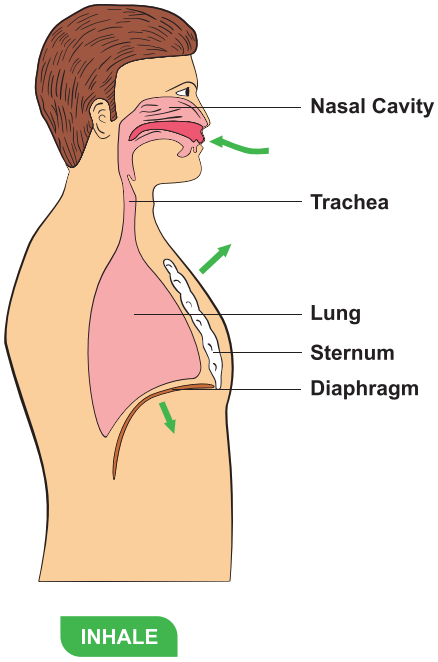
Back pain is one of the most common musculoskeletal problems medical professionals treat. There has been much attention given to the importance of the hip, pelvic, spinal and abdominal musculature in back health. Recently, more attention has focused on the role of the diaphragm in back-related problems. While the primary role of the diaphragm is to assist in respiration, it also significantly contributes to trunk stabilization.

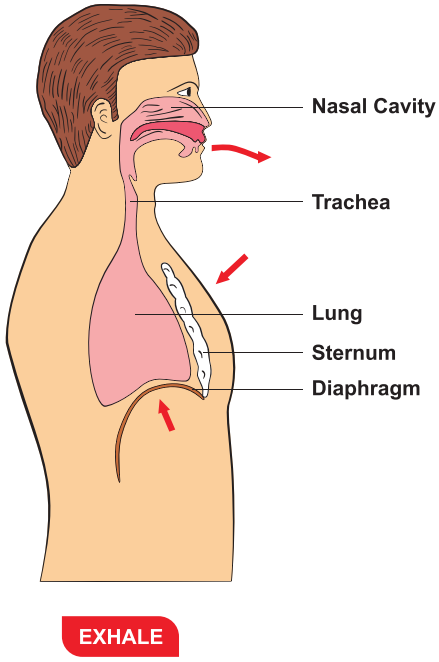
The purpose of this study was to compare the function of the diaphragm during postural tasks between individuals with chronic low back pain and healthy controls.

METHODS

Eighteen individuals with chronic low back pain and 29 healthy controls participated in the study. The patients comprised seven with spondylosis and spinal stenosis, two with spondylosis and spondylolisthesis, five with spondylosis and disk hernia, and four with failed back surgery syndrome (patients operated on for advanced spondylosis, spinal stenosis, and disk hernia not due to an injury). None of these conditions was a result of spine or pelvic traumatic injury.

Both groups presented with normal pulmonary function tests. In order to assess diaphragmatic function, a dynamic magnetic resonance imaging system was synchronized with a specialized spirometric system. Subjects were tested in the supine position, first during tidal breathing and then during isometric flexion of the upper and lower extremities against resistance. The MRI images were used to calculate both the height and the excursion of the diaphragm during these activities.





Patients with low back pain exhibited greater height and lesser excursion of the diaphragm.

RESULTS

No differences in diaphragmatic height or excursion were noted between the injured and healthy groups during quiet tidal breathing. However, patients with chronic low back pain exhibited greater height and lesser excursion of the diaphragm during isometric postural movements of the upper and lower extremities.

DISCUSSION

There are clear differences in the diaphragmatic functions of patients with chronic low back pain. The significance of the greater height and lower excursions may indicate a lack of diaphragm control in these patients. However, it is unclear whether these mechanics preceded the back pain or were a result of the back pain.

Prospective studies are needed to elucidate this further. Regardless, there appears to be an association of abnormal diaphragm function with low back pain. This suggests that approaches such as dynamic neuromuscular stabilization might be a valuable component of rehabilitation programs for low back pain.

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