Kolar's approach to Dynamic Neuromuscular Stabilization (DNS): A Developmental Kinesiology Approach
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Dynamic Neuromuscular Stabilization
DNS is based on developmental kinesiology and the integration of both neurophysiological and biomechanical principles

CNS MOTOR CONTROL
Man, unlike many animals, is immature at birth
Function & Anatomy
After birth maturation of the CNS occurs

Ontogenesis = CNS maturation
• Neurogenesis
• Migration of the neuroblasts
• Synaptogenesis
• Myelination
• Apoptosis
• Neurotransmitter's activation

Spinal & Brain stem level of CNS motor control
Primitive reflexes, global movement patterns

Neonatus
Global generalized motor patterns
No equilibrium
No purposeful movement possible
No support
No grasp
Diaphragm fulfills only respiratory function
What is necessary ....?...
...TO LIFT HEAD?
-Co-activation = balanced, proportional, simultaneous activity between (DEEP) neck flexors and extensors

...TO LIFT LEGS AND PELVIS?
-Co-activation = balanced, proportional, simultaneous activity between diaphragm, pelvic floor, all the sections of abdominal wall = IAP regulation
-In balance with spinal extensors

After newborn stage diaphragm starts to fulfill combined function:
- RESPIRATORY
- POSTURAL
- SPHINCTER
- Very challenging, thus often compromised


1st phase of development: postural stabilization of the trunk
Postural activity occurs as a result of CNS maturation

2nd phase of development:
Stepping forward and supporting function of the extremities

Ipsilateral pattern Contralateral pattern
Epiphyseal line = growth plate

CNS Program
Brain and CNS pathways mature after birth. Level and quality of the CNS maturation correspond with the level and quality of motor patterns.

Muscle Function
Coordinated co-contraction of antagonists. Harmonious influence on growth plates possible only if growth plates function normally. Critical for ideal structural development.

Joints
Every joint position depends on stabilizing muscle function and coordination of local and distant muscles. The quality of muscle coordination is crucial for joint function. CNS dependent.

Muscle Function
Coordinated co-contraction of antagonists. Harmonious influence on growth plates possible only if the CNS functions normally. Critical for ideal structural development.

CNS Function
Structural maturation. Skeletal formation.

Subcortical level of motor control:
MATURATION OF POSTURAL-LOCOMOTION FUNCTION

Stabilization: Feed forward mechanism
First the stabilizers (red muscles on the picture) must activate — automatically, subconsciously.

THEN
The hip flexors (blue muscles) can activate while not decentrating spinal segments, pelvis and chest, from its neutral position during hip flexion.

Stance: Chest - Pelvis relationship

Ideal Chest - Pelvis Relationship

IDEAL: Chest and Pelvic axis: Horizontal & Parallel
ABNORMAL: "Opening scissors" Chest & Pelvic axis: Oblique
ABNORMAL: Chest in front of Pelvic
ABNORMAL: Chest behind the pelvic
Postural Respiratory Diaphragmatic Function

Stabilization strategies
Optimal Postural Pattern
- Spine upright
- Chest properly positioned above the pelvis
- Diaphragm horizontal
- Pelvis in neutral position

Postural MUSCLE CONTRACTION
- EXCENTRIC-ISOMETRIC
- DIAPHRAGM AND PELVIC FLOOR: CONCENTRIC

POSTURAL MUSCLE CONTRACTION FOR WEIGHT LIFTING AND STRENGTHENING EXERCISES

Animations
Optimal stabilization muscle coordination

Stabilization strategies
Open Scissors Syndrome:
- "Inspiratory" chest position
- Diaphragm oblique
- Anterior pelvic tilt

Stabilization strategies
Forward drawn posture:
- Chest positioned in front of pelvis

Dynamic Neuromuscular Stabilization

Forward drawn posture:
Stabilization strategies

Backward drawn posture:
- Chest posterior to pelvis
- Rigid thoracic kyphosis

Hour Glass Syndrome:

Chest & diaphragm elevated
Diaphragmatic excursion for breathing and postural activity limited by constant concentric activity of the abdominal wall.

“If breathing is not normalized, no other movement pattern can be.”

Karel Lewit

Tidal breathing
Izometric activity of arms
Izometric activity of legs


FIGURE A. A subtracted image of the diaphragm excursions (DEs) in its most caudal (inspiratory) and cranial (expiratory) diaphragm positions (DP) during tidal breathing in a healthy control.

FIGURE B. A subtracted image of the diaphragm excursions (DEs) in its most caudal (inspiratory) and cranial (expiratory) diaphragm positions (DP) during tidal breathing in a patient with chronic low back pain.

Diaphragm and pelvic floor have alike anatomy. Act as partners both in respiratory and postural function. Both have also sphincter function! Diaphragm and pelvic floor must work in coordination and synchrony as one functional unit.

Zone of Ineptitude (ZOI)

The time in function or sport during which the athlete is unable to breathe and brace simultaneously.

Weightlifting & DNS

SLIDE BY DR. HANS LINDGREN, DNS INSTRUCTOR
http://www.hanslindgren.com
SLIDE BY DR. RICHARD ULM, DNS INSTRUCTOR
http://www.athlete-enhancement.com

Auxiliary respiratory muscles over use
High Resolution Manometry study on 58 subjects with typical GERD symptoms
Leg raise increases pressure in lower and upper esophageal sphincter pressures

THE STUDY DEMONSTRATES:

- The influence of intra-abdominal pressure on intraesophageal pressure
- The diaphragmatic postural and sphincter function are interrelated.
- The amount of LESP and UESP increase during postural activation depends on resting LESP and UESP.


GERD
Gastroesophageal Reflux Disease = Diaphragmatic incompetence

Postural influence on upper and lower esophageal sphincter

Alignment and functional integration between
1. Mouth floor (C spine)
2. Diaphragm (T spine, chest)
3. Pelvic floor (L spine, pelvic)
Intra abdominal pressure and postural influence on lumbar lordosis

Optimal stabilization pattern

Intra abdominal pressure and postural influence on lumbar lordosis

**OPTIMAL PATTERN**
• Homolateral identical stepping forward or support function of extremities
• Pelvis and trunk maintain parallel axes during rotation

**IPSILATERAL GLOBAL PATTERN**
• Contralateral stepping forward or support function of extremities
• Pelvis and trunk maintain oblique and opposite rotational axes

**CONTRALATERAL GLOBAL PATTERN**

Sensoric integration in postural – locomotion purpose

• Synthesis
• Selection
• Integration

Of all sensoric information into postural – locomotion function
• eyesight
• touch
• hearing
• proprioception
• vestibular perception

Postural – locomotion – sensoric Orofacial integration
NATURAL SYNKINESIS
Look up + inhalation
Look down + exhalation
Often utilized in sport & in mobilization techniques

Functional norms are not clearly defined
E.g. What is ideal posture?
Who trains the best quality of posture?

Martial art  J.H. Pilates  Brugger’s concept

Central nervous program determines the quality of postural locomotion
function greatly influencing skeletal formation (or deformation)

All locomotion patterns are based on the same principles:
Stabilization is related to stepping forward and supporting extremities function in either ipsi- or contralateral pattern

4 main reasons why the basic pattern of stabilization/respiration is disturbed
1. Skeletal abnormality
2. Abnormal early development
3. Cultural, sport, habitual reasons
4. Protective pattern due to any pathology
Sometimes combination of all the etiological factors

Anatomical – Skeletal deformities cannot be changed by rehabilitation
Maybe inconvenient for optimal stabilization coordination and movement patterns

Dynamic Neuromuscular Stabilization
Dynamic Neuromuscular Stabilization

Structural pre-disposition for sport

Weightlifting & DNS Instructor meeting – Praha 2016

Central Coordination Disorder

Developmental aspects
Optimal CNS maturation – Optimal Postural - Locomotion Patterns
Abnormal CNS maturation – Central Coordination Disturbance (CCD)

Poor integration of eyesight into postural function

Idiopathic (?) Scoliosis
Stutter Speech, Poor Posture 1 or 3 diagnoses???
Lesions of the CNS

- affects muscular patterns
- and produce altered joint position, disturbing morphological development

Sport stabilization stereotypes

Aesthetic reasons

PROTECTIVE PATTERN
3rd Level: Matures after one year of age
Cortical level of sensory-motor control

MOTOR LEARNING & TRAINING
Individual qualities, motor patterns’ characteristics

Cortical Level of Sensory-Motor Function

AESTHESIS: Ability to perceive and experience sensation, somatognosis = BODY AWARENESS

MOTOR FUNCTION: Executive, expressive function isolated precise movement, relaxation

IDEOMOTOR: Constructive, planning

INDIVIDUAL QUALITY OF MOTOR PATTERNS

DISTURBED IDEOMOTOR FUNCTION
(Developmental Coordination Disorder/Developmental Dyspraxia)

- Caused by:
  - Lack of motor imaginative ability
  - Lack of motor planning ability
- Therefore difficulty in learning new movement stereotype

Developmental Coordination Disorder
Developmental Dyspraxia

Multi-sensory integration
Disturbed central - cortical, motor regulation

- Repetitive injuries
- Degenerative disorders
- Tendinitis
- Orthopaedic problems resulting from chronic overload, repetitive stress injury
- Unsuccessful motor re-education after injuries, recurrent painful syndromes
- Psychosocial consequences

Postural – Locomotion function (PLF)

- Compromised PLF= one of the most frequent cause of orthopaedic disturbances (chronic overload!)
- PLF cannot be improved by manual/chiropractic techniques only: weak muscle strengthening, short muscle stretching, mobilization, TrPs treatment etc.
- Educational therapeutic system respecting CNS processes is necessary!
- PLF always reacts to all orthopaedic, internal, central and others disorders – by a reflex mechanism

DNS APPROACH

- To train ideal patterns as defined by the developmental kinesiology/reflex locomotion
- STABILIZATION
- RESPIRATORY PATTERN
- LOCOMOTION – IPSI & CONTRA - LATERAL
- BODY AWARENESS

Dynamic Neuromuscular Stabilization (DNS):

Exercise in developmental positions

DNS goal:
To restore functional norms as defined by early physiological development

Treatment effect

The training group gained about 0.25 standard deviations over the control group per session for a total of 1.5 standard deviations (about 27 Newtons) across all sessions.

\[ p < 0.001 \]