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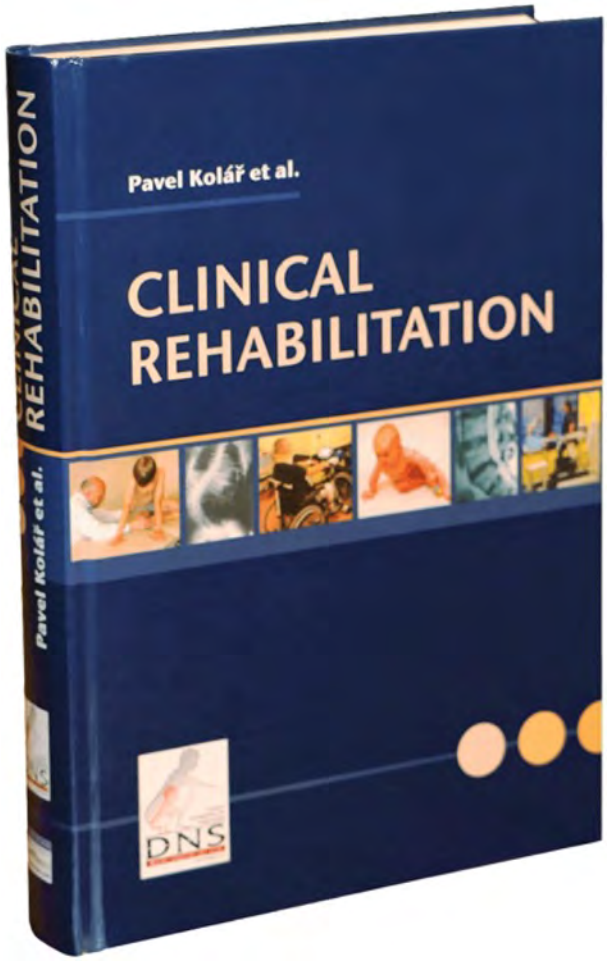
BOOK REVIEW

P. Kolář, et al., Clinical Rehabilitation (2013), Hardback (shipping included) € 109 (e-Book € 82.99). Also available: set of 2 posters illustrating developmental positions for DNS exercises: € 65 (including shipping). Both available at: www.rehabps.com.



Twenty years ago, on a cold morning in Prague, I found myself holding the elbow of a desperately stricken woman. She was an in-patient in the hospital's rehabilitation department; my colleagues and I were observing one of her daily treatments. Physiotherapists had carefully transferred her limp body from a wheelchair onto a treatment mat and I had been instructed to precisely press the woman's elbow after they molded her into a fully slumped kneeling posture (similar to the Child's Pose in yoga but with her toes hanging over the mat's edge). With gentleness and specificity, they pressed areas of the woman's body. Within a minute or so the patient's shallow breathing became audible and increased in frequency and excursion.

Suddenly, I felt a jolt of strength surge up her back and pass into the elbow I was holding. Her efforts partially raised her torso to an upright kneeling position. She stayed there, as if pinned in space, and then she sagged back onto the mat as the therapists released their contacts. This seemingly involuntary muscle effort was repeatedly invoked during her session.

It was startling to feel raw power arise out of listless muscle and yet, her movements resembled those of a newborn colt. The treatment itself was puzzling. The therapists' meticulous manual pressures lacked the improvisational quality of massage. Instead of searching for knotted muscle, their patient positioning was as exact, formalized and pre-determined as was their touch. And, inexplicably, the movements they elicited appeared pre-determined and predictable.

Two years later, my friends and I were amazed to see the woman walking assisted only by crutches. We were informed she had moved out of the hospital and now lived independently. That was our introduction to Reflex Locomotion, an innovative technique developed by Professor Vojta and further refined by Professor Kolář and his colleagues.

What is the Prague School of Rehabilitation?

In response to the suffering due to the effects of polio and World War II, Academician Kamil Henner initiated the Neurology Department in Prague's Charles University School of Medicine. Among his first students were Vaclav Vojta, Karel Lewit, Vladimir Janda, Karel Obrda, Frantisek Véle, and Jan Jirout. All became professors and they and their students developed new clinical rehabilitation methods. Rooted in neurology, the Prague School developed

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diagnostic testing, therapeutic exercises and manual therapy methods emphasizing the role of information processing in rehabilitation.

As we shall see, Professor Vojta elaborated a model of developmental motor control that went beyond the level of cortex. His interest in the spinal cord, brainstem and subcortical structures directly led to the reflex locomotion procedures illustrated in this textbook. Professor Lewit synthesized an approach to palpation, assessment and manual treatment. Professor Janda codified a new way of analyzing muscle function and emphasized the importance of sensorimotor training. Professor Jirout systematically studied functional radiology of the cervical spine. Associate Professor Véle investigated motor learning and the effect of respiratory movements on posture. Associate Professor Obrda developed EMG techniques and (with J. Karpisek) wrote the first Czech textbook of neurological rehabilitation. These accomplishments are explained in this remarkable text.

Recent English-language scientific publications of the Prague School include: Kolář et al. (2009) whose study (using supine MRI and spirometry) found that, although their 16 healthy subjects' diaphragms moved with different amplitudes, synchronicity was seen of the diaphragmatic apex and the dorsal costophrenic angles. Using a similar experimental design, Kolář et al. (2010) observed supine subjects isometrically contract the lower limb against external resistance. They found this effort was accompanied by significant changes in diaphragm position and excursion compared to tidal breathing in the relaxed supine position. In a follow-up pilot study, Kolář et al. (2012), studied 47 subjects (with and without chronic low back pain and all with normal pulmonary function tests) and found their chronic low back pain subjects had a steeper diaphragmatic slope, higher diaphragm position and smaller excursions than normal subjects. These three studies break new ground in the understanding the diaphragm's role in spinal stabilization.

Other English-language publications exemplifying the work of the current generation of Prague School researchers include Kobesová et al. (2012). Using stabilometry, they studied a patient with hereditary motor and sensory neuropathy. Three weeks of treatment produced improved gait and balance and reduced back pain despite the patient's total atrophy of tibialis anterior and peroneal muscles. Kobesová et al. (2007) in a case history involving a man with 20 years of post-appendectomy pain achieved immediate pain reduction with manual mobilization of the scar's superficial and deep layers.

This journal has featured papers authored by Prague School practitioners: two case studies of Dynamic Neuromuscular Stabilization (an umbrella term describing the conceptual principles, observational and palpatory skills, functional assessment tests, treatment techniques and therapeutic exercises developed by Kolář and his colleagues). Oppelt et al. (2014) discusses rehabilitation (32 weeks of spinal manipulation, Dynamic Neuromuscular Stabilization, modified constraint induced movement therapy and personal training) of a 31 year-old male 48 months after a hemorrhagic stroke resulting in left hemiparesis. Improvements were noted in sleep pattern, mobility and body mechanics and emotional outlook. Juehring and Barber (2011) describe a 49 year-old woman with a 40 year history of disabling migraine symptoms. She was treated with a 12-week period of Vojta/Dynamic Neuromuscular Stabilization. Improvements were substantial; symptom frequency, intensity and duration were each reduced to one-fifth of the level of her presenting symptoms.

In addition, Kobesová and Kolář (2014) outline developmental kinesiology (the study of how infants normally grow to access motor control at three levels: brainstem/spinal cord; subcortical and cortical brain structures) and how to use this approach in the assessment and treatment of the motor system. This article highlights the importance of proper breathing mechanics to creating sufficient intra-abdominal pressure to ensure spinal stabilization. This stabilization is seen as an essential pre-requisite to all other movements.

What is the book about?

Professor Kolář is the main author and editor of the recently published Czech textbook: Rehabilitace v kinické praxi. In 2013 an English translation became available. He designed this 764 page textbook as an outline of physical and rehabilitation medicine in Europe. It applies rehabilitation principles to challenges faced in orthopedic and neurological rehabilitation as well as in the specialties of obstetrics & gynecology, pulmonology, internal medicine, oncology, pain-management, psychology and psychiatry. The 70 authors are all Czech specialists. Kolář begins the book by noting many common medical conditions are diagnosed without consideration of postural, breathing or movement pattern influences.

This book attempts to remedy this situation. On p. 27, he reminds us that in movement system dysfunction, the majority of patients have non-specific pain (with essentially normal objective signs, imaging and lab tests) and that "these are patients with abundant clinical findings; many of which can be discovered in knowledgeable history-taking and in careful observation of the patient's quality of neuromuscular control."

On p. 261, he notes a javelin thrower (this applies to any action based upon maximal and mature unilateral arm exertion) moves eyes and tongue in the direction of the release as well as changing the breath and positioning of the contralateral limb. There are many scintillating treats in this book but, this limited review will focus on reflex locomotion and developmental kinesiology.

A central principle informing the text was stated by Janda (1988) "Muscles lie on a functional crossroad being strongly influenced by stimuli coming from both the central nervous system and the osteoarticular system." The book begins a functional assessment of the patient's breathing, postural and movement patterns.

The outstanding contribution of this book is a robust, scalable, explanatory and predictive model of spinal stabilization. The model is robust in that it applies equally to those in sickness and in health. It is scalable across gender, occupation and lifespan. It is explanatory because (using the Prague School innovations of developmental kinesiology, reflex locomotion and sensorimotor stimulation) it gives new

and optimistic insights. These provide an explanation why poor breathing and posture evokes suffering in some sedentary people. These insights also apply to the challenges facing those with stroke, cerebral palsy and other neurological diseases, lower back pain in pregnancy, post-partum abdominal diastasis, incontinent women, scoliosis, disc degeneration and shoulder afflictions to mention a few of the problems discussed in the book. Lastly, it can often predict therapeutic outcomes within a single session as well as outcomes at treatment's end. Much needed scientific evaluation of the model's premises is underway but motivated readers can evaluate the model's value by using themselves as experimental subjects.

The model's weaknesses are two-fold: the therapist must be observant and meticulous and this requires in-depth training. Secondly, patients must be active in their rehabilitation and this requires learning awareness and developing not only better postural, breathing and movement habits but also persistence and patience. As Dr. Čumpelík (on p. 501-2) points out: cultivating the necessary postural awareness and coordination is incremental and "cannot be 'exercised' but rather established." A fuller suite of his exercises is presented in Čumpelík and Velé (2007).

The book defines several concepts integral to the Prague School. For instance, stereognosis is the non-visual recognition of an object's shape and structure; for instance, being able to identify keys by reaching into a pocket. As motor control unfolds, stereognosis spreads from the mouth, tongue and lips to the back before reaching out to the distal extremities. It is essential to purposeful movement. Centration is the optimal alignment of joint surfaces such that force transmission through the bones is maximized. Global centration anticipates aligning the entire skeletal frame to best accomplish a movement. Centration is key to reflex locomotion.

Reflex locomotion

In the 1950s Vojta (1984) noticed normally developing infants manage to optimize discover three constituents of locomotion: preparation, elevation and propulsion. First we prepare for movement; orienting, for instance, to gravity, the environment and the desired movement. Next, we lift a portion of the body to free up the body's center of gravity for weight-shifting and to claim sufficient space to perform the desired action. Finally, with the body, oriented and elevated, we accomplish the desired action. A child severely disabled by cerebral palsy never achieves these core components. Therefore, these children, therefore, never differentiate the movements in their self-image, much less accomplish the far-ranging capacities of mature movement.

Vojta postulated we have fundamental movement patterns (affecting the entire human frame) within our genetic heritage. He showed these patterns could be triggered in infants stunted by cerebral palsy; evidently by bypassing the damaged cerebrum and evoking useful movement controlled from intact subcortical brain structures. He discerned that cerebral palsy is a "disturbance of gross motor *development*." Therefore, if these fundamental movement patterns are repeatedly evoked in therapy, the child may differentiate functions (for instance, standing and skipping on one leg or proper hand-grasping) and, in each case, escape serious disability. In the first instance, the child will avoid being wheelchair-bound, in the second, the child will develop stereognosis and learn to confidently handle tools.

Not mentioned in this Vojta's 1984 English language book chapter is the role of breathing or intra-abdominal pressure in achieving sagittal spinal stabilization. Both are well described (and illustrated) in this recent book by Kolář and colleagues. They detail how normal children, around three months of age, are able to lift their heads while prone. This involves pressing down with the pubic symphysis, legs and the forearms while lifting the head and permitting easy head movements upon the upright spine. In the supine position, the same children will press their spines into the support surface while flexing their lower limbs 90° at the hips and knees. The Prague School believes that, in both the supine and prone actions, the children create sufficient intra-abdominal pressure to stabilize the spine through breathing and co-activation of six muscle groups: the pelvic floor, diaphragm, abdominal muscle wall, hip flexors, deep neck flexors and the spinal extensors.

More importantly, for rehabilitation purposes, they believe many patients are unable to properly perform these fundamental movements normally mastered at three months; substituting instead, head jutting, shoulder girdle elevation, breathing constriction, and excessive lumbar lordosis. They devised a set of rapid assessments and a series of manual therapies and exercises (in addition to reflex locomotion) to identify and remedy these deficiencies. They believe motor control develops sequentially. Importantly, they believe full development of each stage is necessary for continued correct development.

In summary

This is a magnificent book, brimming with surprises. For those interested in the Prague School. The book is well printed and profusely illustrated with clear color photographs and line drawings. Two large wall posters are also available; waterproof and easy-to-clean. The posters nicely complement the text by demonstrating, in clear and exquisitely detailed pictures, 20 developmental milestones in the first 13 months of life. Each infant picture is matched with an adult picture demonstrating proper postural biomechanics. Two nuisances in the book are the impoverished index and the sizable patches of text lacking easily located references. Hopefully the next edition will clarify these problems.

Why is this book important? The Prague School of Rehabilitation weave better breathing and movement patterns into everyday living. This nicely balances the common practice of treatment (after imaging and lab tests) with drugs, surgery or passive physical therapy. It offers a way to discover we cannot purchase health, we can only earn it. More importantly, instead of choosing to treat us only we are bent, breathless and broken-down, it predicts a way to maintain health in the movement system—early discovery of aberrant motor function and vigorous training in awareness, sensorimotor integration and the robust movement patterns underpinning breathing, posture and action.

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