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Sensory-Motor Training, Part II

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Part 1 of this series (see *DC*, April 23, 2001, Volume 19, Issue 9, (www.chiroweb.com/archives/19/09/06.html) described the basic evaluation and treatment approach required to carry out sensory-motor training (SMT). The rationale (**why**), indications (**when**), and techniques (**what**) were all presented. This second part will summarize part one's main points, and then focus on the practical issues surrounding how to integrate SMT into your practice.

Why

SMT is important because proprioceptive and balance dysfunction(s) compromise the body's ability to reflexly stabilize joints under conditions of sudden or unexpected external load or perturbations. Balance disorders have been found to correlate with a wide variety of conditions: ankle and knee instability; low back pain; ataxia; and even cervicobrachial complaints.

Table 1: *Normative data for the one leg standing test (Bohannon '84).*

A few studies which illustrate the importance of a healthy sensory-motor system are reviewed here:

- Excessive anterior-to-posterior body sway on an unstable surface or poor single-leg-standing balance is correlated with low back pain (Byl '91).
- Poor balance has been correlated with future LBP (Takala'00).
- LBP patients, when compared to normal asymptomatic subjects, demonstrated a slower reaction time and decreased peak muscle output. The latter was increased after discharges when an irregular load was

handled (Wilder '96). This study had particularly strong methodology because treatment was given and the reactions improved. Sitting was shown to disturb these variables; a brief walking break showed an improvement in them.

- A specific motor control signature discriminates LBP patients from asymptomatics - specifically a slow reaction time, increased activation, and subsequent slow relaxation to unexpected perturbations in both sitting and standing postures (Radebold '00, '01).

When

SMT is indicated when balance tests show less than normal balance function. The basic balance test is the one leg standing test (see **Table 1** for the standards). In your clinic this test can be performed on any nonacute patient.

Table 1: Normative data for the one leg standing test (Bohannon '84).

AGE (years)	EYES OPEN (seconds)	EYES CLOSED (seconds)
20-59	29-30	21-28.8
60-69	22.5 average	10
70-79	14.2	4.3

The Test



Instruct your patient to:

1. place arms at the sides; raise foot off the floor;
2. practice balance with eyes open for 5-10 seconds on each leg;
3. return to the first leg and raise the foot off the floor; fix the gaze straight ahead and close eyes;
4. try to maintain for 30 seconds with two chances.

There is failure if:

- a foot is put down; the arms reach out; the patient has to grasp something; or the stance foot hops.

Additional qualitative information is described by Janda (Janda "96)

Qualitative signs of poor balance:

- excessive weight shift on the stance leg;
- Trendelenberg sign (pelvic obliquity - high on stance leg side);
- excessive shaking of the foot or ankle; or
- increased postural disturbance (increased lumbar lordosis; thoracolumbar muscle hypertonus; unleveling of the shoulders, head forward posture).

Other tests that can be used in the office to screen for poor sensory-motor function include Vele's test of reflex foot stability and Janda's lumbosacral perturbation test.

Note: If balance or reaction times are compromised, SMT is indicated.

What

SMT involves learning to balance, walk without excessive subtalar pronation, and to actively "brace" the lumbar spine to stabilize it under adverse load situations. The "tools of the trade" include various labile training surfaces, such as rocker boards built to Janda's specification; wobble boards; balance sandals; gymnastic balls; and mini-trampolines.

How

Integrating SMT into your busy practice is not difficult. Most patients are highly motivated to begin this training, as it is usually obvious that their balance is poor and training it is fun. There are three distinct stages of motor learning that you should guide a patient through (see **Table 2**). The first stage is **cognitive training of the kinaesthetic awareness** of proper foot and spine position, which activates the "deep" stabilization system. Subsequent **neuromuscular training on labile surfaces** engrains new patterns of locomotor function, which improves balance and reaction times. Eventually, a new pattern of locomotor function should emerge which is active during the patient's **activities of daily living (ADL)**.

Table 2

Stages of Motor Learning
1. cognitive training of kinaesthetic awareness;
2. neuromuscular training on labile surfaces; and
3. ADL training.

Stage one involves training the patient in proper foot position or how to actively "brace" the lumbar spine with slight abdominal tension. This can commence during the acute phase of care. It usually takes a few minutes per treatment session with practice at home. Within a week or two, most patients develop the kinaesthetic sense to be able to execute these motor skills volitionally.

Stage two training involves placing a patient on a labile surface such as a rocker board or simply having them stand on one foot and balance. This can be initiated when the patient is out of the initial acute phase. Such training should be taught carefully in the office and supervised. Once the patient demonstrates proper

form and control, the training can be prescribed for home use. Ideally, home SMT would consist of 15 minutes per day broken into three equal sessions of approximately five minutes each (Bullock-Saxton '93).

Rocker board exercises are an excellent introduction to SMT for patients. The patient can start by standing on the board while learning to slowly rock it in an A-to-P direction. At first, there will usually be a great deal of upper-body sway and hinging from the hips and lumbosacral spine. But quickly, the patient will learn to hinge from the ankles and rock the board equally forward or backwards. The "learning curve" is particularly rapid, which gives the patient positive reinforcement and a sense of accomplishment. This facilitates further progressions such as working with the board at other angles, standing on it on one foot, or progressing to wobble boards or balance sandals.

Stage three training involves incorporation of improved balance, foot position "sense", and abdominal "bracing" abilities in ADL. Lunge; squat; carrying; kneeling; sit-to-stand; pushing; and pulling activities can all be trained without any special equipment. At most, elastic tubing is probably the only equipment needed. The goal is for the patient to demonstrate good motor control and skill in their ADLs and then to repeat certain functional stereotypes repetitively to engrain the new neuromuscular patterns.

Conclusion

SMT is valuable, inexpensive, easy and fun. Its clinical utility is very high, and thus belongs in every chiropractor's armamentarium.

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