Dynamic Chiropractic

DIAGNOSIS & DIAGNOSTIC EQUIP

Combined Motions: Your Best Friend, or Your Worst Enemy?

As virtually all natural movements are combined or coupled, examination of the musculoskeletal system will elicit the most precise and fullest clinical information when combined/coupled movements and localized manual digital pressures in combined postures are added to orthodox single-plane joint-testing motions.

Dynamic Examination in Real-Life Situations Versus Static Examination

The articular signs and provocation of nociceptive symptoms revealed, for example, on joint-play testing lateral flexion (+/- Z rotation) and/or rotation (+/- Y rotation) from the neutral position, can be markedly different when the same movements are tested in flexion and extension, or as coupled motions. Initial symptoms can be sharply accentuated, changed or diminished, and initially localized symptoms may refer elsewhere. This represents a very different clinical differential diagnostic workup from the initial complaint. Clearly, the area of pain is not always the area to treat.

Consider the following statement from Guyton, who says that more than half of all nerve fibers ascending and descending in the spinal cord are propriospinal fibers, which run from one segment to another providing pathways for multisegmental reflexes (Guyton MD. Propriospinal tracts. *Medical Physiology* 1991:591).

Also consider the following from Ghez: "Propriospinal neurons main axons branches terminate in distant spinal segments, running up and down the cord, terminating on interneurons and on motor nuclei located several segments away. Axons of medial propriospinal neurons are longer and may extend the entire length of the spinal cord. This pattern of organization allows the axial muscles, innervated by many spinal segments to be coordinated." (Ghez C. The control of movement. In: Kandel ER, Schwartz JH, Jessel TM (eds). *Principles of Neural Science,* 3rd edition. New York: Elsevier, 1991, chap. 35:534-547).

From the preceding two paragraphs, we understand that the pain patterns our patients describe during dynamic coupled motion examination are undoubtedly related to the characteristic physiologic movement combinations (coupled motions), which themselves are the functional expression of close-packed and loose-packed positions of vertebral motion units. By using combined examination procedures, a more comprehensive perception of the unique nature of aberrant motion from patient to patient is appreciated.

Examination techniques utilizing coupled motion-joint play analysis reveal the following points:

1. enhance precision of clinical findings;

2. allow the application of accurately controlled stress to particular aspects of individual vertebral segments (joint play);

3. allow recognition of regular and irregular patterns of response (based, of course, upon one's knowledge of the normal functional anatomy of the area);

4. allow for a monitoring of the patient's progress.

Coupling is very common in spinal function. Frequently, three motions will simultaneously take place during normal physiological movement. Pure motion in one plane perhaps does not exist. Only sagittal motion unit movements roughly approximate to motion in one plane, assuming that no abnormal or other curves exist.

Characteristic Coupled Motion Patterns in Rotation and Lateral Bending Motions

After the first degree or two of motion, one induces a portion of the other, and they are inseparable. It is possible, however, to produce lateral flexion of the cervical spine while keeping the head pointed to the front (maintenance of a frontal plane projection), but vertebral body rotation to the same side (spinous process opposite) will occur to a degree anyway. This is of great use to the examiner, as maintenance of frontal plane projection when examining the C0-C1-C2 motion unit in, for example, right lateral flexion (+Z rotation) will result in a paradoxical motion (left axial rotation, +Y rotation) of the C0-C1 articulation with respect to C2.

Flexion reduces lateral flexion (+/- Z rotation) and rotation (+/- Y rotation) ranges of motion. It eradicates the cervical lordosis, usually between C4-5-6 and according to Grieve, may slightly reverse the lumbar curve from L3 upwards. Extension also reduces the range of lateral flexion and rotation. (Grieve G. *Common Vertebral Joint Problems,* 2nd edition. Churchill Livingstone, 1998.)

Lateral flexion restricts sagittal flexion (+X rotation) and extension (-X rotation); however, from a clinical point of view, and with the spine lateral flexation, the following observations can be noted:

1. In the cervical spine, lateral flexion makes rotation easier to the concavity (vertebral body rotation) whether the spine be in neutral, flexion or extension.

2. In the thoracic spine below T3-4 motion segments and in the lumbar spine, lateral flexion makes rotation easier to the convexity (vertebral body rotation) when the lateral flexion occurs in neutral or extension. If the thoracic or lumbar spine is flexed and then laterally flexed, the rotation will be easier to the concavity (vertebral body rotation) as in the cervical spine. A point of interest is found in: White A, Panjabi M. *Clinical Biomechanics of the Spine,* 2nd edition. 1990, ch. 2:104. White and Panjabi state: "In the middle and lower thoracic spine, the axial rotation, which is coupled with lateral bending, can be in either direction." This appears to be a function of rib cage stiffness and patient individuality. Clearly, from the work of White and Panjabi, we cannot use the rotation of the middle and lower thoracic spinous as a constant.

Rotation restricts flexion and extension, and is invariably accompanied by a degree or two of lateral flexion. This statement warrants further clarification as traditional, and historical motion palpation does not address this issue.

From White and Panjabi (pp. 53-55), we read the following: "... The lumbar region shows certain cross-coupling of all three rotations. In other words, when the lumbar motion segment is rotated axially, it bends in the frontal and sagittal planes." This means that lateral bending moments are a function of axial rotation. Pursuing this further, consider the following from White and Panjabi: "The left axial rotation of L1 due to left axial torque (+MY) of 10 Nm resulted in the motions shown. The axial rotations (RY) decrease from L1-L2 to L5-S1. The coupled lateral bending (RZ) changes direction from right bending (opposite the applied torque) at L1-L2 and L2-L3 to left bending (same direction as the applied torque) at L4-L5 and L5-S1. The coupled sagittal plane rotation is flexion at all levels."

Applying the above information into the motion examination significantly changes one's interpretation of what is occurring in the patient's spinal movement patterns, both normal and abnormal. Rotation is a coupled action of lateral flexion. During lateral flexion, the spinous rotates to the concavity (vertebral body motion is to the convexity).

Classical dynamic palpation would have the examining doctor, during left axial rotation (+Y), challenge the facet joint in the same direction as the applied torque. This is consistent with the work of White and Panjabi, but only for L1-L2 and L2-L3 as the lateral bending is concavity to the right; therefore, the right facets rotate toward the anterior. The same cannot be said for L4-L5 and L5-S1, as the lateral bending is to the left; therefore, the right facets toward the posterior. L3-L4 appears to be at the intersection point of two lateral bending actions.
It is therefore reasonable to assume that its action with respect to the lateral bending (+/-Z rotation) is to be negligible. This, too is consistent with the work of White and Panjabi.

Without question, the intra- and inter-reliability of motion palpation has been weak. Of this I have no quarrel. I do, however, offer to the profession that one of the major reasons (and there are others) is not the technique or the concept. Rather, it may be a lack of understanding of the normal motions that the spine undergoes in real life. The above motions are but a few examples.

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