PAIN & DISABILITY℠
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Erect Balance and Stance

Erect balance requires biomechanic balance. Since the vertebral column is flexible, it would appear that muscular effort is necessary to maintain column relationship to the center of gravity. If this were true, muscular fatigue and collapse of the erect column would ensue. Nature has prevented this total dependence on muscular balance by permitting the column to be supported on ligamentous structure. The lumbar curve extends into greater lordosis, placing its support upon the anterior longitudinal ligament and posteriorly upon the facet joints

The hip joints can be immobilized in the extended position by virtue of the ligamentous bands within the anterior capsule of the hip joint. With the body weight "leaning" against this iliopectineal band (the Y ligament of Bigelow) the hip can remain extended with no muscular activity. The knee joint is prevented from hyperextending by virtue ofthe posterior popliteal capsular tissues. The knee can thus be maintained in the extended position by ligamentous support requiring no muscular effort.

Only the ankle cannot be immobilized and supported by ligamentous tissue. The ankle, however, can be maintained in the erect weight bearing position with alternating isometric contraction of the anterior dorsiflexors and the posterior gastrocnemius-soleus muscle groups.

Since forward flexion of the lumbar spine is essentially only a reversal of the lumbar lordosis into a slight lumbar kyphosis, full body flexion requires simultaneous rotation about the hip joints of the pelvis as the lumbar spine flexes. The synchronous lumbar spine flexion with pelvic rotation is aptly termed lumbar-pelvic rhythm. For every degree of lumbar spine flexion there is a proportional rotation of the pelvis.

Because the erect stance is essentially a posture dependent upon ligamentous support, muscular support must be elicited the instant the body flexes forward anterior to the center of gravity. As the body flexes forward, the erector spinae muscles elongate to decelerate forward flexion. Insofar as muscular elongation which performs deceleration is a learned reflex, its smoothness and efficiency requires neuromuscular coordination. Poor training or distraction during this motion will interrupt the smooth efficiency offorward flexion. Poor body condition may also, by increasing the fibrous elements of the muscular system, limit the degree of extensibility.

Once the body reaches full forward flexion it is again restricted by ligamentous connective tissue.

To return to the full erect posture the extensor muscles must now shorten and function as acceleration or body elevation until the full erect posture of ligamentous support is achieved.

The return to erect posture must also accomplish the reverse of the flexion lumbar-pelvic rhythm. The lumbar lordosis must be gradually resumed as the pelvis is *derotated.* Here again, precise coordinated neuromuscular effort must exist and requires training, practice, and no interference by distraction.

Insofar as the posterior articulations, the facets, guide the direction of lumbar flexion and extension and deny lateral flexion and rotation, this direction of reextension must be carefully observed.

In the flexed position, i.e., the body bent forward and the lumbar lordosis reversed, the facets are separated, thus permitting some degree of lateral flexion and rotation. As lordosis is achieved, the facets approximate and, ultimately, as hyperextension is achieved, are in direct contact and prevent *any* lateral or rotation movement.

In the forward flexed position, the separation of the posterior facet joints place all the limitation of rotation of the functional unit upon the intervertebral disk. It is probable that in faulty rotation with the body flexed forward disk injury occurs.

Therefore, any of the following can result in painful disability: violation of proper lumbar-pelvic rhythm, either in the act of forward flexion or reextension to the erect posture; faulty neuromuscular deceleration or acceleration; or violation of the proper direction of reextension mandated by the plane of the facets. The following factors are related to proper neuromuscular coordination: proper training, constant practice, good conditioning, and no diversion such as can be expected from anxiety, anger, haste, or distraction.