



Spinal Mobility with Concept of the Combination of Motion Spheres in the Body

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Abbreviations: ROM-Range of Motion.

In recent years, the importance of physical rehabilitation has been more emphasized. The authors and colleagues have continued practice and research for long [1,2]. Furthermore, we have given workshops for various subjects [3,4]. The content included how to perform walking, jogging, and running associated with stretching, pole exercising, standing straight, leaning forward and others. How can person keep a good standing attitude at all times? Firstly, make the body relax without muscle tension. Secondly, make your back bone stretch straight. It is important to conduct the following three operations slowly in this order [5].

Make the spine round and warp: When you make rolling back, the movement of the spine starts not from the chest but from the pelvis. As the pelvis is rotated backward, the movement is transmitted and the spine becomes round forward [6]. Conversely, when the spine is bent backward, the pelvis can at first rotate forward direction. After this movement, the spine can extend upward and backward. Regarding these operations, the subject cannot make the back sufficiently rounded or warped, if the abdominal muscles may be in tension without relax.

Make thorax stretch and shrink: There is a body action to bend the upper body straight in bilateral direction to right or left. In this case, the flank on one side becomes expansion. Simultaneously, the opposite flank on other side becomes contraction. On the extension side, the ribs and pelvis become situated with pulling apart. At this time, the trunk muscles are softer and move more greatly [7]. When these movements become smooth, the person can make the Range of Motion (ROM) larger smoothly in the shoulder, arm, and hand.

Twisting the upper body: When you can twist the thorax from side to side, the movement does not start from the upper body. The lower body (pelvis) and upper body (trunk) would be twisted in opposite directions. The movement will be intended to twist the spine one by

one, distinguishing between the upper and lower body [8,9]. Among the operations of three movements mentioned above, twisting is the movement that can generate the largest power. Then this power can be used for the batting in the baseball or hitting the ball in the tennis. However, there is inevitably a tendency for the legs to move with the trunk. The above three movements are summarized as front/rear, left/right, rotation of the trunk.

There is the opposite movement included in each mechanism. Thus, the human body can move in minute degree smoothly by moving three parts of the head, chest and lower back [10,11]. We have reported and given the lectures on the importance of standing straight with relaxed status. In that case, the spine can be straightened without muscle tension. One of the recommended methods is to learn how to improve the natural posture in standing [12]. The crucial points are as follows: i) the back of the head is lifted straight upward to the ceiling, ii) the abdomen is stretched, iii) the pelvis is in an upright position. These postures are summarized as the illustration of (Figure 1).

The positive direction of the X axis is the front aspect of the face. Consequently, it is important that the vector force is applied to the upward direction of the Y axis associated with the straightened back. The subject can have an image of pulling back of the head and then one can maintain good posture for standing. The concept of the figure 1 is in the following: i) the movement of each part of the body is interconnected, ii) there are three motion sphere balls in head, chest and pelvis, iii) the mastoid process of the head motion sphere and the sternoclavicular joint of the chest motion sphere are connected, iv) the sternoclavicular joint of the chest motion sphere is connected to the upper posterior iliac spine of the iliac bone [13].

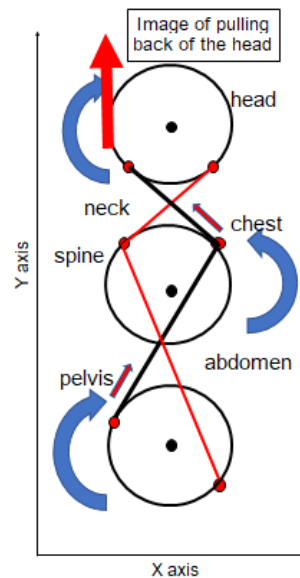


Figure 1: The concept of the combination of motion spheres.

In figure 1, three mutual movements are shown by circles on the sagittal plane. However, this is not a two-dimensional circular movement in a plane, but a three-dimensional sphere movement [14]. In other words, these ball motions exist in sagittal, frontal and transverse planes. Thus, there are three motion balls in the body, in which smooth motion is always functioning with linking each other. These movements are included in all kinds of sports. When muscles are with tension, these smooth movements are difficult to be performed. Relaxed condition would be necessary.

Generally, usual sports players do not usually notice these function. On the other hand, top level athletes and Japanese martial arts experts can detect and recognize these minute movements inside the body. Specifically, such professionals can slightly relax the tight condition of the sternocostal joints and sacroiliac joints. Subtle movements are possible by moving the left or right pelvis slightly shifted [15]. The concept represents that human body has a centerline indicating gravity line associated with left and right axes. They can recognize these axes and move their minute movement using these axes as they like.

Consequently, three motion sphere balls described above are operating smoothly. These two joints were originally movable joints and moved freely during infancy. From the viewpoint of animal evolution, the quadrupeds moved freely using these joints [16]. There is the animal evolution of lower limb. As a reptile, Mosasaurs had ilium in lower body. It connected to vertebral column in a horse as a quadruped. The hind limbs in quadrupedal vertebrates were transformed into the lower limbs in the humans [17]. As human grows, these joints have become fixed. However, Japanese martial experts can move both joints by training and apply it to their astonishing movements.

Recently, Japanese martial arts are attracting attention, and 20 kinds of martial arts magazines and books are published in Europe [18]. Human has been gradually moving in a direction that gradually deteriorates physical movement and in a direction with not relaxing but focusing on muscle training. Is this really preferable training way? In summary, we described the topic concerning the spinal mobility with the concept of motion spheres. They include three balls like sphere of head, chest and pelvis, which work together according to the spinal movement. We expect that this concept would become reference for further research development in the future.

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