

Commentary

POSTURAL AND RESPIRATORY MODULATION OF AUTONOMIC FUNCTION, PAIN, AND HEALTH

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Abstract. Posture and normal physiology and function are inter-related. Abnormal posture is evident in patients with chronic pain-related conditions including backache, headache, and stress-related illnesses. Posture training and gravity-centered breathing may play a role in comprehensive treatment of patients with chronic pain and stress-related problems.

Descriptors. gravity-centered breathing, posture, respiratory modulation

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INTRODUCTION

Despite considerable evidence that posture affects physiology and function, the significant influence of posture on health is not addressed by most physicians. In fact, neither comprehensive postural nor structural evaluation is a routine part of training in physical diagnosis, and most osteopathic physicians do not describe postural/spinal mechanics in their usual patient evaluations.

Observations of the striking influence of postural mechanics on function and symptomatology have led to our hypothesis that posture affects and moderates every physiologic function from breathing to hormonal production. Spinal pain, headache, mood, blood pressure, pulse, and lung capacity are among the functions most easily influenced by posture. The most significant influences of posture are upon respiration, oxygenation, and sympathetic function. Ultimately, it appears that homeostasis and autonomic regulation are intimately connected with posture. The corollary of these observations is that many symptoms, including pain, may be moderated or eliminated by improved posture.

Optimal adult human posture is generally considered to include lordosis of the lumbar and cervical spine; this usual

posture develops as infants begin to sit and stand. In the newborn, the spine is relatively straight. Interestingly, migration of the larynx from its cephalad position opposite cervical spine C1, C2, and C3 to its usual adult position opposite C4, C5, and C6 occurs during the transition from reclining to upright posture, usually complete about age two.

All mammals, including humans, are born with the tongue entirely in the oral cavity. At birth, the human larynx is situated in front of the first, second, and third cervical vertebrae. This laryngeal configuration allows the infant to swallow and breathe simultaneously—actions essential to nursing. Because of this laryngeal configuration, however, human infants are born obligate nose-breathers; that is, the infant may breathe only through the nose, except when crying, at which time it may also take in air through the mouth.

The human is the only mammal whose tongue does not remain in the oral cavity for life. Instead, the posterior one-third of the human infant's tongue begins moving down into the throat at approximately two years of age. The infant can, however, lower the posterior one-third of the tongue into the throat by voluntary muscular activity between the second and fifth month after birth. When the tongue is lowered thusly, the infant ceases to be an obligate nose-breather, yet can alternatively breathe through the nose only, if necessary. As the posterior part of the tongue moves down into the throat, the larynx moves with it. At maturity, the posterior one-third of the tongue forms the anterior wall of the adult throat, and the larynx will have descended to a position of rest in front of the fourth, fifth, and sixth cervical vertebrae, where it remains for the duration of life. It has been clinically noted that this lower position appreciably alters both breathing and vocalization (1).

Generally speaking, the human larynx is considered a *voice box*. "It is, however, far more accurate to define voice

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production in man as a secondary function of the postural mechanisms that include respiratory activity" (2). Its sound-producing potential is only a fringe benefit. The primary purpose of the human larynx is to function as an exchange valve, controlling the flow of air in and out of the lungs. It also serves as protection against invasion of foreign material into the lungs. For example, during choking the vocal cords close involuntarily, preventing foreign substances from entering the lungs. This innate protective system also prevents continued breathing, sometimes causing moments of panic. The same response causes problems for asthmatics, but for different physiologic and psychologic reasons.

Momentary panic, in turn, often causes an unconscious postural response that only worsens the problem. Gasping for air, most persons thrust the head forward, extending the neck in an exaggerated manner and bringing the larynx to a higher position in the throat. This higher laryngeal position forces the vocal folds into a tighter spastic closure, making breathing even more difficult. Fortunately, in most instances of normal choking, these spasms eventually subside, allowing normal breathing to return. As normal breathing returns, the head usually moves back from its exaggerated forward position.

To illustrate, several years ago, on an airplane flight, the senior author witnessed a female passenger choking while drinking liquid. The situation became critical enough that the stewardess asked, over the intercom, if a physician was on-board. No medical personnel responded, so he volunteered his assistance because the lady, several seats removed, was beginning to turn blue. He sat down beside her, and, taking her clenched fists in his hands, began speaking in a calm but commanding voice. Her head was thrust forward in extreme extension as she attempted to gasp air into her lungs. Telling her what he was going to do, he placed the palm of his right hand on her forehead and gently pushed her head back until her neck touched the headrest of the seat. He then asked her to put the palm of her hand over her gasping mouth and begin breathing through her nose. She did as requested and immediately her breathing returned to normal, with color gradually returning to her face as panic subsided. Her smile indicated that the crisis was over. One of the stewardesses later confided that she had seen medical personnel address this same problem on several occasions with much less effectiveness. Moving the choking passenger's head back to a more efficient alignment lowers the larynx, thus relaxing its constriction and allowing unrestricted breathing to resume. It should be pointed-out, however, that when the choking substance is something other than liquid, the standard Heimlich technique is still advised.

This experience illustrates how alteration of postural alignment affects laryngeal responsiveness. Physiologically, the body responds to the position of the head above the shoulders. This fact can be verified informally by observing the movements of the blind. The typical blind person moves with the head balanced so that the ears are directly above the shoulders. Deprived of visual input, most blind people find that this attitude is crucial for structural balance. The implication is that the entire body responds, not only psychosomatically (*i.e.*, mind and body), but visibly and audibly to how individuals

position and use their structures with respect to gravity.

In terms of body mechanics, "Posture is more fully defined in terms of body mechanics as the interrelationship between muscle and the skeletal tissue of the body" (2). As Bunch states, "For many years physiologists have shown that the position of the head on the neck is vital because it governs all postural reflexes. If the head is misaligned, other parts of the body move in and out of line to maintain balance and thus energy is expended to counteract the effects of gravity" (3).

Most people, because of poor posture, do not ventilate and oxygenate their bodies optimally. On the other hand, those persons standing straight and tall invariably exude vitality and project a commanding vocal presence. Even that elusive attribute enviably referred to as *charisma* may well be nothing more than a state of mind reflected in the postural, visual, and aural presence of those few individuals with properly-adjusted posture.

When postural efficiency is optimized, not only is breathing and vocal resonance maximized, but all other responsive functions of the human body-mind also improve. How one uses the body-mind instrument in relation to the invariable forces of gravity establishes the effectiveness of all psychosomatic human function and environmental interaction. Optimal oxygenation provides not only one means of minimizing undesirable tension throughout the body while maximizing one's potential for uninhibited vocal resonance, but also forms a neurophysiologic pathway to improved overall health and well-being.

Numerous authors have considered some aspects of posture, muscle, tension, and/or oxygenation. According to Freeman, shifts in centers of gravity or postural adjustments of aging lead to intestinal diverticula, hemorrhoids, varicosities of the legs, osteoporosis, hip and foot deformities, overall poorer health, and even shortened life span. He theorizes that carbon dioxide retention is partly responsible for many of these changes (4).

Korr concluded that long-term hyperactivity of the sympathetic system is harmful both to the body as a whole and specifically to individual organs affected by segmental "sympathicotonia," induced by spinal and paraspinal musculoskeletal dysfunction. Areas of focal sympathetic hyperactivity are correlated with musculoskeletal strain, and such areas can be produced experimentally by postural insults such as placing three-eighths inch lift under one foot (5).

Energetics of skeletal muscle, sensation, circulation, bone growth, fat deposits, immune function, hormonal functions, and even enzyme activity are all sympathetically influenced functions. The best known effect of sympathicotonia upon pain is reflex sympathetic dystrophy; but vasospasm and other trophic influences of a "facilitated" (hyper-excitable) neuronal pool affect sensation and muscle tension. Muscle tension throughout the body is modulated by sympathetic activity, which, in turn, is related to all aspects of posture. In summary, the focal stress of spinal misalignment leads to muscle tension, hyperesthesia, altered circulation, and a wide variety of visceral illnesses generally associated with stress (5).

Benson's extensive work with the "relaxation response"

has given us in-depth understanding of the physiologic benefits of reducing muscle tension. He reported, for instance, that deep relaxation practiced 20 minutes twice a day reduced catecholamine production by approximately 50% for the entire 24-hour period. Since most catecholamines are from the sympathetic chain, it is apparent that muscular relaxation assists in reducing excessive sympathetic activity (6).

Jacobson, 50 years earlier, had demonstrated that 80% of a wide variety of psychosomatic illnesses responded favorably to his technique of "progressive relaxation" (7). Neither Benson nor Jacobson emphasized the primacy of posture and breathing as the major determinants of muscle tension.

Reich included posture and respiration in his concepts of health. For instance, he believed that tension led to decreased blood flow and that this decrease in tissue oxygenation was a major factor in disease, including cancer (8). Funderburk has reported significant evidence of the influence of breathing upon sympathetic function, physiology, and catecholamine production, although he does not include posture as a major modulator of breathing (9).

At the Shealy Institute, clinicians have consistently observed striking postural abnormalities in virtually every patient with back pain, headache, or depression. The Institute clinicians' observations of postural abnormalities noted in 27 consecutive headache patients follow. There were 21 women age 18-69 and six men age 31-57. Eleven of the 26 patients had migraine. Sixteen had significant myofascial pain, often post-whiplash or post-cervical fusion. Twenty-six patients had various postural abnormalities, with only one migrainous patient exhibiting normal posture. The postural abnormalities noted included a wide variety of abnormalities—a total of 131 postural deviations in 26 patients. The most common were:

Compressed or flattened thoracic spine	20
Head forward	17
Increased lordosis	11
Kyphosis	9
Scoliosis	9
Rotated pelvis	9

Additionally, several patients exhibited rotation of head, shoulders, legs, and feet. Thus, postural abnormalities seem to contribute some degree of autonomic, myotonic, and sensory facilitation in most patients with headache; even modest improvements in posture often assist patients in achieving greater comfort. Optimizing posture and respiration should lead to even more striking improvement.

It seems logical that if postural habits influence vocal sound, they would also affect breathing. Vocal sound is, after all, the result of breath efficiency, and vocal science has long conceded that a lower larynx enhances vocal resonance. An early observation of our investigation was that individual postural habits determine the effectiveness of both functions. In essence, human vocal sound is the expression of energized breath. Improved postural habits provide greater awareness of conscious air exchange, resulting in better vocal sound as well as general homeostasis.

In the summer of 1990, the senior author conducted a three-week workshop at Emporia State University in Emporia,

Kansas, with eight volunteers from the Emporia community. The purpose was to produce physical evidence that posture influenced breath and vocal production. Each participant was evaluated individually, twice weekly in 90-minute sessions, by computer spectrograph sound wave analysis, together with an oximeter, a portable device that digitally monitors pulse and blood oxygenation. At the beginning of each session, the participant was asked to vocalize and sustain a predetermined pitch for five seconds while standing erect in normal posture. This vocalization was recorded by the computer for spectrographic analysis. The subject was then guided through an extended period of relaxation using a procedure termed *gravity-centered breathing*. The intent of this procedure is to relax the usual exaggeration of the secondary vertebral curves (cervical and lumbar) by having the subject lie on the floor, legs elevated, while consciously breathing as deeply as possible. Resting the legs, flexed at the knees, on a chair repositions the customary tilt of the pelvis, thus minimizing lower back curvature. Simultaneously, the head is elevated posteriorly and then retracted slightly to assist in flattening the curvature of the neck. At the conclusion of each session, another sound wave analysis was made with the participant still lying on the floor. The resulting spectrograph was considerably enhanced, in some cases almost unbelievably, when compared with the first. By the end of the third week, five of the participants had attained a breathing efficiency that provided them with 100% blood oxygenation (see Figures 1 and 2).

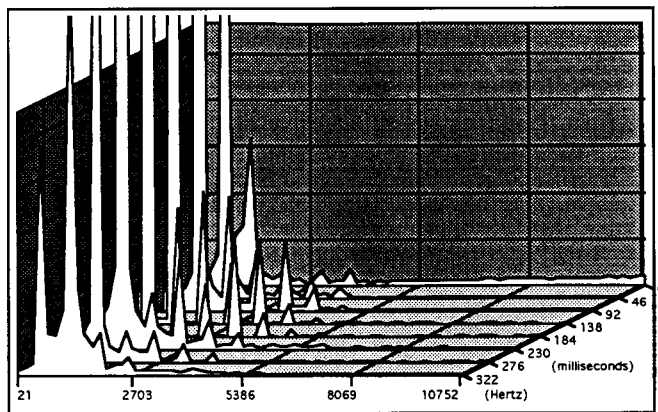


Figure 1. Subject R. spectrogram.

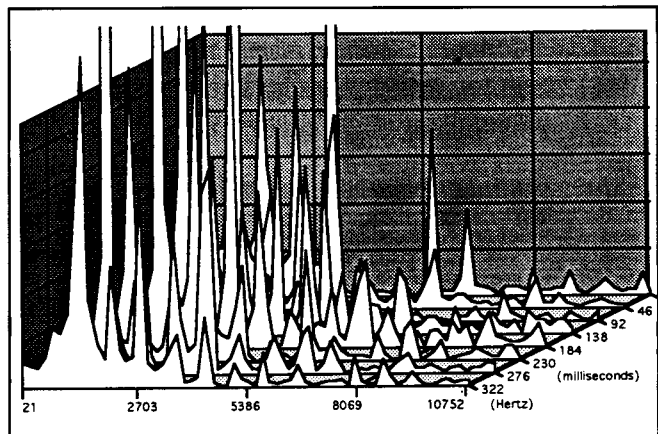


Figure 2. Subject R. spectrogram 1 week later.

This and other personal observations have led us to the conclusion that optimal posture and its accompanying improved respiration/oxygenation offer potentially powerful influences upon autonomic nervous system function. Numerous individuals have reported improvement in a variety of illnesses after practice of gravity-centered breathing. Back pain, headache, TMJ syndrome, depression, hypertension, asthma, anxiety—all stress illnesses—have responded favorably in non-controlled applications of gravity-centered breathing. Currently, we are extending our studies to investigate the influence of postural therapy upon chronic pain as well as catecholamines and other physiologic functions.

CONCLUSION

1. Posture affects all human function, both consciously and unconsciously, from breathing to thinking.
2. Because posture affects breathing, it also influences vocal sound. If sound is not optimally vocalized, the individual does not experience optimal vocal expression.
3. Posture reflects mind and body interaction. Inefficient postural and resultant poor breathing habits eventually lead, in extreme cases, to pathologic dysfunction.
4. Individuals in advanced stages of postural/breathing dysfunction often suffer from structural deviations so marked as to impede efficient air exchange and elicit a sympathetic

nervous system stress response, as well as increased musculoskeletal pain.

5. Maximally efficient breathing and posture open pathways to body-mind balance and improved well-being. The more effectively one breathes, the greater overall health.
6. Postural/respiratory balance and improved homeostasis can be taught through gravity-centered breathing.

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