A COMPARISON BETWEEN NORMALS AND MENTALLY RETARDED ON POSTURAL DEVIATIONS IN THE SPINAL COLUMN

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INTRODUCTION

An individual's posture in a large measure determines the impression he or she makes on other persons. Each person's posture can be an expression of inner thoughts, feelings or moods. Each person possesses not one but many postures. Any position is a posture and one individual assumes thousands of static and dynamic postures (Sherrill, 1981). Mastering efficient static and dynamic posture involves the correct employment of body mechanics. In most cases poor body mechanics is produced by a combination of two or more causes, such causes include medical problems like functional scoliosis and functional lordosis, postural disorders which can be corrected by remedial programs in physical education, and even poor body image and negative self concept as mentioned by Fait (1975). According to this author, achievement of good body mechanics is dependent upon good body image. A child who does not know how his body moves and what space it occupies as it moves cannot tell when he is utilizing good body mechanics, consequently he is likely to develop poor postural habits (Fait, 1975).

It was reported by Cratty (1980) that retarded adults and children have poor body images, and when compared with their normal counterparts, are found to be inferior on measures of self concept. Misconceptions by retarded children or adults about their body image may exist. Some retarded individuals feel comfortable with their body image even though abnormalities such as scoliosis and lordosis exist and are quite visible (Cratty, 1980). Self concept does have an influence on good or poor body posture. It was stated by Cratty (1980) that self concept guides and regulates a person's performance and action in reference to his body alighment. There is no evidence to suggest that by improving self concept that posture will directly improve. However, Cratty (1980) reported that after successful movement experiences, measurable changes do occur in how high children and adults hold their head. There exists evidence to suggest that participation in physical activity programs may improve self concept and body image. Johnson (1968) investigated the effects of physical training on self attitude changes, and the results indicated significant changes in body attitude and attitude toward self. By those findings, it can be assumed that corrective physical education programs which instruct students to improve body image and body posture may indirectly improve self concept.

Physical educators and/or adapted physical educators should not ignore this relationship and the effects that poor posture will have upon the efficiency of the body. Because of the relationships among self concept, body image and body posture, this study will try to determine the incidence of posture deviations in the mentally retarded population, a group known to be inferior on measures of self concept and body image.

Statement of the Problem

This research was designed to compare normal and retarded groups on postural deviations of the spine.

The Hypotheses

The following hypotheses were tested at the .05 level of significance:

The first hypothesis: There is not a statistically significant difference on total body posture between the retarded and the normal groups.

The second hyposthesis: There is not a statistically significant difference on the score of five items, representing the spinal column posture, between the retarded and the normal groups.

Limitations

The research may be affected by the following limitations:

The first limitation: The first limitation is the number of subjects in each group.

The second limitation: The second limitation is that both groups were not selected randomly.

The third limitation: The third limitation is the absence of comprehensive normative data.

Delimitations

The research was deliminated to:

1. The group of retarded male and females from "Hearthstone Nursing Home" and to the retarded children from the "Exceptional Child Center" in Stillwater.
2. A volunteer group of normal males and females from Oklahoma State University and from public schools in Stillwater matched for age and gender with the mentally retarded group.

Assumptions

The following assumptions were made:

The first assumption: The first assumption is that the testing conditions and procedures were equal for all subjects during the New York Posture Test.

The second assumption: The second assumption is that the New York Posture rating test is valid and reliable.

Definitions of Terms

In order to understand the meaning of terms used in this study, the following definitions were classified as conceptual or functional. Conceptual definitions include those terms defined by authorities. Functional definitions include those terms which hold special meaning for this study.

Conceptual Definitions

The following were categorized as conceptual definitions:

1. Mental Retardation: The two percent of the population who have intelligence quotients less than two standard deviations below the mean (mean - 100 I.Q., S.D. = 16) (Kalakian and Eiches, 1982).
2. Normal Population: The 98 percent of the general population who have intelligence quotients that are not less than two standard deviations below the mean (mean = 100 I.Q., S.D. = 16) (Kalakian and Eiches, 1982).
3. Posture: The relative arrangement of the parts of the body (Crow, Auxter and Pyfer, 1981).

4. Body Mechanics: The alignment of the various segments of the body (Fait, 1975).
5. Center of Gravity: An abstract point in the body where the pull of gravity on one side is equal to the pull of gravity on the other side (Crow, Auxter and Pyfer, 1981).
6. Turberculosis: The turberculosis bacteria infection of the lungs or, less often, any organ or system in the body (Seaman and Depauw, 1972).
7. Arthritis: Inflamation of a joint that causes great pain in and around the joint (Rothenberg, 1975).
8. Clubfoot: A birth deformity in which the front portion of the food is deformed and turned inward (Rothenberg, 1975).
9. Kyphosis: An abnormal amount of flexion (convexity) in the upper dorsal or thoracic spine (Seaman and Depauw, 1972).
10. Lordosis: An exaggeration of the normal posterior concave curve of the spine in the lumbar region (Hauser, 1962).
11. Scoliosis: A complex deformity of the spine in which rotation of the vertebrae about the longitudinal axis is usually associated with lateral curvature of the spine (Roaf, 1971).
12. Functional Scoliosis: A transitional curvature of the spine occurring in the soft tissues which tends to disappear to some degree when a hanging or prone position is assumed (Kalakian and Eiches, 1972).
13. Structural Scoliosis: A resistant curvature of the spine progressing from a functional scoliosis and accompanied by a permanent deformity of the vertebrae (Moore and Moore, 1977).
14. Congenital Scoliosis: An abnormality and deformity of the

spine which is present at birth (Patrick, 1981).

15. Idiopatic Scoliosis: An abnormality of the spine in which the etiology of the abnormality is unknown (Patrick, 1981).

Functional Definitions

1. Self Concept: An attitude that one has about himself (Shneerson, 1978).
2. Body Image: The perception of the body as derived from external and internal sensations (Daniels and Davies, 1965).

CHAPTER II

SELECTED REVIEW OF RELATED LITERATURE

The review of the literature in this chapter consists of seven sections. The sections are: (a) body posture characteristics, (b) standing posture characteristics, (c) factors related to good posture, (d) values of good posture and body mechanics, (e) causes of poor posture, (f) posture deviations in the spinal column, (g) assessment techniques for body posture, and (h) relationship between body image and posture.

Body Posture Characteristics

Posture is the relative arrangement of the body segments such as the head, trunk, pelvis and lower limbs. When they are in proper muscular and skeletal balance, they enable the body to be used in the most effective way with the least amount of strain placed on its supporting structures (Crow, Auxter and Pyber, 1981). Good body alignment, good balance and ease of stance give a feeling of alertness and readiness for movement. This coordination of movements among the body segments should be noticeable as mentioned by Clarke and Clarke (1963). Mastering efficient static and dynamic posture involves the correct employment of body mechanics (Fait, 1975) which helps individuals keep their bodies in proper balance with as small an expenditure of energy as possible and with the minimum amount of strain (Hansson, 1972).

Poor posture results from a faulty relationship between the various parts of the body which produce increased strain on the supporting structures, and in which there is less efficient balance of the body over its base of support (Crow, Auxter and Pyfer, 1981).

Standing Posture Characteristics

When in good standing posture, the body is erect, poised and balanced but not tense. The poise of the body should be such to provide conditions of efficient balance while permitting favorable functioning of the internal organs (Daniels and Davies, 1965).

Proper posture includes the feet approximately parallel and about two or four inches apart or with one foot slightly in advance of the other. The toes should point straight ahead. The feet should be so placed as to support the body weight with least strain. The weight of the body should be equally distributed and carried toward the feet along the lateral side of the bottom of the foot and across the total ball of the foot with the assistance of the five toes. Therefore, the strain is primarily placed on the outer bony structures rather than on the ligaments of the longitudinal arches (Cureton and Wickness, 1935). The legs should be straight, but not stiff. The pattelas of the knees will point straight ahead. The thighs will be in midposition of inward and outward rotation. The knees should be in easy extension with the quadriceps femoris muscles in slight contraction. The pelvis should be balanced over the top of the legs with the lower abdomen kept flat and with a normal amount of anteroposterior curvature (Phelps, Robert and Goff, 1956). Normally, the upper back should also have a shallow amount of anteroposterior curvature extending through the cervical spine to the head balancing thereon. The shoulders should be held level and comfortably balanced. The head should be erect with the chin in and the lobe of the ear directly over the center of the tip of the shoulders. This position is accomplished by pushing the back of the head up so that the acromion is on the straight gravitional. The chest should be held high, but not stiff and the arms hang comfortably at the sides (Cureton and Wickness, 1935).

Looking at the individual from the front or rear views the pelvis should be level, the shoulders level, the spine straight and the head above the shoulders (Phelps, Robert and Goff, 1956).

Factors Related to Good Posture

The following factors will be considered as related to good posture: the spinal column, the pelvis and the body center of gravity.

The spinal column supports the body skeleton, absorbs shocks, defies gravity, conserves energy and permits locomotion and purposeful movement. Antigravity support and movement flexibility are also demanded of the vertebral column (Cailliet, 1974). At birth, the entire spinal column of the infant is flexed in a single C-shaped curve. Only when the extensor muscles of the neck and back are sufficiently stretched by random kicking and wiggling do the cervical and lumbar curves develop. This occurs about four to five months of age while the lumbar curve begins to develop sometime after the child learns to walk. Toddlers and young children with disabilities which prevent the upright locomotion characteristically have flat backs. This condition is normal during the months when the child is gaining confidence in walking and running activities. If a flat back persists beyond the toddler stage, it is considered a postural deviation (Sherrill, 1981).

The normal preschool child tends to develop an exaggerated lumbar curve which may persist through grade school. This condition is caused by imbalance in the strength of abdominal muscles and the hip flexors. Normally the abdominal musculature of the preschool child maintains the pelvis in a natural position (Hansson, 1972).

In the adult four curves are readily discernible in the spinal column when viewed from the side: (1) cervical spine - at the neck, comprised of seven vertebrae, (2) thoracic spine - at the upper back, comprised of twelve vertebrae, (3) lumbar spine - at the lower back, comprised of five vertebrae, (4) sacral spine - at the sacrum, comprised of five vertebrae (Rasch and Burke, 1975). When one or more of the spine's natural curves is increased or decreased, changes will often occur which compensate for the imbalance, which if left unattended for several years will become permanent defects (Thompson, 1977).

The importance of the function of the pelvis is in maintaining the ideal erect posture. It is one of the most important structural units of the body because it supports the body weight from above and conveys it to the legs (Thompson, 1977). The normal pelvis is inclined forward and downward at approximately a 60 degree angle. This can be seen by locating the lumbosacral joint and the symphsis pubis and drawing an imaginary line connecting these two segments. Any variation in this angle through pelvic tilt downward and forward usually results in a greater curve of the spine (Crow, Auxter and Pyfer, 1981).

The sacroiliac joint is basically an immobile portion of the spine. Because it joined to the flexible mobile portion, deviations from its normal position have an affect upon the full length of the spinal column.

Only a minimal amount of motion takes place at the lumbosacral joint because of the pelvic inclination and because the lumbar or spinal curves are closely linked (Thompson, 1977).

The center of gravity of the human body falls in front of the sacrum, at a point approximately 54 to 56 percent of the individual's height when standing (Crow, Auxter and Pyfer, 1981). The center of gravity is changed any time the body or its segments change position (Adams, 1972). In the upright position the human body is relatively unstable. Its base of support, the feet, is small; its center of gravity is high; and it consists of a number of bony segments superimposed on one another. These bony segments are bound together by ligaments and by joints. Any time the body assumes a static or dynamic posture, these muscles and ligaments must act on the body levers to offset the continuous downward pull of gravity (Wells and Luttgens, 1976).

The human body can be balanced only when the gravity line falls in certain segments of the body. From a lateral view and starting at the base of support, the feet, the gravity line should fall at a point about 1 to 1½ inches anterior to the external malleolus. It extends just posterior to the patella and continues through the center of the hip, approximately at the center of the greater trochanter of the femur. Further, the gravity line falls in the spinal column anterior to the lumbar and the throacic sections of the spinal column, through the center of the shoulder and through the lobe of the ear (Adams, 1972). Because the gravity line is usually located anterior to the spinal column and anterior to the malleolus, the body tends to fall forward. But the body segments are maintained in a proper well balanced alignment by the proper use of antigravity muscles (Crow, Auxter and Pyfer, 1981).

Whenever the gravity line of the body falls within its base of support, the better will be the equilibrium of body segments. This has important implication for the individual both in terms of good posture, and as it relates to good balance for body movement. The body is kept well balanced for activities in which stability is important, where it may be purposely thrown out of equilibrium when movement is desired, speed is to be increased, or force is to be extended on an object (Rasch and Burke, 1975).

As the human being matures, balance for both static and dynamic positions becomes more automatic. An individual develops a feel for a correct position in space, so that little or no conscious effort is needed to regulate body position, and attention can be devoted to other factors involved with movement patterns (Adams, 1972).

Values of Good Posture and Good Body Mechanics

Good posture might be defined as a position that enables the body to function to the best advantage with regard to work, health and appearance (Morrison and Chenoweth, 1955). It is believed that optimum growth and development in the young is favorably affected by good mechanics. In the presence of good muscle tone, proper alignment of the body segments permits good support of the vital organs of the body and a full supply of blood to these same organs. General health and physical efficiency are favorably affected and defects are prevented when these conditions are obtained (Fait, 1975). Fatigue and tissue injury due to poor body mechanics may cause further structural malalignment and possibly lead to chronic conditions (Daniels and Davies, 1965).

Also, although this popular belief is unsupported by scientific evidence, aside from its health value, good body mechanics has a social value. Good posture adds to the attractiveness of the appearance and suggests a state of well being, as contrasted with the suggestion of laziness and poor physical vitality of a slumping posture (Fait, 1975). Similarly, posture may have a statistical, but not causal relationship to many components of a child's physical and emotional makeup. In a study published by Moriarity and Irwin (1952) a number of physical and emotional variables were compared in 57 intermediate grade girls. Girls with good posture were found to be freer from disease, heart defects and hearing defects, and were less selfconscious, less restless and less underweight than those with poor posture (Moriarity and Irwin, 1952).

Causes of Poor Posture

There are many causes of poor posture and poor body mechanics. Any one of the following causes may have an adverse effect on the posture of the growing child, the adolescent or the adult.

Environmental factors that may cause poor posture include such things as improper shoes and clothing that do not fit the growing youngster properly as well as over fatigure and over work, especially with the growing child and adolescent. Also of concern are improper seating and sleeping postures including short or sagging beds. Additionally, unilateral use of any type of toy that causes asymmetrical postural development is considered to be a harmful environmental factor (Fait, 1975).

Personal factors that may lead to postural deviations include such things as egotism, shyness, modesty, low self concept, hypersensitiveness and depression (Crow, Auxter and Pyfer, 1981).

Pathological conditions too often lead to both functional and structural deviations. Included are faulty vision and hearing; various cardiovascular conditions; turberculosis; arthritis and neuromuscular conditions resulting in atrophy, dystrophy and spasticity (Sherril, 1981).

Growth handicaps can also cause postural problems and this includes some of the following types of conditions: weaknesses in the skeletal structure and in the muscular system; growth divergencies of various sorts, and fatigue and flandular malfunctions. Also, nutritional problems such as underweight, overweight and poor nutrition are problematic areas (Fait, 1975).

Posture Deviations in the Spinal Column

Kyphosis translated literally means a sharp angulation. Increasing backward convexity in the thoracic region results in the condition commonly known as hampback, or round upper back (Phelps, Robert and Goff, 1956). Kyphosis is also an abnormal amount of flexion in the dorsal or thoracic spine. This condition ordinarily involves a weakening and stretching of the extensor of the spine and other extensor muscles in the dorsal or thoracic regions. It involves weak trapezius muscles along with a shortening and tightening of their antagonists, the pectoralis muscles on the anterior side of the chest and the shoulder girdle (Daniels and Davies, 1965). Round shoulders, forward head and winged scapulae often accompany this condition. Kyphosis should not be confused with round shoulders which may be found without any spinal variation (Hauster, 1962). True kyphosis is associated with disease of the intervertebral disks of the epiphyseal area of the vertebra. Internally, the disk is fibrocartilage padding between vertebral bodies, and the disk is comprised of two parts: the outer annulus fibrosus known for its strength and elasticity, and the inner nucleus pulposus, which contains fluid that absorbs shocks in locomotor movements and maintains the separation of the vertebral bodies. When the curve in the dorsal region of the spine is excessive, after a period of time, the anterior portions of the vertebrae tend to become wedge-shaped. When this occurs, complete correction is not possible through exercise after full growth has been attained. In this condition the extensors of the upper back become stretched, and the muscles across the chest become shortened and thickened (Sherrill, 1981).

Other causes of kyphosis are associated with a lack of muscle tonus due to fatigue, faulty nutrition or faulty habitual position. Tall girls who are conscious of their height and slump to be less noticeable sometimes develop kyphosis (Daniels and Davies, 1965). Severely and profoundly retarded individuals whose mobility is limited often exhibit kyphosis at a young age (Davies, 1956).

Another postural defect is lordosis, a posture deformity in the lumbar region of the spine and known as sway or hollow back (Hauser, 1962). The exaggerated concave curve results in a forward and downward tilt of the pelvis. Weak abdominals, gluteals and hamstring muscles, tight muscles such as the lumbar extensors, lower erector spinae, rectus femoris and hip flexors contribute to pelvic tilting and possible hyper-extention of the knees (Klein, 1973). When this position in which muscles are elongated is assumed habitually, too much weight is thrown on the posterior edges of the bodies of the lumbar vertebrae, and there is a marked tendency to develop abducted scapulae in compensation for the backward shifting of the body weight (Rathbone and Rathbone, 1959).

The possible causes of lordosis are many and varied. Genetic predisposition is always a potential cause. Weak abdominal muscles can cause problems through poor muscle tonus in the abdominal wall that permits increased forward tilt of the pelvis with the resulting increase in the lumbar curve. Another cause stems from imbalance between the abdominal muscles and tight hip flexors that pull the pelvis down in the front and tight lumbar extensors that pull the pelvis in back (Whith, 1971). Finally, muscular immaturity may also result in spinal problems (Klein, 1973).

In true lordosis the following characteristics will probably be present: anterior tilt of the pelvis and tight lower back muscles, tight abdominal fascia, tight hip flexors, weak abdominals, and weak hamstring and gluteals (Crow, Auxter and Pyfer, 1981). Lordosis is usually accompanied by a number of other compensatory deviations such as round upper back, round shoulders and forward head (Clark and Clark, 1963). The upper body tends to shift backwards as a compensatory measure. This shifts the weight of the body from the vertebral bodies onto the neural arches bringing the spinous process closer together than normal. This sometimes results in pinching nerves and can cause lower back pains. Increased incidence of back strain and back injuries also characterize lordosis (Hauser, 1962). In most cases, lordosis is correctable through therapeutic exercise and counterbalancing activities that promote muscle strengthening and shortening or muscle stretching (Seaman and Depauw, 1972).

Scoliosis is another spinal deviation, defined as a complex deformity in which rotation of the vertebrae about the longitudinal axis is usually associated with lateral curvature of the spine (Seaman and

Depauw, 1972). Although the condition begins with a single curve, it usually consists of a primary curve and a compensatory curve in the opposite direction (Roaf, 1971). The condition may be either congenital or acquired in early childhood. It can arrest itself without treatment, but usually it becomes progressively debilitating. Scoliosis is the most serious and complex of the common posture deviations (Roaf, 1971).

There is a distinction between the two kinds of scoliosis: scoliosis C and scoliosis S. Scoliosis usually begins and is described in its early stages as C-curvatures. The C-curvature occurs between the last cervical vertebra (C-7) and the last lumbar vertebra (L-5) and first sacral vertebra (S-1) (Patrick, 1981). The C-curvature may be to either side, but since most people are right-handed, the muscles on the right side of the body are generally stronger, and the convexity tends to develop to the left (Grant, 1962). A C-curvature may also tilt the head sideways, in which case there is a reflex tendency to right the head to a point where the eyes are again level (Roaf, 1971). The condition tends to be more prevalent in girls and among ectomorphic types, but it is not confined to either (Riddle and Roaf, 1955).

Scoliosis in its later stages is known as S-curvature. Over a period of time the righting reflexes create a reversal of the C-curve at the upper spinal level thus producing an S-curve. Further attempts at compensations may appear which create additional undulations in the curve (Arkin, 1950).

The lateral curves can also be classified as functional-transitional and as structural. The functional-transitional curve is one in which the body tissues are still pliable, and the involved muscles are still flexible so the curvature occurs in the soft tissues (Patrick, 1981).

Usually this curve is caused by growth faults, abnormal postural positions, or over strengthening of back muscles (Kalakian and Eiches, 1982). The functional curves usually disappear when the effect of gravity on the posture is eliminated. This condition is correctable through properly assigned stretching and developmental exercise under the guidance of a physician. Untreated spines will often become progressively worse and result in permanent changes (Crow, Auxter and Pyfer, 1981).

In the later stages the functional scoliosis becomes resistant or structural. This term indicates a deformity of the vertebrae. The curve is a permanent one and cannot be remedied. Many physicians classify all S-curves as structural, regardless of the degree of flexibility which they present (Moore and Moore, 1977). Structural deviations are usually found in children with birth defects or bone disease; however, in most cases the etiology is unknown. These cases are termed idiopatic, and the condition predominately occurs in adolescent females. The ratio is approximately 6:1 in favor of the females (Patrick, 1981). Over several years functional scoliosis can result in permanent changes and can become a structural deviation (Kalakian and Eiches, 1982).

Physicians classify the severity of the curve in terms of the number of degrees which the major or primary curve deviates from normal. A mild scoliosis is marked by a deviation of 15-30 degrees of the major or ordinary curve from the normal. A moderate scoliosis results in a deviation of 35-75 degrees and severe scoliosis is represented by deviation of 75-150 degrees (Cratty, 1980). A number of medical interventions are used to correct these deviations, including bracing techniques such as a cast with a turnbuckle that may be gradually adjusted (Cratty, 1980).

The possible causes of scoliosis are many and varied. Hereditary defects in structure are always a potential cause. Deterioration of vertebrae, ligaments or muscles as a result of infection or disease can also cause the deviation. Another cause stems from ligamentous, muscular and bony forces acting on the vertebrae in an abnormal manner (Arkin, 1950). Also, unilateral conditions may cause scoliosis. Such conditions inclue: unilateral flat foot or pronation; unilateral short legs; and unilateral paralysis of spinal muscles. Another muscular cause is an imbalance of muscular development as the result of occupation or habit. Another structural-cause is pelvis tilt. It sometimes happens that one side of the pelvis is higher than the other. This may be caused by inequality in the length of the legs, a flat foot or by muscular atrophy of one side of the legs (Cureton and Wickness, 1955). There is a strong correlation between scoliosis and the lateral tilting of the pelvis seen in a child with one short leg. When the pelvis is tilted, the sacrum also tilts and the spinal column curves (Kalakian and Eiches, 1982). Also, there are congenital factors that cause the deformity, in which the deformity is present at birth. In most cases the etiology is unknown. In such situations the scoliosis is termed as Idiopatic Scoliosis (Patrick, 1981). While extensive research has advanced many different hypotheses of the cause of Idiopatic scoliosis, the pathogenesis of the disease remains unknown. Nelson and Macewen (1970) concluded that Idiopatic scoliosis is a familial condition with multiple-gene inheritance. Muscle imbalance has also been investigated as a potential cause of Idiopatic scoliosis. Electromyographic studies have reported increased muscle activity on the convex side of the curve (Fidler, 1976). Seemingly incompatible findings were stated in another investigation done by Hoogmartens and Basmajian (1976). Their results from vibration electromyograms induced in deep spinal muscles indicated a hypersensitivity of the muscle spindle system on the concave side of the curve (Hoogmartens and Basmajian, 1976). Much of the current research in Idiopatic scoliosis has been focused on the possible involvement of the neurological factor. A high incidence of scoliosis is present in diseases involving various levels of the nervous system (Jip, 1976). Perhaps the most familiar example is the scoliosis associated with lesions in the spinal cord, that is, a change in tissue structure due to disease. Also, about 80 percent of children with Friedrich's Ataxia resulting from cerebellar degeneration (Robin, 1975), and 20 percent of cerebral palsy patients develop scoliosis (Macewen, 1972).

Therefore, the complex interaction of factors upon scoliosis is apparent, however, none of these factors alone can be solely responsible for initiating the lateral curvature. They all probably contribute in some manner to the progression of the deformity once the condition has started (Jip, 1976).

Scoliosis is accompanied by observable characteristics and postural adjustments. The spinous processes deviate from midline, rotating toward the concavity of the curve. This condition creates compensatory shifts in the height of the shoulders, and depending upon the degree of the deviation, the head sometimes tilts in a direction opposite from that of the shoulders (Clarke and Clarke, 1963). In addition to these shifts, a lateral displacement of the trunk often occurs toward the side of the convexity, since the thorax is no longer balanced directly over the pelvis (Robin, 1975). Usually, if unlevel height of legs is the cause for scoliosis, then one hip is usually higher than the other and also a lateral pelvic tilt occurs (Fidler, 1976). Also, muscles on the concave side become increasingly tight while those on the convex side are stretched and weakened (Sherril, 1981). Posteriorly, the ribs usually bulge out on the convex side of the curve, and the rib cage tends to lose its flexibility (Jip, 1976). Also, side bending tends to be freer to the concave side than to the convex, and forward flexibility of the spine may be limited as a natural protection mechanism of the body against further deformity (Patrick, 1981).

Assessment Techniques for Body Posture

The measurement of body alignment or posture is made difficult by the fact that there is little agreement on what specifically constitutes good posture. Some of the earliest attempts to assess posture by Bancroft (1913) and others (Crampton, 1925) relied on the subjective judgment of the examiner in determining deviations from normal. Typically assessment involved the use of a pole or a plumb line to decide whether or not the body segments were aligned properly. Since the definition of proper alignment of the body segment was not necessarily consistent among examiners, these tests were not very objective (Mood, 1980).

In an effort to improve on posture measurement, several attempts were made in the late 1920's and throughout the 1930's to construct common standards against which posture could be judged (Mood, 1980). Brownell (1928) judged rate silhouettes of ninth-grade boys and from this data developed a scale of thirteen silhouettes each having a numberical score ranging from 20 to 120. To use the scale the examiner compared a silhouette of the student being evaluated with each of the 13 standards, and the posture grade was obtained by averaging the scores (Mood, 1980). Christenson (1933) reported a technique for superimposing a photograph of the student on the standards devised by Brownell (1928) and provided evidence that this procedure increased evaluation consistency.

Using methods similar to those of Brownell (1928), Crook (1936) devised a series of 13 silhouettes to be used to evaluate the posture of preschool children. Other techniques, such as Habbard's use of shadow-silhouettes (Habbard, 1935) and Korb's comparograph, were introduced in the late 1930's to improve the objectivity and reliability of the use of silhouettes (Korb, 1939). The shadow-silhouettes were proposed as an improvement becuase they depict some characteristics, such as muscular development, the direction of the spine and the difference in the height of the shoulder blades which were not visible in the silhouettes. Korb's comparograph involved photographing the subject in front of a curtain on which had been painted the outline of a normative posture developed from 2,200 subjects (Mood, 1980).

Even with the introduction of the silhouettes and the attemps to improve on their use, several investigators were disturbed by the lack of consistency in posture evaluation. The result of this uneasiness was the development of several relatively objective posture tests generally involving photographing subjects to obtain measurements of angles and distances and converting these measurements to a posture grade (Mood, 1980).

The Wellesely posture test uses 11 aluminum pointers placed on specific anatomical landmarks prior to photographing students. From the resulting print three measurements are obtained: (1) the amount of anteroposterior curvature in the dorsal and lumbar spine, (2) the amount of segmental angulation and body tilt, and (3) the position of the head and neck. These measurements are weighted and summed resulting in a posture grade from one of the 15 categories encompassed by the labels from A+ to E-. Eight judges and photographs of 853 college-age women were used to establish the norm values. The norms, directions for preparing the student for the photograph, directions for obtaining the required information from the photograph, and explanations of how the validity, objectivity, and reliability of the test were examined are explained in the reference (Macewan and Howe, 1932).

The Cureton-Gunby conformator is another such test. In a study investigating the precision of various methods of measuring posture, Cureton and others (1935) found the use of two devices, the spinograph and the conformater, to be more accurate than the use of the silhouettes. The spinograph is an instrument that yields a tracing of the curvature of the spine. The conformater is basically a vertical post through which movable rods extend horizontally. With the back of the subject facing the post, the rods are moved so that each one contracts a vertebra. When the rods are so located they are locked in place (Cureton, 1935).

The Yale posture rate uses six specific anatomical landmarks. The marks are placed with a flesh pencil. Also, aluminum marks are placed on these six spots prior to the subject being photographed. On the resulting print, several lines are drawn and various angles are examined to obtain measurements of the head, kyphosis, lordosis, the chest, the abdomen, the shoulders, the trunk, the hips, and the knees. Complete directions for measuring these angles and reports on the validity of the method are given by Wickness and Kiphuth (1937). This test was later modified to include a photographic procedure using mirrors, making it possible to obtain front, back, side and top views of the student simultaneously (Meyers and Blesh, 1962).

The Massey posture test yielded 50 anthropometric measurements and used the conformater to obtain a silhouette for 200 males between the ages of 17 and 25. Through a process involving scaling, and measuring 40 angles and indices, and using three experts to establish a criterion, Massey (1943) calculated a regression equation requiring the measurement of just four angles: head and neck-trunk alignment; trunk-hip alignment; hip-thigh alignment; and thigh-leg alignment. Although the value resulting from substitution in the regression equation correlated .985 with the criterion score, the equation is seldom used since it was found that the mere sum of the four angles correlated .97 with the criterion score. Complete directions for preparing the photographs and measuring the required angles, as well as comparisons of other posture tests, are reported in the following reference (Mood, 1980).

The Howland alignometer was developed as an instrument for both teaching and measuring posture. It consists of two horizontal calibrated pointers attached to a vertical pole. The top adjustable pointer is placed at the center of the sternum, and the lower pointer is located at the superior border of the symphysis pubis. When these two landmarks line up vertically, the student is in a position of balanced trunk alignment. In this position the distance of both pointers from the vertical pole will be equal. If the two pointers are not extended the same distance to touch the two landmarks, improper alignment is indicated (Howland, 1953).

One of the obvious criticisms of most of the posture tests described thus far is that a student's true posture may not be revealed when he or she is standing to be evaluated or photographed. In an attempt to overcome this weakness, some tests have been devised to evaluate posture while the student is engaged in various activities such as walking, sitting, stooping down, and others. These tests, although usually involving much subjective judgment, generally utilize some type of rating sheet to increase objectivity (Mood, 1980).

For instance, the Iowa posture test can be administered to a group of 10 to 12 students at a time to examine foot mechanics (heel-toe walking, absence of pronation, and feet parallel), as well as posture while standing, walking, sitting, stooping, ascending and descending stairs. The various aspects are rated by the examiner as good, fair, or poor by assigning a 3, 2, or 1, respectively. The criteria for each of these ratings, as well as a suggested score sheet format, are given in the reference (McCloy and Young, 1954).

The Washington State College test is used as a posture screening exam to select those who require further examination. This test includes a subjective evaluation of the anteroposterior and lateral balance, the alignment of the feet and legs while the subject is standing, and the efficiency of the gait as viewed from the front, back and side. Directions for administering and scoring the test are reported in the following reference (Mathews, 1973).

The Functional body mechanics appraisal is used in a manner similar to that employed in the Iowa Posture Test. A checklist is used to evaluate posture while the child is standing and while performing some everyday activities. A score of excellent, good, fair or poor is recorded for various aspects of standing posture, lateral balance, sitting mechanics, walking posture, reaching mechanics, climbing and descending stairs, lifting mechanics, and skipping rope. Directions for efficient administering and scoring of the test are reported in the following reference (Mathews, 1973).

Functional tests, characterized by rating posture while the student is engaged in everyday activities, in some way reverts back to the problem of imposing the examiner's subjective standards on the measurement. The New York test prevents that problem of subjective standards as stated by Mood (1980).

The New York posture test evaluates lateral and anteroposterior posture. The procedure is an objective type of evaluation which uses the New York Posture Rating chart. The student takes a standing position between a plumb line and a posture grid with his back toward the plumb line and his feet straddling a line. The examiner assumes his position about 10 feet directly to the rear of the student being tested. After the student has been rated for the lateral position, he assumes the anteroposterior position for rating by making a one-quarter turn to the left and stands comfortably and naturally with his left side to the plumb line. The examiner, using the Posture Rating Chart, rates each student by scoring him in each of the 13 segments representing the body posture. Each segment is scored, 5, 3, or 1 according to the illustrations and descriptions. These 13 scores are summed with a possible low of 13 and a high of 65. A single item score of one or a composite socre of 39 or below would be indicative of posture deviation (Barrow and McGee, 1973). (See Appendix.)

The Relationship Between Body Image and Posture

Retarded adults and children are found to have poor body images when compared with their normal counterparts (Cratty, 1980). The following review discusses the relationship between body image and posture. The relationship might give further understanding about why the rate of posture deviations in the mentally retarded population could be higher than in the normal population.

Fait (1975) stated that achievement of graceful posture involves good body mechanics. Achievement of good body mechanics is dependent upon good body image (Fait, 1975). By improving body image, the individual develops an awareness of the positions the body occupies in space and how the body moves in the environment to occupy new space. Developing this awareness is prerequisite to the most efficient use of the muscles to ensure the most efficient alignment for the position desired. Such awareness requires the development of a kinesthetic sense which refers to the individual knowing where certain parts of the body are in relation to other parts, thereby affecting coordination and space perception (Fait, 1975). The child's proprioception must be developed to maintain static and dynamic balance. Therefore, body awareness is an important initial step in becoming aware of the environment. Body awareness must be established before establishing laterality and directionality (Kalakian and Eiches, 1982). Laterality is the proprioceptive awareness of right and left. The upright posture demands an internal awareness of right and left in order to maintain balance against the pull of gravity (Sherrill, 1972). Directionality is the proprioceptive awareness of the body in space and includes sensory perception of up, down, forward, backward, sideward and other directional dimensions (Cratty, 1980).

General physical education programs that are designed to improve body posture, usually emphasize the use of kinesthetic sense modalities. These programs include such activities as body awareness, body image and body alignment activities in front of mirrors (Sherrill, 1980). Awareness through body image is developed in students by helping them to assume positions of efficient posture, and noting how the body segments relate to achieve each position. Practice is afforded by specific corrective exercises, which subsequently become more meaningful to the students because of their awareness of how the body must move in order to achieve efficient posture (Fait, 1975).

Summary

The review of literature revealed information about body posture and its relation to body image. Posture is the relative arrangement of the body segments, and mastering efficient static and dynamic posture involves the correct employment of body mechanics. Such mechanics help individuals keep their bodies in proper balance using as little expenditure of energy as possible with a minimum amount of strain. When good standing posture is evidence the body is erect, poised and balanced but not tense. The spinal column, the pelvis and the body center of gravity are the most important factors in maintaining the erect posture. The human body can be balanced if its gravity line falls within the body base of support. This has important implications for the individual both in terms of good posture and as it relates to good balance for body movement. Good body posture and good body mechanics have favorable effects on growth and development, general health and physical efficiency and it also has redeeming social value. A graceful posture adds to the attractiveness of the appearance and suggests a state of well being. Poor posture may result because of environmental factors such as improper clothing or shoes, or personal factors such as egotism, shyness and low self concept. Also, pathological conditions, growth handicaps or nutritional problems may lead to postural deviations. Common posture deviations in the spinal column include: kyphosis, an increasing backward convexity in the thoracic region; Lordosis, a postural deformity in the lumbar region of the spine; and Scoliosis, a postural deformity in which rotation of the vertebrae about the longitudinal axis is usually associated with lateran curvature of the spine. There is a distinction between C-scoliosis, S-scoliosis, and also between functional and structural scoliosis according to the degree of the deviation. An issue identified in the literature was the objectivity of assessment techniques of body posture. In an effort to improve on posture measurement several techniques such as silhouettes, the Wellesley posture test, the Cureton-Gunby conformators and other tests have been developed. Achievement of efficient and graceful posture involves good body mechanics as well as good body image. By improving body image, the individual develops body awareness which refers to the individual knowing where certain parts of the body are in relation to other body parts. Such development can positively affect coordination and space perception. Retarded adults and children are found to have poor body images when compared with their normal counterparts. That foundation, in relation to the importance of body image for good body posture, may have implications for the retarded adult's posture.

CHAPTER III

METHODS AND PROCEDURES

The procedures that were in this study are described in terms of: a) the selection of subjects, b) operational procedures, c) research design, and d) statistical analysis.

Selection of Subjects

The author had contacted the Activities Director of "Hearthstone Nursing Home" which is located in Stillwater, Oklahoma, and the parents of the children from the "Exceptional Child Center" to obtain permission for the students and children to participate in this study as subjects for the retarded group. The males and females which represented the normal sample were students and faculty volunteers from Oklahoma State University and children from public schools from Stillwater, Oklahoma who match the retarded subjects on age and gender. The normal subjects were considered matched on age if their birthdate was within two months on either of the retarded subject's birthdate.

Operational Procedures

The two groups were administered the New York Posture Rating Test with modification by Adams, Daniel and Rullman (1958). The purpose of this test is to evaluate lateral and anteroposterior posture under standard instructions (Barrow and McGee, 1979). The test was administered individually, in a 7½' x 8' room which was prepared prior to the subject's arrival. The apparatus that was used was a standard posture grid of two-inch squares on the wall. The vertical lines were at right angles to the horizontal lines and extended all the way to the floor. These lines provided reference points for ascertaining the correct alignment of the body parts. Footprints were printed on the floor in front of the grid to facilitate correct standing position. A plumb line was hung in front of the posture grid with the bob almost touching the floor and was used as a vertical reference point to check the alignment of the midline or the line of gravity of the body (Sherrill, 1981). A straight line was made on the floor with masking tape extended away from the bob to a point three feet inside the bob (Barrow and McGee, 1979).

The test was administered individually at one sitting. Male subjects were barefoot wearing swimming trunks or shorts, and female subjects wore pants and bra or a two-piece swimming suit. Long hair was pulled back to reveal the ear lobe. The subject's back was bare with a black dot placed on each spinour process while in the standing position as recommended by Sherrill (1981). For the examination each subject assumed a comfortable natural standing position between the plumb line and the posture grid with her/his back toward the plumb line and feet were straddling the line. The testor assumed a position about seven feet to the rear of the subject being tested. After the subject was rated for the lateral position, he/she assumed the anteroposterior position. The subjects assumed this position by making a one-quarter turn to the left and standing comfortably and naturally. The left side was to the plumb line, the feet at right angles to the floor line, and the left ankle in line with the plumb bob. The testor used the posture rating chart and rated each subject according to the illustrations and descriptions (Barrow and McGee, 1979).

Standard Instructions

The following standard instructions were used for each subject: "Take your position with your feet comfortably apart and straddle the end line with your back just in front of the plumb line, facing the grid." The subject then stood between the posture grid and the plumb line facing the grid. "Stand comfortably and naturally in a relaxed manner." The testor then checked to see if the subject assumed a comfortable and natural standing posture or a stiff, strained and/or unnatural standing posture. If the subject stood with strain, the testor waited until the subject adjusted to the test situation. "On the signal 'turn', you are to make a one-quarter turn toward your left with your feet at right angles to the floor line and your left ankle bone in line with the plumb bob." The subject then made a one-quarter turn toward his/her left, and the testor checked to see if the subject was placed correctly. "Stand comfortably and naturally in the same manner as before" (Barrow and McGee, 1979).

In order to facilitate understanding of the instructions by the mentally retarded group, instructions and demonstrations were used for each of the mentally retarded subjects.

Research Design

A comparative survey approach was used to compare the postural deviations of the normal and the retarded groups (Fox, 1969). The two groups were administered the New York Posture Rating Test (Adams, Daniel and Rullman, 1982). There are 13 items in the test and each item is cored on a 5-3-1 basis. This score is based on written criteria which accompanied the test. The maximum score obtained by this procedure is 65. A single item score of one or composite score of 39 or below is indicative of posture problems (Adams, Daniel and Rullman, 1982).

The validity of the New York Posture Rating Test was established by cooperative efforts of the New York State Education Department, testing and research experts, physical education staff members and school district administrators (Meyer and Blesh, 1962). Validity was established by a logical validity technique (Barrow and McGee, 1973). Most posture measures are largely subjective, although many objective techniques do exist. However, when objective devices are employed, they are often based on subjective judgement. Such objective devices employ standards which in turn are based upon criteria. In the final analysis, these criteria revert to subjective judgement, as do all criteria since they are based on expert opinions (Barrow and McGee, 1979).

Meyers and Blesh (1962) reported that the norms of the New York Test are based on a single combined distribution for the 12,626 students tested. This sample included boys and girls from grades 4 to 12. Barrow and McGee (1979) reported that this method is a simple inspection measurement with the subjective approach but is objectified by means of the pictured standards shown on the Rating Chart. It is obvious that precise techniques for posture measurement are lacking precision in measurement but, as stated by Barrow and McGee (1973), this lack of precision in measurement does not preclude posture evaluation.

Statistical Analysis

The statistical technique used to determine if any significant difference existed between the two groups on the dependent variables was the t-test for uncorrelated samples. The alpha level for statistical significance was set at .05 (Terrace and Parker, 1971). The data analysis was done by using the t-test program from the statistical package for the social sciences (Nie et al., 1975). All analyses were done on the IBM 3081D computer at Oklahoma State University.

Total scores for each subject were calculated. These scores were a composite of the 13 items in the New York Posture Rating Test, representing the overall body posture. The t-test was used to compare the mean of the mentally retarded group to the mean of the normal group. Similarly, spine posture scores were calculated for each subject. These scores were a composite of the five items representing the spinal column. The t-test was used to compare the mean of the retarded group to the mean of the normal group.

CHAPTER IV

RESULTS AND DISCUSSION

The problem in this study was to examine the difference between the retarded subjects and the normal subjects on overall body posture and, also, to examine the difference between the two groups on spinal column deviations. Thirty retarded and 30 normal people served as subjects in the study and were administered the New York Posture Rating Test individually. This chapter presents a statistical analysis of the data.

Results

The mean and the standard deviation for the scores of the selected variables were computed. The results of the calculated mean and standard deviation of the total scores for the two groups are presented in Table I.

TABLE I

t-TEST COMPARISON BETWEEN RETARDED AND NORMAL GROUPS ON TOTAL SCORES

Group	N	MEAN	SD	t
RETARDED	30	33.3	±7.36	12.25*
NORMAL	30	51.9	±3.81	

*significant at .001 level

These results indicated that the mean of the total scores in the retarded group was equal to 33.3, and in the normal group it was equal to 51.9. The variability in the normal group was substantially lower than that of the retarded group considering the total score.

The results of the calculated mean and standard deviation of the spinal scores for both groups are represented in Table II.

TABLE II

t-TEST COMPARISON BETWEEN RETARDED AND NORMAL GROUPS ON SPINE SCORES

GROUP	N	MEAN	SD	t
RETARDED	30	12.3	±3.30	9.08*
NORMAL	30	19.1	±2.43	

*significant at .001 level

These results indicated that the mean of the spinal scores in the retarded group was equal to 12.3 and in the normal group it was equal to 19.1. The normal group also had a lower standard deviation than the retarded group.

The statistical procedure chosen to test hypotheses one and two was the *t*-test for uncorrelated samples. The alpha level for statistical significance was set at .05. This procedure was used to determine if any significant differences existed between the two groups (Terrace and

Parker, 1972).

The first hypothesis stated that a statistically significant difference would not be shown between the total score obtained in the retarded group and the total score obtained in the normal group. The results are presented in Table I. The t-test for uncorrelated samples yielded a t-ratio of 12.25. The first null hypothesis was rejected at the .05 level based on these results.

The second hypothesis stated that a statistically significant difference would not be shown between the spinal scores obtained in the retarded group and the spinal scores obtained in the normal group. The results are presented in Table II. The t-test for uncorrelated sampled yielded a t-ratio of 9.08. The second null hypothesis was rejected at the .05 level based on these results.

Discussion

The results indicated that the mean of the total scores in the retarded group was much lower than the mean of the normal group. The retarded group had substantially more body posture deviations than the normal group. Also, the mean score in the retarded group, 33.3, is lower than the criteria score of 39 indicating major posture problems as reported using the New York Posture Test. On the other hand, the mean score of the normal group, 51.9, is quite close to the maximum score that can be scored in the New York Posture Test, indicating quite normal posture among these subjects.

The results of this study showed that the normal group had a lower standard deviation than the retarded group for both the total score and the spinal score. This indicated a larger degree of variance among the retarded group's scores than was present among the normal group's scores.

The t-test comparisons, using the total scores, between the retarded group and the total scores in the normal group revealed a marked difference between the two groups. The normal group scored significantly higher than the retarded group indicating a lower degree of posture deviations.

The t-test comparisons, using the spinal scores, between the retarded group and the normal group also revealed a marked difference between the two groups. The normal group scored significantly higher than the retarded group because of a lower degree of postural deviations in the spinal column.

The purpose of this study was to compare normal and retarded groups on postural deviations of the spine, and the results indicated substantial differences between the retarded and the normal group on postural deviations. The normal group had significantly less spinal column deviations and also significantly less posture deviations on the overall body posture than in the mentally retarded group.

It was stated by Fait (1975) that mastering efficient static and dynamic posture involves the correct employment of body mechanics. Also, achievement of good body mechanics is dependent upon good body image (Fait, 1975). A child who does not know how his body moves and what space it occupies as it moves cannot tell when he is utilizing good body mechanics and consequently, he is likely to develop poor postural habits (Fait, 1975). It was reported by numerous authors, including Cratty (1980), that retarded adults and children have poor body images when compared with their normal counterparts. The significant postural differences revealed in this study in favor of the normal group might help explain this known relationship between poor body image and poor posture.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains a summary of the study, the findings derived from the analysis of the data, conclusions, and recommendations.

Summary

This study was designed to determine:

a) If A: statistical difference existed between the retarded and the normal groups on the scores of overall body posture.

b) If A: statistical difference existed between the retarded and the normal groups on the scores of spinal column posture.

The 24 retarded subjects from "Hearthstone Nursing Home" participated in this study after the author received permission from the Activities Director of that nursing home. The other six retarded subjects were from the "Exceptional Child Center," and they participated in this study after the author received permission from the children's parents. The 30 males and females which represented the normal sample were students and faculty volunteers from Oklahoma State University as well as children from public schools in Stillwater, Oklahoma, who agreed to participate in this study. The normal group matched the retarded subjects in age and gender.

The two groups were administered the New York Posture Rating Test with modifications by Adams et al. (1982). All subjects were administered the test individually, under the same conditions, in a room that was designed especially for the test.

Findings

The data collected in this study were analyzed and yielded the following findings:

1. Hypothesis one was rejected indicating a statistically significant difference between the normal and retarded groups using the total posture score.

2. Hypothesis two was rejected indicating a statistically significant difference between the normal and retarded groups using the spine score.

Conclusions

Based upon the findings and within the limitations of this study, it was concluded that the normal group had substantially better body alignment and body posture than the retarded group.

Recommendations

In reviewing the methods, procedures and results of this study, the following recommendations are warranted:

1. A randomly selected sample is needed in order to infer conclusions to the general normal and retarded populations.

2. There is a need for further research in body posture to obtain comprehensive normative data.

3. Remedial programs in physical education are needed to improve

body posture in the mentally retarded group.

4. Remedial programs in physical education need to be developed for normal children to prevent postural deviations and also to improve body alignment and spinal column posture.

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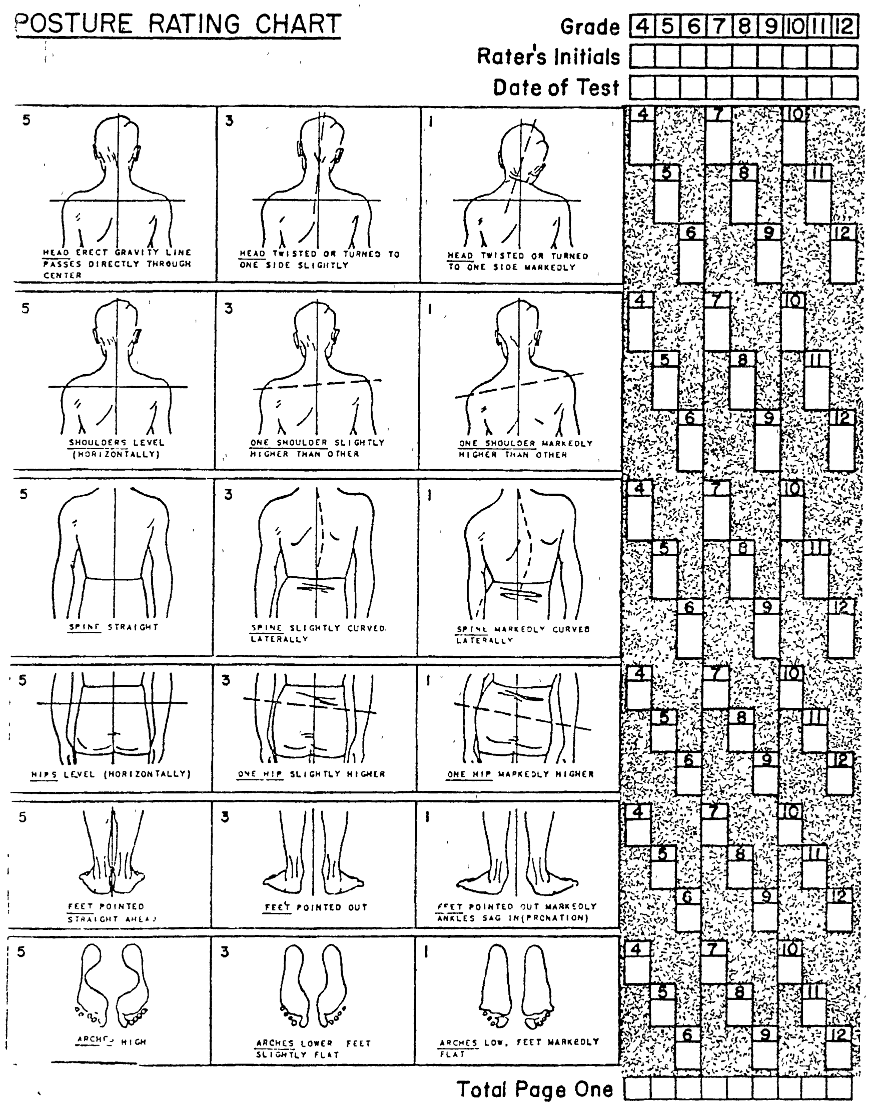
APPENDIX



Source: New York State Education Department, 1983.

Figure 1. The New York Posture Rating Chart

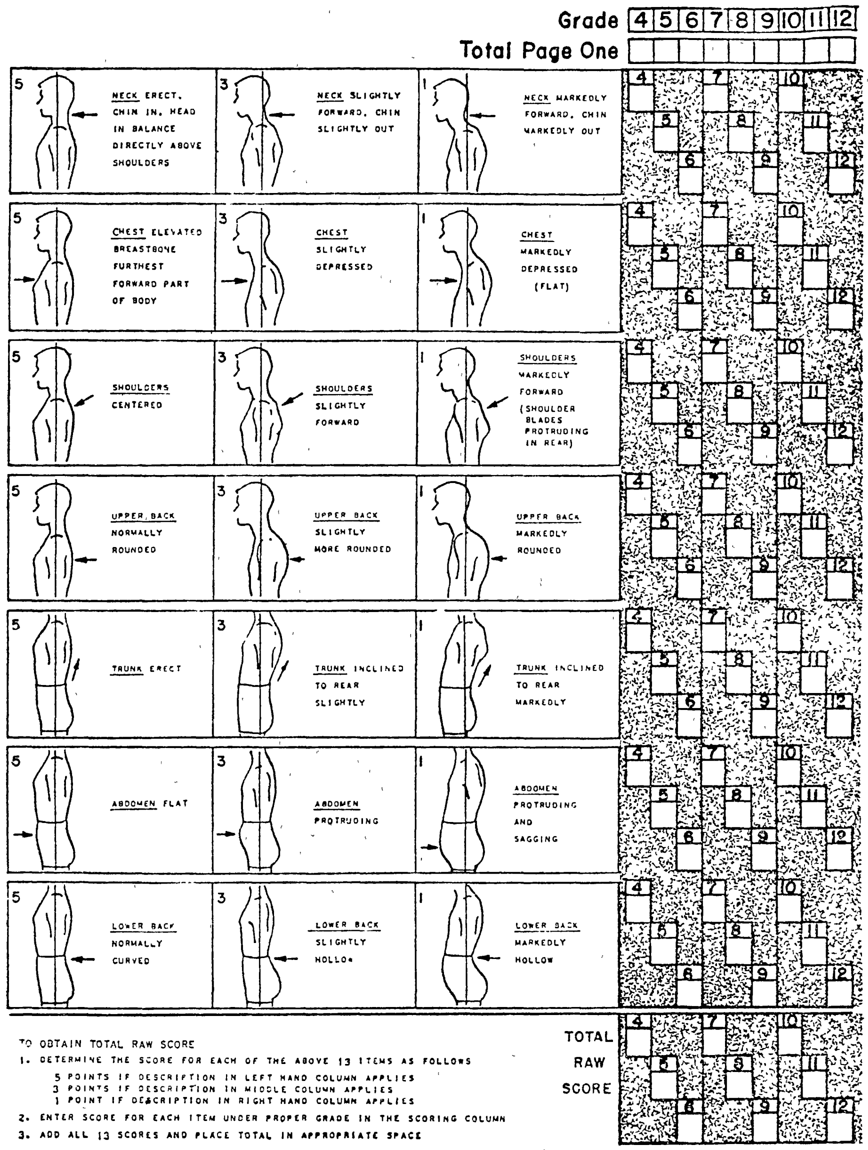


Figure 1. (Continued)

VITA 2

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