

THE STAGES OF POSTURE FORMATION AND VARIOUS FACTORS LEADING TO A CHANGE IN POSTURE (LITERATURE REVIEW)

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ABSTRACT

Posture has attracted the attention of doctors and scientists since time immemorial. Early studies were exclusively practical in nature and were associated with pathological conditions of the spine. Hippocrates (460-377 BC) wrote several works on spinal curvature, in which he proposed methods for correcting body posture defects in the form of breathing exercises [9]. An equally popular ancient physician Galen from Pergamon described the treatment of scoliosis with the help of breathing exercises, singing and special chest bandaging [3]. It was he who first introduced the concepts of lordosis, kyphosis and scoliosis.

Key words: stages, formations, scientists, lordosis, kyphosis and scoliosis, spinal column.

INTRODUCTION

In 1561, the French researcher Ambroise Paré (Ambroise Paré) wrote a work "On the causes and treatment of spinal curvature" [4]. In his opinion, a corset made of perforated tin is needed to correct the defect. The first image of scoliosis, dating back to 1614, was made by the founder of German surgery Fabricius Hildanus (Fabricius Hildanus) - an autopsy of a child with a curved spine. In 1741, the French physician Nicolas Andrieu published the first full-fledged orthopedic manual in two volumes, Orthopedics, or the art of preventing and correcting deformities of the body in children, in which he drew attention to school hygiene, proper fit, and the need to do exercises [4]. In 1748, Lorenz Geister published a reprint of the works of his predecessors, in which he described the structure of the spine and the

rules for the treatment of scoliosis, Albrecht von Haller, a Swiss physician and naturalist, studied pathanatomy and heredity in the development of scoliosis, in 1756 published "Anatomical images" [4]. Percival Pott (Percivall Pott) - an English surgeon of the 18th century, described tuberculous spondylitis (Pott's disease), leading to the development of pathological kyphosis (hump) [5].

Since the 19th century, interest in the study of posture has been growing especially actively, and by now there is a wide range of works in various fields devoted to posture.

According to etymological dictionaries, the word "posture" is formed from the root "-san-", and the words "san", "dignitary", "to sit up" are related to it [7]. There are also attempts to explain the word "posture" using the word "axis"; here it is implied that posture determines the position "as if on the axis" of the main vertical links of the human body.

When translating the word "posture" into English, several variants are found that do not quite coincide with our concept. Thus, the terms carnage, bearing mean rather "bearing", which is more typical for military terminology or in relation to titled persons [6]. Some specialists in physical therapy have also noted the difference between "posture" and the term posture, which is much broader than our interpretation of "posture". Posture can also mean the position or pose of a certain figure; and a certain position or approach to some issue, in addition, the state of affairs and the current situation, also pose can be used as a verb [2].

Despite the quite unambiguous understanding of the word "posture" in Russian, it can be given many definitions depending on the field of knowledge in which it is used. Posture is the subject of research in many sciences - medicine, physical education, ergonomics, biomechanics, pedagogy, aesthetics, theater, military and sewing. Conducting an anthropological study, we will focus on the biological meaning of the concept of "posture". First of all, it means a certain degree of curvature of the spinal column, a unique characteristic peculiar only to man and his ancestors.

According to the theory of uneven morphological evolution of hominids, the two main parts of the skeleton (skull and postcranial skeleton) were undoubtedly formed at different speeds, and the postcranial skeleton developed faster. As one of the most important adaptations to walking upright, the bends of the spine formed very early, about 2.3 million years ago. Researchers agree that thoracic kyphosis and lumbar lordosis were already pronounced in australopithecus [2]. In the further development of the human evolutionary line, the bends were increasingly approaching the characteristics of the modern state. "Paleoanthropes had a completely human type of spine and thorax" [5].

Thus, the bends of the spinal column are an ancient morphological system associated with the development of bipedia and the straightened position of the body. The upright walking complex is an extremely important characteristic for hominids, and adaptations to it were formed even before the emergence of the genus *Homo*. The curves that appeared in almost unchanged form existed before the appearance of a modern anatomical human. [20].

From the point of view of human morphology, posture is understood not only as the severity of the bends of the spine. Many researchers define the concept of posture in this way - a familiar, natural and stable pose of a calmly standing person who holds the body and limbs without special active muscle tension [30]. This is the manner of holding a figure, it is developed throughout the entire previous life of a person [8]. P.N.Bashkirov wrote that posture largely determines the features of the external shape of a person, determines the sagittal profile of the body [2].

At the same time, many researchers believe that there are certain differences between "body position" and posture. "The position of the body is a certain forced state associated with the active conscious giving of certain parts of the body a certain position [5]. Posture is the specific features of this position, individual for each person.

In the most general form, we can say that posture is a complex concept that can be defined differently depending on the choice of approach. From a biological point of view, posture is an important adaptation to upright walking, an integrative characteristic of the body structure, physical status and state of human health, including the anatomical structure of the spine, its physiological state, biomechanical structure, influenced not only by hereditary, but also by environmental, personal and social factors. The systematic study of the morphological and biomechanical features of the human vertebral column dates back to the beginning of the XIX century. For the first time, the natural curves of the spine attracted the attention of German researchers, brothers I. and V. Weber [20]. After a series of studies on corpses, they concluded that the bends of the spinal column depend not only on the shape of the vertebrae themselves, but also on the cartilage, which is located between the vertebrae along a curved line due to its wedge-shaped shape. The shape of the bend depends on the different height of the intervertebral disc in front and behind [16.]. Hirschfeld believed that "the bends of the spine depend on the elastic traction of the yellow ligaments, which compress the intervertebral discs" [21]. The inconsistency of such opinions was later pointed out by some authors - Nuhu, I.F. Balandin. Nuhu believed that the thoracic spine is curved from behind only due to the shape of the vertebrae. Hirschfeld denied Nuhu's opinion, arguing that the bends of the spine, together with the bodies of the

vertebrae, are formed due to yellow ligaments [22]. For this purpose, he cut the yellow ligaments along the entire length of the spinal column and observed that the cervical and lumbar curvatures disappear, and the height of the intervertebral discs remains the same on the posterior and anterior surfaces [6]. In 1864, Parov's article on the normal curvature of the spine was published. In his opinion, they are "maintained and changed under the influence of four factors: the anatomical shape of individual parts of the spine, traction of soft tissues; connecting the vertebrae to each other and to the rest of the body; gravity and muscle strength" [7]. He showed that if the chest is not closed, then the thoracic kyphosis straightens.

Gorner explains the origin of the bends in connection with the tilt of the pelvis, [7]. According to Staffel, the development of the skeleton is greatly influenced by how long a person occupies a particular position [10].

Schultess examines in detail the mechanism of formation of spinal bends: "Newborns are given the direction in which spinal curvatures develop, while the formation and strengthening of the designated forms occurs in the future. The forces producing the curvature are muscular work and gravity" [14]

P.F. Lesgaft criticizes both the Weber brothers and Hirschfeld, explaining that the wedge-shaped shape of the vertebrae and the tension of the yellow ligaments are all a consequence, not a cause, since in newborns the sizes of the vertebral bodies and intervertebral discs are the same in front and back, and there are no differences in the length of the yellow ligaments [8]. It is to him that the merit of the discovery of the dynamic or muscular theory of the formation of spinal bends belongs. Through numerous experiments, P.F. Lesgaft showed that under the influence of the external environment and function, there is a continuous development of the skeleton, and in particular, the spine [20].

The severity of the bends formed during growth is of great physiological and biochemical importance in connection with the supporting and spring functions of the spine [1]. External influences on the human body (level of motor activity, occupation) are so great that the length of the spine may vary slightly during the same day [5]. The normal bends of the spinal column increase its cushioning properties.

Posture is important not only from an aesthetic point of view. This is an indispensable condition for the normal functioning of organs and systems, and the development of the body as a whole. Proper posture ensures the physiological position and normal activity of internal organs, creating the best conditions for the work of the whole body, contributes to the lowest expenditure of energy, which significantly increases overall performance [1]. With the "correct" posture, according to many authors, all organ systems work in concert with maximum

effect and duration [7] It is generally accepted that diseases worsen posture, and posture defects disrupt the proper function of organs and systems [8]. With an increase in the bends of the spine, internal organs are displaced, which causes painful symptoms from the nervous system. Due to severe tension in the intervertebral joints, inflammation may develop. According to O.N. Aksenova, the causes of poor posture are rickets, juvenile kyphosis, myopia, poor hearing, etc. "Defects in posture, disfiguring a person, affect his mood and depress the psyche, good posture is associated with well-being and dexterity" [6]. Wellness systems are quite widespread, when digestive disorders and other systems were cured by correcting posture. Thus, posture cannot but affect the physical development of the body. This is especially true for children, whose posture can change significantly under the influence of a number of exogenous and endogenous factors due to the high plasticity of the body and actively occurring growth processes [5]. As shown above, posture and physical development are closely related. The state of posture is in some way a consequence of physical development, and on the other hand affects its further change [1]. Thus, proper posture has a positive effect on the level of health, and posture disorders, on the contrary, significantly worsen it. In the XIX-XX centuries, scoliosis was studied quite a lot, as they were the most common and often led to significant pathology [7]. Right-sided scoliosis is formed from improper sitting at a desk, left-sided scoliosis is physiological, since there is an asymmetry in the musculature, and mothers more often carry children on their left arm [9]. Much less research has been devoted to curvatures in the sagittal plane, perhaps because it is difficult to establish the boundary between norm and pathology here. Many authors have noted that for school-age children, the most common posture defect is stooping and pronounced thoracic kyphosis, although more attention is paid to scoliosis [8]. In girls, defects increase during puberty, in gymnasts they are less marked, but regular and prolonged performance of special exercises improves the state of posture [6]. Most researchers report that, to date, posture disorders remain the most common functional abnormality in the state of the musculoskeletal system in children [1]. The frequency of occurrence of such disorders in different age periods ranges from 27 to 96% [7]. The peak of diagnosed defects in posture occurs in the adolescent period of 11-16 years [10]. Probably, this age is the most vulnerable, since at this time morphological and functional transformations of organs and systems occur, there is a disproportionality in the physique due to the increased growth of the upper and lower extremities. Ossification has not yet been completed, which creates a danger of postural disorders [6]. What is the cause of the development of posture disorders? S.M. Dukhovskiy, without denying the role of heredity in posture

disorders, pointed to the weakness of the muscular system of the back as the cause of the development of posture defects. In his opinion, such muscle weakness is a consequence of insufficient physical education of children in schools [4]. The authors also cite the discrepancy between school furniture and children's body sizes as the cause of defects [5]. The factors influencing the development of lateral curvature of the spinal column include muscle tone and asymmetry of their development, the effect of gravity, as well as the influence of habitual body holding. There may also be some difference in the length of the legs. If one leg is longer than the other, then the pelvis is not horizontal when standing, but has a slight inclination to the left or right, which leads to a compensatory curvature of the spine in the opposite direction [5]. Back at the end of the XIX century, A.V. Butovsky pointed out the social nature of the causes of posture disorders - the lack of proper upbringing (training), which leads to inability to keep one's own camp [6]. When the physiological bends of the spine change, the spring function is disrupted, which leads to permanent microtrauma of the brain during movements, and this negatively affects higher nervous activity [8]. Such violations are accompanied by increased fatigue and headaches [18]. Children with posture deformities are less attentive [4]. R.U. Avakian and A.A. Manvelyan showed that 53% of gymnasts and 51.3% of track and field athletes have good posture, and for students who do not engage in sports, this indicator is lowered to 46% [2]. But among wrestlers, the number of people with good posture is only 41%, and defects in wrestlers occur in 9.8%, while in non-athletes in 6.4%. The authors explain such differences by the fact that they begin to practice gymnastics from early childhood, and wrestling at a later age, therefore, gymnasts can correct defects earlier. In addition, gymnastics has more elements for correcting posture, and when practicing wrestling, muscle asymmetry often develops. Athletes often have an increased and special load, most of the defects occur in those sports where muscle tension is uneven or asymmetric, which causes posture disorders. This confirms the opinion of Arslanov V.A. that even high physical fitness does not guarantee good posture [15]. Nevertheless, moderate in strength physical exercises, amateur sports have a very great impact on the development of the spinal column, preventing the formation of stooping, abnormal lateral curvature [8]. Ivanitsky wrote about the use of physical exercises to maintain proper posture: "They are also a powerful means to correct existing defects" [4]. In anatomy and anthropology, body posture is commonly understood as the natural pose of a calmly standing person holding his head and body straight, without applying special muscular efforts to maintain this pose [5]. Posture is determined by the relative position of all parts of the human body, depends on the position of the

general center of gravity, the tilt of the pelvis, the severity of the physiological bends of the spine, the shape of the chest, abdomen, legs [2]. Thus, posture creates a sagittal profile of the human body, determines the shape of the trunk [3]. According to most authors, the formation of body posture occurs during the period of human growth [9]. This process is completed, according to various sources, in the period from 16 to 25 years [6]. It is quite difficult to assess the contribution of various factors to the formation of posture, since, without a doubt, it is influenced not only by heredity. The social component plays an important role, for example, the peculiarities of upbringing, professional activity, sports, as well as psychological - the type of temperament, character traits, mood. As a result of the interaction of these factors, each person develops an individual posture peculiar only to him. The analysis of the stages of formation and the causes of differences in body posture in different population groups is an important task from an anthropological point of view, since posture affects the processes of growth and the level of physical development [6]. The structural features of the spine and pelvis, together with the physiological state of the muscles, are certainly an essential addition to assessing the state of health, the level of stress on the body. Recently, the analysis of the state of posture has become an integral part of general anthropometric programs for monitoring the physical development of different population groups. The need to determine the age dynamics of the formation of spinal bends in the context of modern growth trends, sexual and ethno-territorial differences, the influence of motor activity on the state of posture has attracted the attention of doctors and scientists since time immemorial. Early studies were exclusively practical in nature and were associated with pathological conditions of the spine. Hippocrates (460-377 BC) wrote several works on spinal curvature, in which he proposed methods for correcting body posture defects in the form of breathing exercises [9]. An equally popular ancient physician Galen from Pergamon described the treatment of scoliosis with the help of breathing exercises, singing and special chest bandaging [3]. It was he who first introduced the concepts of lordosis, kyphosis and scoliosis. In 1561, the French researcher Ambrois Pare (Ambrois Raguét) wrote a work "On the causes and treatment of spinal curvature" [4]. In his opinion, a corset made of perforated tin is needed to correct the defect. The first image of scoliosis, dating back to 1614, was made by the founder of German surgery Fabricius Hildanus (Fabricius Hildanus) - an autopsy of a child with a curved spine. In 1741, the French physician Nicolas Andrie published the first full-fledged orthopedic manual in two volumes "Orthopedics, or the art of preventing and correcting deformities of the body in children", in which he drew attention to school hygiene, proper fit, the need to do

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REFERENCES

1. Beloselsky N.N., Ershova O.B. X-ray diagnostic and X-ray morphometric examination of the spinal column in osteoporosis //Scientific and practical rheumatology. – 2000. – vol. 3. – No. 3. – pp. 4-11.
2. Khodjaeva D.I. ANALYSIS OF COMPARISON OF MORPHOTOPOMETRIC PARAMETERS OF STRUCTURES OF THE LUMBAR SPINE IN NORMAL AND DEGENERATIVE-DYSTROPHIC CHANGES //Uzbek Scholar Journal. – 2022. – Vol. 5. – PP. 192-196.
3. Maslovsky E.A., Vlasova S.V., Yakovlev A.N. Biomechanical approaches in the prevention of irrational "exploitation" of the spinal column //Scientific notes of PF Lesgaft University. – 2013. – №. 4 (98). – Pp. 88-94.

4. Chaplygina E.V., Kuchieva M.B., Kalashaov B.M. Anatomical variability of the cervical spine in age, sex and type aspects. Opportunities and prospects for studying //Modern problems of science and education. – 2021. – No. 3. – pp. 178-178.
5. Dorontsev A.V., Gorst V. R., Medvedeva A. S. Determination of risk factors for the development of neurological pathologies in the structural elements of the spinal column in power sports //Scientific notes of PF Lesgaft University. – 2017. – №. 8 (150). – Pp. 25-29.
6. Anisimova E.A. Patterns of variability in the size and shape of the vertebrae of the precrestal spine //News of higher educational institutions. The Volga region. Medical sciences. - 2009. – No. 2. – pp. 3-13.
7. Anisimova E.A. et al. Comparative analysis of morphotopometric parameters of structures of the lumbar spine in normal and degenerative-dystrophic changes //Saratov Scientific Medical Journal. – 2015. – vol. 11. – No. 4. – pp. 515-520.
8. Aksenova O.A. et al. Possibilities and prospects of using radiological diagnostic methods in the study of spinal column anatomy //Journal of Anatomy and Histopathology. – 2017. – vol. 6. – No. 3. – pp. 111-116.
9. Yukhvid E.V. et al. Scoliotic deformity of the spinal column in girls //Russian Bulletin of Perinatology and Pediatrics. – 2020. – Vol. 65. – No. 4. – pp. 363-363.
10. Spirin V.K., Boldyshev D.N. Diagnosis of functional disorders of posture based on indicators of strength endurance of muscles on both sides of the spinal column //Scientific notes of PF Lesgaft University. – 2012. – №. 4 (86). – Pp. 149-153.
11. Anisimov D.I. Correlations of the size of the vertebral column, its sections and individual vertebrae of adults //News of higher educational institutions. The Volga region. Medical sciences. – 2013. – №. 1 (25). – Pp. 5-10.
12. Menshchikova I. A. Osteometry of the vertebral column of a mature person in the Ural region //Kazan Medical Journal. – 2019. – vol. 100. – No. 4. – pp. 622-628.
13. Kornilova N. L. et al. Power analysis of the human spinal column for the design of orthopedic corset products //Izv. vuzov. Text technology. prom-sti. – 2009. – №. 4. – Pp. 80-83.
14. Shalikova L.O. et al. Topographic and anatomical features of the spinal column and spinal cord in human fetuses 18-21 weeks of intrauterine development //Journal of Anatomy and Histopathology. – 2019. – Vol. 8. – No. 1. – pp. 89-95.

15. Ershov E. V. Diagnosis and correction of spinal deformities in patients with unilateral shortening of the lower limb //The mound.-2007.-30 p. – 2007.
16. Bondarenko K. K., Chechetin D. A., Bondarenko A. E. Dynamics of functional changes of the spinal column in scoliosis in children with the use of adaptive physical culture //Health and environmental issues. – 2022. – Vol. 19. – No. 3. – pp. 87-92.
17. Bondarenko A. E. Formation of a muscular corset in case of spinal column instability by means of therapeutic physical culture //Modern problems of physical culture, sports and youth. – 2019. – pp. 60-62.
18. Kozlov N. A., Karaman V. S., Kaverzin I. A. Incidence of discopathies in the cervical spine in dwarf dog breeds //Scientific notes of the Kazan State Academy of Veterinary Medicine named after NE Bauman. – 2021. – vol. 248. – No. 4. – pp. 117-122.
19. Kabardaev R. M. et al. Primary malignant tumors of the spinal column. Literature review //Sarcomas of bones, soft tissues and skin tumors. – 2018. – vol. 10. – No. 1. – pp. 10-17.
20. Anisimova E. A. et al. Topographic variability of sizes and shapes of intervertebral openings of the lumbar spine //News of higher educational institutions. The Volga region. Medical sciences. – 2015. – №. 4 (36). – Pp. 20-30.
21. Filimonova G. N., Kobzyev A. E., Krasnov V. V. Morphological features of the small lumbar muscle in modeling scoliotic deformation of the lumbar spine //The successes of modern natural science. - 2014. – Vol. 9. – pp. 28-33.
22. Yukhvid E. V., Orlov S. A., Orlova I. S. Optical and topographic parameters of the vertebral column in children with a stooped type of posture //Russian Bulletin of Perinatology and Pediatrics. – 2018. – vol. 63. – No. 4. – pp. 287-288.
23. Koinosov P. G. et al. Constitutional features of mature men with degenerative spinal column changes //Medical science and education of the Urals. – 2022. – T. 23. – №. 1 (109). – P. 86.
25. Zavislyak O. A. Morphometric characteristics of the lumbar spine of an adult in a magnetic resonance image : dis. – State Educational Institution of higher professional education "St. Petersburg State Pediatric Medical Academy of the Ministry of Health of the Russian Federation", 2005.
26. Sergeev K. S. Interbody fusion using carbon nanostructured implants in spinal column injuries (clinical recommendations) //Clinical recommendations. Tyumen. – 2014.
27. Volkov A. A., Beloselsky N. N., Pribytkov Yu. N. X-ray morphometry of intervertebral spaces of the spinal column in normal and dystrophic changes of

intervertebral discs //Bulletin of Radiology and Radiology. – 2015. – No. 3. – pp. 23-30.

28. Isengulova A. Yu. et al. Anatomy of the cervical spine and human spinal cord at 20-22 weeks of intrauterine development //Journal of Anatomy and Histopathology. – 2021. – vol. 10. – No. 1. – pp. 15-20.

29. Schroeder R. et al. Modeling the dependence of the amount of physical activity in the formation of spinal column competencies on the somatotype of athletes in weightlifting //MODERNIZATION OF THE RUSSIAN ECONOMY. FORECASTS AND REALITY. - 2015. – pp. 455-465.

30. Podorueva A.V., Saiko S.G., Filippova N.G. Structural features of the skeleton of the trunk and muscles of the vertebral column of a snake //Youth and science. - 2018. – No. 8. – pp. 88.