

# The problem of prevention and correction of posture disorders with the help of orderly muscle activity: A literature review



Raspopova E.A.,<sup>1</sup> Shmeleva Svetlana Vasilyevna,<sup>2\*</sup>  
Irina Vitalevna Mikhaylova,<sup>2</sup> Rysakova O.G.<sup>2</sup>

## ABSTRACT

**Background:** One of the frequent manifestations of decreased motor activity and a decrease in the strength of skeletal muscles is a violation of posture. Under these conditions, the deformation of the posture is the result of a violation of the vertical position of the spine and the weakening of its adaptive reactions aimed at maintaining the vertical posture. The redistribution of the load in the spine is accompanied by a change in its configuration. In this regard, the only way to combat the violation of posture can be considered increased muscle activity.

**Objective:** This article provides a review of the literature regarding the problem of prevention and correction of posture disorders with the help of orderly muscle activity.

**Method:** The writing methodology used was the literature review. The source of study consists of relevant journals from the search engines [www.pubmed.com](http://www.pubmed.com), [scholar.google.com](http://scholar.google.com) and [proquest.com](http://proquest.com).

**Conclusion:** In this regard, exercise is a powerful biological stimulant for most of the physiological functions of the body. This allows them to purposefully increase the volume of various muscle structures, change the functional state of the body and solve the problems of short-term and long-term recovery.

**Keywords:** posture, musculoskeletal system, scoliosis, prevention, physical exercises.

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<sup>1</sup>Russian State University of Physical Culture, Sports, Youth and Tourism, Lilac Boulevard, 4 Moscow, 105122, Russian Federation

<sup>2</sup>Russian State Social University, St. V. Pika, 4, Moscow, 129226, Russian Federation

## INTRODUCTION

Human health is a complex social phenomenon, which includes a harmonious mix of biological and social qualities under the influence of environmental factors.<sup>1,2</sup> Human health has a biological basis - a smooth natural flow of physiological processes in the formed morphological structure.<sup>3</sup> All these processes normally occur in conditions of harmony, balance within the body and with the environment, with a definite work of control systems and adaptation to living conditions.<sup>4,5,6</sup>

The modern rhythm of life and the decrease in physical activity in humans is an essential factor in the weakening of health at any age.<sup>7,8,9</sup> One of the frequent manifestations of a reduction in motor activity and a decrease in the strength of skeletal muscles is a violation of posture.<sup>10</sup> In this connection, the only way to combat scoliosis is to increase motor activity. Purposeful individually selected motor activity allows to preserve and enhance the amplitude of joint motion, spinal mobility, the appearance of the necessary muscle strength and the speed of their motor response.<sup>11,12</sup> In this connection, the goal is to summarize the available information on the possibilities of orderly muscular

activity in relation to prevention and correction of posture disorders.

## METHOD

The writing methodology used was the literature review. The source of study consists of relevant journals from the search engines [www.pubmed.com](http://www.pubmed.com), [scholar.google.com](http://scholar.google.com), and [proquest.com](http://proquest.com). Writers searched with keywords “physical exercise”, “posture”, “scoliosis” “prevention”, and “correction”. The reference materials should not exceed the last ten years. From 60 journals that were reviewed, 22 were found suitable as references for this paper. The collected information noted and analyzed for validity and reliability, interpreted and compiled into one scientific literature review. The protocol was approved by The Russian State Social University on September 15, 2016 (protocol No. 9).

## DISCUSSION

### Human Posture and Its Violation

The state of posture depends on the degree of development of the human's neuromuscular system and its ability to withstand prolonged static stress, as

\*Correspondence to:  
Shmeleva Svetlana Vasilyevna,  
Russian State Social University, St.  
V. Pika, 4, Moscow, 129226, Russian  
Federation  
[svetlanazsyu@mail.ru](mailto:svetlanazsyu@mail.ru)

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well as the elastic properties of intervertebral discs, cartilaginous and connective tissue joints and joints of the spine, pelvis and lower limbs.<sup>13</sup>

Normal posture is characterized by the vertical direction of the trunk and head, unbent in the hip joints and completely lowered in the knee joints by the lower extremities, the “unfolded” thorax, slightly diverted shoulders, tightly fitting to the thorax with scapulae and tightened abdomen.

Disorders of posture in the frontal plane (scoliotic posture) is characterized by displacement of the axis of the spinal column to the right or left of the median position. With increasing thoracic kyphosis and lumbar lordosis, a posture with a round-bent back is formed. A total increase in thoracic kyphosis leads to the formation of a posture with around back, and an increase in the lumbar lordosis - to the lordotic. When flattening physiological curves, a flat posture develops. Combined posture in the sagittal and frontal planes is characterized by an increase or decrease in physiological bends in combination with the primary lateral displacement of the axis of the spinal column at different levels.

Scoliosis is the most common cause of abnormal posture in the frontal plane. This is a severe progressive disease of the spinal column, characterized by its lateral curvature and twisting of the vertebrae around the vertical axis - torsion. The form of curvature is determined by the C-shaped shape (one bend to the right or the left) and the S-shape (except for the basic curvature, one or two less pronounced compensatory ones appear, directed in opposite directions). In the size of the curvature of the spine in scoliosis, IV degrees are distinguished: I degree - curvature from 5° to 10°, II degree - curvature from 11° to 30°, III degree - curvature from 31° to 60°, IV degree - curvature from 61° to 90° or more. In practice, the most commonly used division of scoliosis into three degrees: I degree - non-reference Rowan scoliosis (5-8°); II degree - fixed scoliosis (9-15°); III degree - a pronounced fixed scoliosis (more than 16°).<sup>14</sup>

As the person ages, anatomical-physiological and biomechanical changes occur in the locomotor apparatus. In a person of elderly or senile age, his posture attracts attention, which is often characterized by the severity of the cervical, lumbar lordosis, and thoracic kyphosis. There are five types of posture, inherent in the elderly: 1. Unchanging; 2. Saddle-shaped; 3. The kyphosis; 4. Kyphosis-lordosis; 5. The kyphosis-flattened. In the age group up to 60 years, scoliosis, thoracic kyphosis, cervical and lumbar lordosis are more often detected in women. With increasing age, the number of people with a constant posture in a vertical posture

decreases sharply, and the number of persons with a kyphosis posture increases.<sup>15</sup>

Among the various changes in the structure and function of the spinal column developing in the process of aging, vertebral dislocation or torsion takes a special place, as the frequency of their detection and degree of expression increases with aging. Developing with aging, the torsion is closely related to the violation of muscle functions, in particular, with the function of the longest muscle. It is strengthened by the combination of torsion with lateral curvature of the spinal column. Torsion and dysfunction of the longest muscle develop against a background of dystrophic-destructive processes of the spinal column, increasing the negative effect on the statics and dynamics of a person with aging.<sup>15</sup>

Changing the static-dynamic stereotype leads to a change in the tone of the conjugated muscle groups involved in the formation of posture. Relaxation of the abdominal muscles leads to an increase in all bends of the spine: 1) development of lumbar hyper lordosis; 2) increased thoracic kyphosis; 3) the growth of cervical lordosis. As a result, the head moves anteriorly. Also, the pelvis also tilts forward, and the line connecting the anterior superior iliac bone and the posterior upper tip of the ilium is displaced obliquely down and forward. In this case, functional disorders of the musculoskeletal system are manifested by impaired posture not only due to skewing of the pelvis but also as a result of the length of the lower limbs.<sup>16</sup> Inequality of the length of the lower extremities greatly contributes to the development of degenerative osteoarthritis of the hip joints and the curved spine. This causes the compensatory torso of the trunk (scoliosis), supported by a constant muscle effort with a progressive impairment of their activity.

Skeletal asymmetries that lead to bending of the lumbar spine can develop in the lumbar region and the pelvis or lower extremities. Asymmetry of the spine and pelvis can be organic and functional. In some cases, the asymmetry of the length of the lower limbs acquires a pathological character and requires various orthopedic interventions.<sup>16</sup>

Thus, the bodies of support and movement are a single functional system, and deviations in one part are inevitably associated with changes in its other departments. Their condition determines the posture in a person who is either normal or impaired, which requires effective correction.

### **Preventive maintenance of infringements of a posture**

The struggle for a healthy posture should go along the path of preventing all diseases and eliminating

the causes that cause violations of posture. It is necessary to timely identify these violations of posture and vigorously eliminate them by applying all possible means and methods, among which one of the leading places is occupied by a physical culture aimed at correcting the defects of posture.<sup>17</sup>

In recent years, in the preventive physical culture and the rehabilitation system, simulators have become widely introduced, which allow to influence a particular segment, organ, and functional system purposefully. The special value of simulators is that, by performing various exercises on them, you can dose the force, tempo and amplitude of movements. They help develop strength, endurance of muscles, develop joints and eliminate the effects of hypodynamic. Exercises performed on the simulators act on separate groups of muscles and joints. Classes on the simulators contribute to the development of basic movements in the joints and strengthening of the muscles.<sup>18</sup>

Modern health methods and their scientific and methodological support are largely conditioned by the development of the sports and recreation industry, special aerobics, shaping, stretching, training power training, etc., as well as the progress of sports-accessory and pharmacological technologies. One of the mass forms of physical culture is athletic gymnastics, which is also able to improve the human posture.<sup>19</sup>

Thus, systematic and metered physical training is the best means of preventing posture disorders. Their competent application preserves the health of the musculoskeletal system throughout life.

### Correction of Posture Disorders

In the construction of the program of classes and the choice of methodology, everything must obey a certain algorithm: the conditional optimum of the physical state; testing; choice of strategy of employment; method, exercises. The process of physical preparation has a different character and duration, but in any case it solves four problems: restoration, preservation, development, maintenance of the achieved level of preparedness. These tasks are consistent with the characteristics of the motor regimes: rehabilitation, general physical training, training and the maintenance of sports longevity.<sup>20</sup>

The impact of physical exertion on the spine of a person with impaired posture leads to an increase in pressure on the concave side of the spine, which is initially amortized by the elasticity of the intervertebral discs. Prolonged increased physical stress leads to compression of the vertebrae on the concave side.<sup>17</sup> Correction of

the posture defect involves correcting the pelvic incline angle, violations of the physiological curvature of the spine, abnormalities of the position and shape of the chest, abdomen, scapula and head.<sup>17</sup>

Exercises with gymnastic objects, including sticks, dumbbells, balls, shock absorbers are types of exercises with local and dosed force tension, stretching of muscles, their relaxation, coordination of movements, corrective and respiratory. The influence of these exercises is enhanced in comparison with similar exercises without objects due to the weight of the object, improving the level of the moving body segment, increasing the inertial forces arising during the swinging and pendulum movements, complicating the requirements for coordinating movements, etc.<sup>21</sup>

Special shells, apparatus and simulators provide an increase in the therapeutic effect of exercise due to a more accurate dosage of the load, an increase in the stretching effect or intensity of muscle tension. So on the power simulators the mechanical work for differentiated or local impact on a given group of muscles is modeled. Exceptions are progressive and congenital forms of spine pathology with pain symptoms.<sup>6,20</sup>

The largest group of funds for the formation and consolidation of proper posture are special physical exercises. Correcting (anti-curvature) exercises, against which the correction of the arc of curvature is carried out, should be attributed.<sup>17</sup>

1. Asymmetric exercises, which are based on the principle of correction of the spine. They differ in the optimal effect on its curvature, moderate stretching of muscles and ligaments on a concave arc of curvature and differentiated strengthening of weakened muscles on the convex side. These exercises are aimed at selective one-sided strengthening of the muscles of the trunk.
2. Symmetric exercises are based on the principle of minimal biomechanical effect of special exercises on the curvature of the spine. These exercises have a different effect on the symmetrically arranged muscles of the trunk, which, as a result of deformation of the spine, are in a physiologically unbalanced state. On weak muscles of the trunk (for example, on a convex arc of curvature) with each regular exercise should have increased functional loads, as a result of which they train harder than the stronger muscles.
3. Decorative exercises aimed at correcting existing deformities and preventing possible disorders of the spine.

In violation of posture, breathing exercises are often used, which lead to: normalization and improvement of the respiratory mechanism and inter-coordination of breathing and movements; strengthening of the respiratory muscles; improvement of mobility of the chest and diaphragm; prevention and correction of chest deformities (for example, exercises performed in the original position lying sideways on a platen, laid under the convex part of the chest, - pulling the arm to the side up).<sup>22</sup>

Adaptation to loads occurs more quickly if for some time the load remains standard. It is advisable to choose a certain unchanged complex of strength exercises and repeat it for a fairly long time, varying only the weight and number of approaches. However, the use of the same complex will lead to the fact that its implementation will become habitual and will cause small adaptive shifts. Therefore, it is recommended to change these complexes (once every 6-8 weeks) periodically.

Thus, competently built exercises of physical exercises can strengthen the musculoskeletal system and improve the human posture.

## CONCLUSION

The process of forming postural deformations is the result of interaction of factors that disrupt the vertical position of the spine and adaptive reactions aimed at maintaining the vertical posture. It is known that the redistribution of the load is accompanied by a change in the configuration of the spine. In this regard, exercise is a powerful biological stimulant for most of the physiological functions of the body. This allows them to purposefully increase the volume of various muscle structures, change the functional state of the body and solve the problems of short-term and long-term recovery. Physical exercises are very effective in preventing their development and progression of curvature of the spine.

## CONFLICT OF INTEREST

The author declares that we has no conflicts of interest and no relevant or material financial interests that relate to the research described in this paper.

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Work done only by authors. All the authors equally participated in the analysis of current level of scientific knowledge on the topic of article. All authors equally participated in writing this review article and compiling a list of references to it. Upon

completion of manuscripts, each author reread the article and approved it.

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