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REVIEW ARTICLE

New approaches to identifying postural deviation in adolescence: Literature review

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ABSTRACT

The issues of improving postural deviations continue to be controversial. Exercise programs are effective in correcting postural deviations from adolescence. Method; Study sources and inclusion criteria are: Scopus, Google Scholar, PubMed and Web of Science which were used as sources for collecting data for our investigation. The keywords used were; "*posture*", "*scoliosis*", "*body position*", "*deviations*", "*exercises program*", "*adolescents and adults*". The studies were selected in full and abstract from the last 10 years published in both English and Spanish based on our criteria. Results; From our database search, 115 studies were collected that were suitable for our needs based on the implementation of the study methodology, and after a more thorough evaluation, 27 full-text studies were finally selected as suitable for this review. Conclusion; The way we see and treat postural deviations is a fundamental aspect of our health care and well-being. An important aspect of this study is the use of rehabilitation therapy as part of an integrated medical plan. This review showed that the use of innovative methods in identifying postural deviations and rehabilitation therapy brings a significant improvement in the health and well-being of subjects.
Keywords: Posture, Scoliosis, Body position, Deviations, Exercises program, Adolescents, Adults.

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INTRODUCTION

Understanding the evolution of postural changes, bipedal locomotion, and their implications for human evolution has also been supported by an understanding of evolutionary changes in ape anatomy, particularly in spinal morphology (Rolian, 2020). In a detailed review of hominoid spinal features, Lovejoy (2005) highlighted important evolutionary features of the human spine and pelvis between the "long spine" and the "*short spine*," the latter group characterized by adaptations that aid lower limb movement. These adaptations lead to a reduction in the number of lumbar vertebrae, changes in the morphology of the thorax and scapula, and the locking of the last two vertebrae between the iliac crests.

Fossils of hominids and apes (Thompson & Almécija, 2017) found that, contrary to the short-spine scenario, the idea of a long-spine scenario is not supported and was reconstructed with only four lumbar vertebrae and thirty thoracic vertebrae. It appears that this change reduced the mobility of the lower spine, which promoted a persistent incorrect habit of upright posture. Weight support and foot position are two important trade-offs in the transition from previous walking to bipedalism. Bipedal humans, i.e., with extended legs, have lower energy costs, greater endurance, and the ability to forage over greater distances compared to non-human primates, who maintain flexion of the legs to reduce their load (Raichlen & Pontzer, 2021). The definition of "*body position*" has changed over time, starting as a noun and ending as a medical term used to describe a person's general health condition. In the field of medicine, orthopaedics is developing, which uses proper posture to diagnose diseases and determine a person's health condition (Gilman, 2013). In addition to defining proper posture, there are other deviations that are important, such as hyperkyphosis, hyperlordosis, and a slouched position that deviates from the ideal position, which is the military stance. Many techniques for correcting poor posture have begun to be developed, along with a discussion of good and bad posture (Malpas, 2004), using a variety of orthopaedic devices to mechanically address issues related to low posture, such as in children.

Having a correct posture improves physical health, but more than that, it is said that a bad posture can lead to fatigue and injuries that can cause long-term problems, so studies aim to show that the human body can prevent the development of pain or injuries and increase the quality of life (Araújo et al., 2014). A significant shift or deviation from the typical position in the body's kinetic chain is called postural deviation. This phenomenon can lead to biomechanical stress and limit the body's capacity to resist stresses (Schamberger, 2016).

School-age children and adolescents are more likely to experience postural deviations; while some changes are normal during growth, puberty, and human development, they can have a negative impact on a person's quality of life (Schwanke et al., 2016). Aging can also cause postural deviations, which can limit pulmonary function and quality of life (Bansal et al., 2014). Significant deviation from ideal posture can also affect a person's ability to move their muscles efficiently, making them more vulnerable to neurological or musculoskeletal conditions (Hrysomallis & Goodman, 2001). Postural misalignment of the head, shoulders, and spine affects many biomechanical characteristics, motor control, and performance, which is why doctors believe that measuring it is important (Claus et al., 2016). Various studies suggest that exercise can correct these postural deviations. It is interesting to note that, although it is included in large-scale exercise programs, postural correction has very little conflicting or experimental data to support its efficacy, and it is unclear whether any given exercise program is the most effective (Harman et al., 2005).

In conclusion, this systematic review aims to fully examine the efficacy of exercise programs on improving and correcting postural deviations.

METHODOLOGY

This literature review was conducted using recommendations from a meta-analysis. Since the data used in this study came from previous research that had received ethics board approval, this approval was not necessary for us. The study data were processed using Microsoft Excel.

Study sources

The bibliographic databases we used are; Scopus, Google Scholar, PubMed and Web of Science which were used as sources for the literature review in order to collect data for our investigation.

Inclusion criteria

Keywords used in the selection of studies; "*posture*", "*scoliosis*", "*body position*", "*deviations*", "*exercises program*", "*adolescents and adults*", which were among the terms included in the search strategy due to their relevance to health. The studies were selected in full and abstract form from the last 10 years published in both English and Spanish.

After selecting abstracts and scientific articles, we determined the most important details, such as methodology and main findings. We identified 115 studies that were suitable for our needs in the initial searches we conducted. Studies that did not meet the inclusion requirements were not considered from the list.

RESULTS

From our database search, 115 studies were collected that were suitable for our needs based on the implementation of the study methodology, and after a more thorough evaluation, 27 full-text studies were finally selected as suitable for this review.

Microsoft Excel was used to enter publication characteristics (year of publication, type of study), study characteristics, etc.

All studies were selected from the bibliographic databases; Scopus, Google Scholar, PubMed and Web of Science

DISCUSSIONS

Due to the lack of relevant and reliable data collected under controlled circumstances, two previous studies found limited evidence to support the claim that exercise interventions will improve postural deviations (Bansal et al., 2014; Hrysomallis & Goodman, 2001). Exercise is beneficial in correcting postural deviations, according to two recent systematic reviews and a meta-analysis (González-Gálvez et al., 2019; Sheikhhoseini et al., 2018). Although the details of the improvement are still unknown, one study showed that physiotherapeutic activities could lead to modifications in trunk postural deviation (Sheikhhoseini et al., 2018).

It appears that practitioners need evidence-based guidance on appropriate exercises for people with postural deviations. Most of these have been limited to specific deviations and participants (such as adolescents with scoliosis) or individuals with hyper kyphosis (Bansal et al., 2014) or lordosis (Hrysomallis & Goodman, 2001). In the various research studies conducted, exercise therapies for postural deviations have shown some

beneficial advantages in most of the literature reviews reported in the last 23 years. The most effective outcome for correcting postural deviations would come from an improvement and correction program that aims to address both neurological and muscular components and that is implemented three times a week for at least six weeks, with a duration of 15 to 60 minutes per session.

There is a 10% increase in the risk of a first-degree relative with scoliosis, suggesting that the disease may have a genetic basis, although the exact genetic factors are still unknown (Gorman et al. (2012); Sharma et al. (2011). In otherwise healthy children and adolescents, asymmetry of the chest and trunk is often observed, which is the basis for the physical examination of scoliosis. According to Bunnell (1993), only 1.6% of high school students are completely symmetrical. Of over two thousand children evaluated as part of a school screening program, 4.1% showed improvement based on visual assessment in both static and forward bending positions (forward bending test, Adams) and measurements of the rib cage; 1.8% showed signs of idiopathic scoliosis over ten degrees, and 0.4% required active treatment (Yawn, 1999).

The main consequences of scoliosis in growing children are lateral trunk deformities due to trunk or rib rotation, trunk imbalance, and shoulder or lumbar asymmetry. For most patients, idiopathic scoliosis does not progress. Studies on the natural history of scoliosis have shown that deformities below thirty degrees, at the end of growth, never worsen in adults, while deformities above fifty degrees are observed to deteriorate at a rate of 0.75 to 1.00 degrees per year in adults. As a result, the patient who has scoliosis above 25 to 30 degrees and an immature skeleton is susceptible to further development. Development of the thoracic arch in pre-adolescents is necessary to achieve adult chest volume, as lung volume almost doubles from the age of 10 years to skeletal maturity (Diméglio & Canavese, 2011).

Compared with age-matched norms, adolescents with thoracic scoliosis greater than 50 degrees have a higher chance of experiencing dyspnoea later in life (hazard ratio, approximately 15% at 30 years of follow-up and 4% at 50 years of follow-up). As idiopathic thoracic scoliosis approaches 70 degrees, lung capacity is reduced compared with norms, and patients with a deformity greater than 100 degrees are likely to have symptomatic restrictive pulmonary disease (Johnston et al., 2011). However, these are very rare and extreme cases.

Determining skeletal maturity is important for predicting the likelihood of scoliosis progression. Growth velocity and the likelihood of scoliosis progression are correlated, as determined by serial height assessments. The year before menarche is when girls reach their peak growth velocity. In the absence of consistent data, radiography is used to determine bone age by assessing skeletal maturity and bone density. A skeletal maturity score has been developed that takes into account the degree of deviation and phalangeal physical appearance. Based on limited data, this score may indicate the likelihood of developing scoliosis that requires surgical intervention (Sanders et al., 2008). If the patient has reached skeletal maturity, which is defined as a bone age of 15 years for females and 17 years for males, progression of spinal deviation is unusual if the magnitude is below 30 degrees.

Scoliosis is a complex deformity of the trunk in all dimensions. In addition to being recognized by the trunk deformities in the sagittal plane, it is diagnosed by measuring the angle of the spinal curve (a Cobb angle of at least 10º) in the frontal plane and the axial rotation in the horizontal plane (Illés et al., 2019; "*Adolescent Idiopathic Scoliosis*," s. f.). In children affected by a general health condition, it is a structural, lateral, deformity of the spine that develops around puberty (Peng et al., 2020). Although scoliosis can be diagnosed at any age, most cases are detected during adolescence, between 10 and 18 years of age (Négrini et al., 2018). According to Seleviciene et al. (2022b) and Fruergaard et al. (2019), scoliosis is the most common spinal

deformity in children who do not engage in physical activity. According to estimates by the International Society for Scoliosis Orthopaedic Treatment and Rehabilitation (SOSORT), the incidence of adolescent idiopathic scoliosis (AIS) in the paediatric population ranges from 0.93% to 12% worldwide (Négrini et al., 2018).

The SOSORT consensus considers "*3D autocorrection*" as the most important component to be included in the exercises. According to Negrini et al. (2018), autocorrection is the process of trying to integrate the patient as best as possible in each of the three spatial planes. PSSE treatment assessment can be performed from two to seven days a week, depending on the complexity of the approach, the patients' needs, and their capacity to follow the recommended regimen. According to Négrini et al. (2018), if the patient is willing to participate, daily outpatient sessions are usually held two to four times a week. Physical activities are selected according to the type and degree of scoliosis in each patient, and the exercises themselves are based on the methodology used (Négrini et al., 2018). For this type of physiotherapy, only professionally trained physiotherapists are usually used, and their methods are similar to each other, and attention is paid to positional awareness, breathing exercises, implementation of corrective exercises in three planes, and establishing stability and balance.

The GYROTONIC® Extension System is a unique, movement-based approach. Some of the benefits of regular Gyrotonic practice include a healthier and more flexible spine, increased mobility, greater joint stability, better speed and athletic performance, and deep core strength. The Gyrotonic Extension System involves three-dimensional (3D) movement of the spine that not only improves its functional movement but also increases muscular strength and flexibility around the spine. Unlike many traditional exercise methods that focus primarily on linear movement, Gyrotonic exercises promote movement in all three planes of motion: flexion/extension, lateral movement, and rotation. This multidimensional approach helps increase range of motion and functional strength. However, further high-quality research is still needed, as current evidence is insufficient to support the superiority of one particular physiotherapy technique over another.

Patients, healthcare professionals, and rehabilitation centres should be aware of practical and effective intervention techniques with exercises that provide specific details for reducing or eliminating postural deviations.

CONCLUSION

The way we see and treat postural deviations is a fundamental aspect of our health care and well-being. The incorporation of advanced technology, such as electronic devices and computer analysis, has enabled an in-depth look at the structures and functions of the body. An important aspect of this study is the use of rehabilitation therapy as part of an integrated medical plan. Innovative rehabilitation methods have served as a powerful instrument in restoring normal body function and improving postural positioning. This review showed that the use of innovative methods in identifying postural deviations and rehabilitation therapy brings a significant improvement in the health and well-being of subjects. Each method has its specific use and its own role in assessing and monitoring the health of patients, bringing valuable contributions to modern medicine.

AUTHOR CONTRIBUTIONS

The contribution to this review is joint, where Tedi Prifti is a PhD candidate and Prof. Dr. Robert Çina his scientific leader. PhD. Can. T. Prifti implemented every instruction on scientific research, directed by his scientific leader.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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