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Significance of Preventive Behaviour in the Context of a Correct Body Posture in Violin Students

Abstract

One of the important elements of musical education is correct body posture and the ability to properlay use the motor organ to play. This work presented the possibility of applying biomechanical tests to support and enhance the education of playing instruments. The results showed that it is possible to perform such an assessment based on measurements of the body's centre mass (COM) and loads exerted on the feet. The measurement data collected in this way enables quantitative evaluation of the body posture and the COM movement during the playing activity.

Keywords: *musical education, violin, biomechanics*

Introduction

The playing skills require the player to be in excellent physical condition. The youngest violin players start practising their musical skills very early and do so as intensely as their peers training sports. To produce beautiful sound during the performance of musical works, the players must focus on the technical intricacies of the violin playing and mastering each movement of their bodies.

One of the elements of education in the scope of playing stringed musical instruments is correct body posture and the ability to properly use a motor organ to play such instruments. The skills are taught at a very early stage of students' education. According to the decree of the Minister of Culture and National Heritage on the core curriculum of schools educating artistic professions, one of the educational goals of the schools of music is to teach students learning the violin as their main instrument the skills in maintaining proper body posture while playing the instrument and proper use of the violin technique. Proper and stable posture during the violin playing activity guarantees correct use of the motor organ and adequate quality from the music of a piece of music performed.

A crucial issue when it comes to playing string instruments is the stabilisation of the instrument, which ensures the production of clear and precise sounds of proper quality. In the case of violin playing, stably keeping the instrument is no easy task, which requires properly preparing the musician's body. Education in the scope of proper instrument placement is one of the elements of the core curriculum. While playing the violin, the violinist should place the violin on the shoulder girdle in a stable way and simultaneously support the instrument with the left upper limb.

In addition to supporting the violin, the left arm is also responsible for producing sounds by pressing the proper strings in an appropriate position on the fingerboard. The right upper limb is responsible for bowing, resulting in the emission of sounds.

Therefore, all other movements of the remaining body segments, not connected with playing, may interfere with the correct placement of the instrument and its stability, which in turn may translate into the deterioration of the quality of emitted sounds. Additionally, the position during the activity of playing is asymmetric. This fact, undoubtedly, requires proper motor skills and harmonious functioning of the entire muscular system of the upper limbs and shoulder girdle, as well as a stable body posture.

The description of playing the violin makes us realise just how difficult the task of teaching musical instruments can be. In addition to evaluating a series of musical values, they should also evaluate and correct the body postures of young musicians. The task of simultaneous observation of the movement of the left upper limb, the position of the violin and the upper right limb, and a stable body posture is demanding and requires vast experience and knowledge.

The fact that an objective evaluation of body posture is extremely difficult was proven by the results obtained from a survey conducted by a group of 500 physiotherapists. They were supposed to select a correct sitting posture based

on several photos. Despite the comprehensive experience of the physiotherapists participating in the experiment, the results of their assessment of the correct sitting posture were divergent (O'Sullivan et al., 2012; Korakakis et al., 2019).

To make a body posture evaluation more objective, one can use biomechanical measurement methods that have been successfully used to aid the diagnosis of various dysfunctions of the motor organs or the assessment of sport training (Zadoń et al., 2023; Michnik et al., 2016).

This study aimed to develop and verify the methodology of the investigations that enables an objective assessment of body posture during the activity of violin playing.

Research Methodology

Research Background

The test protocol assumed the assessment of the measurements of the body movements during the performance of two compositions played to the score. The quality of the works performed was evaluated under the guidelines provided by the Ministry of Art and Culture in the scope of the detailed effects of education of pupils studying at the schools of music of the first degree (Seidel et al., 2009).

Sample

The tests were conducted in a group of pupils of the 1st, 4th, and 5th forms (two pupils of the 1st and 4th forms as well as four pupils of the 5th form) at the School of Music in Bytom (Szkoła Muzyczna w Bytomiu). The study included eight children who played violin at the age of 8 and 13. The study group included 7 girls and 1 boy.

Instruments and Procedures

The musical and educational evaluation of the violin pupils of the school of music was conducted based on the music works performed and recorded during the tests. The children played two musical pieces (MP1 and MP2) to the score at a different tempo and difficulty level. The compositions were selected adequately to their level of musical education. The sets of works encompassed: Pachelbel-Kanon-fragment; K. D. Blackwell – 'Scales' Etude no. 2; A. Cofalik-Kangur,

Mexican Fiesta and 'Globtroters' Blues – R. Stephen. D. K. Blackwell Mexican Fiesta, Midnight song, D. Obijalska, M. Wawruk 'Rozkoszne kokoszki'.

The quality of the music pieces (MP) was evaluated on a scale from 1 to 6 using the following criteria:

- **K1** – Musical memory in the context of understanding, learning, and performing music
- **K2** – Musical sensitivity: the quality of the sound produced, the aesthetic and intellectual transmission of a work of music
- **K3** – Resistance to stress
- **K4** – Violin technique
- **K5** – Intonation
- **K6** – Bowing
- **K6** – Dynamics
- **K8** – Articulation
- **K9** – Tempo
- **K10** – Interpretation
- **K11** – Technical skills
- **K12** – Musical logic

During the performance of musical pieces (MP) by the violin students, the researchers simultaneously recorded the movement of the centre of the children's body mass of the children and the distribution of loads exerted on their feet. A diagram of the measurement station is presented in Figure 1. The data obtained were compared to the results of studies of the mass centre movement during standing activity. The measurement time in all three tests was identical and was 60 seconds.

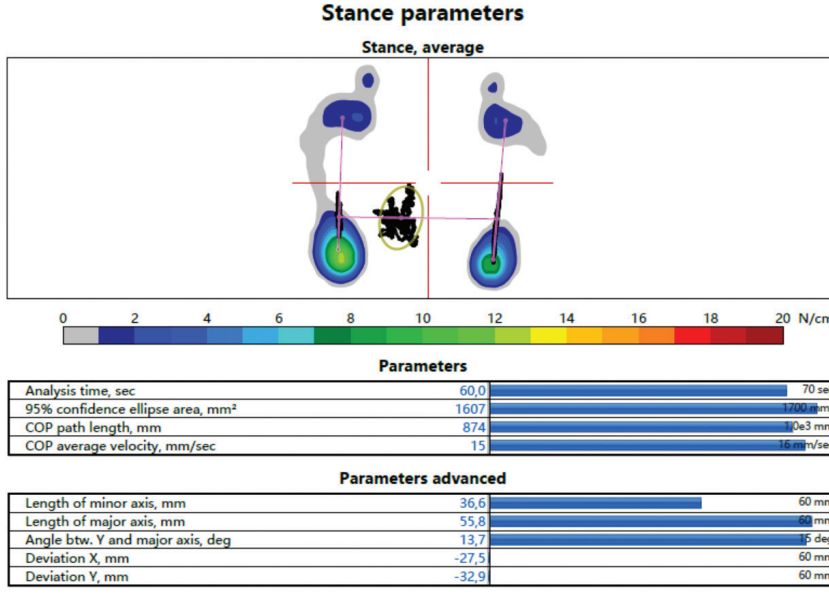
Measurement data enable an objective assessment of the body posture and an indirect evaluation of the muscle tension – the elements essential to correct playing both in the educational process and during the performance.

The investigations of the movement of the mass centre were carried out using a ZEBRIS FDM-S stabilographic platform. The software analyses data recorded by the platform and makes it possible to record displacements of the resultant vector of ground reaction forces (the length of the COP path), ellipse area, which encompasses the COP locations, the long axis and the short axis of the ellipse, inclination angle of the long axis of the ellipse in relation to the sagittal axis, as well as the percentage distribution of ground reaction forces exerted on the right and left limbs.

Data Analysis

For quantitative research, it is obligatory to formulate and verify hypotheses using statistical analysis. In the case of qualitative research, the author should formulate research questions, the answers of which should be included in the conclusions.

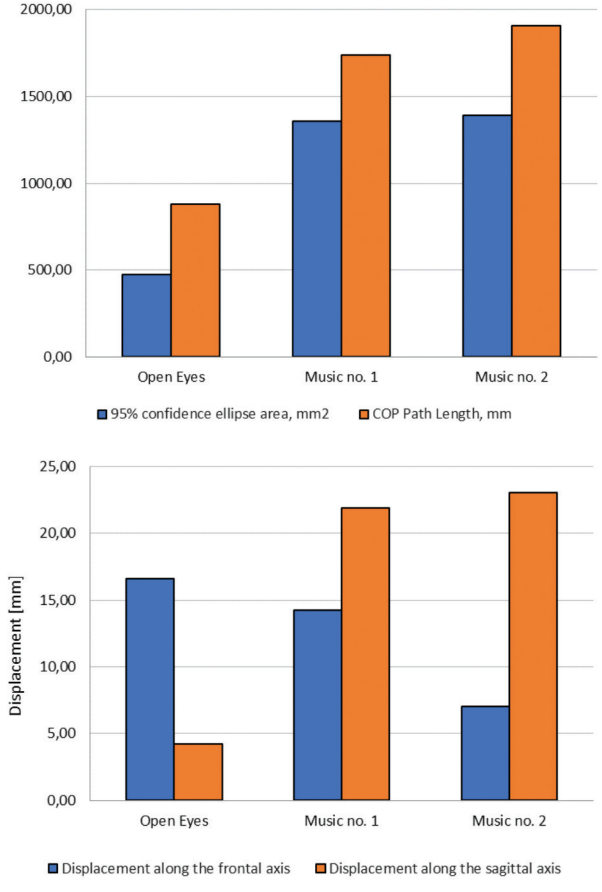
Figure 1. Measurement station diagram and an example of measurement results visualisation



Results

The COM movement were conducted during the standing activity of standing for 60 seconds, both during the performance of a piece of music no 1 and during the performance of a piece of music no 2. The mean values obtained for the study group during the mentioned measurements are presented in Figure 2. The mean results obtained by primary school students tested based on the musical and educational evaluation of the performed works are presented in Figure 3.

Figure 2. Comparison of mean values of the biomechanical parameters



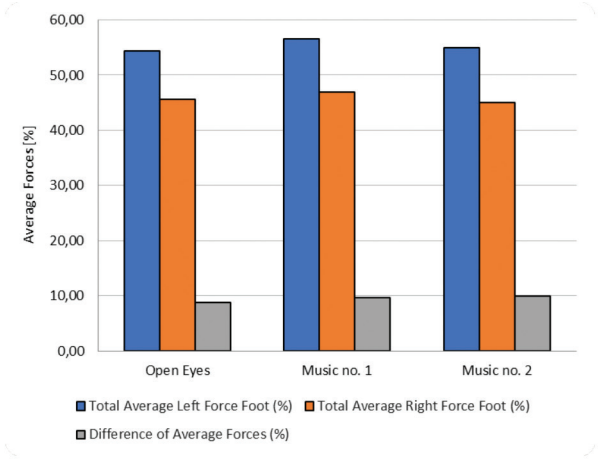
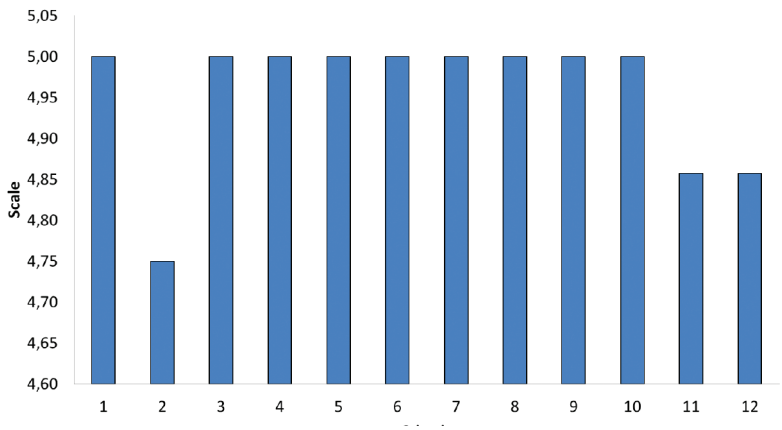


Figure 3. The mean results obtained by primary school students tested based on the musical and educational evaluation



Discussion

Based on the assessment of musical and educational qualities, it was concluded that the skills of the surveyed students are appropriate to their level of musical education. Appropriate articulation, interpretation, dynamics, and tempo characterised the musical pieces performed by the children. The pupils examined were featured by the musical sensitivity and memory required at this level of education. The quality of the sound made when playing was satisfactory. The pupils correctly interpreted the songs being played and showed good musical

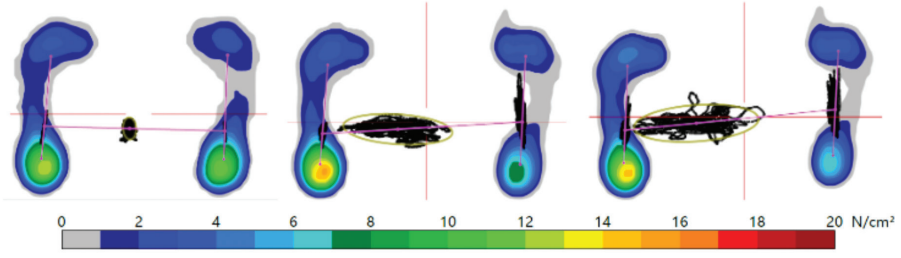
memory.

Analysing the mean values of the determined parameters from the tests of the movement of the centre of mass and the distribution of forces acting on the feet, it was found that during the playing of the musical pieces (MP1, MP2), the load on the left foot increased slightly (2.6% for MP1 and 2.8% for MP2) compared to the test in the free-standing position. Feliński et al. (2010), describing the correct posture of a violinist, point out that body weight should be distributed equally on both legs. It corresponds to the study results, which noted a slight difference in the load on the right and left limbs when playing musical pieces. The greater load on the left limb is probably the result of the subjects' position when playing the violin, the elevation of the left limb, and the violin's weight.

The movement of the right upper limb while playing the violin increases the movement of the body's centre of mass. It is confirmed by the results of the tests. Comparing the average values of the movement of the centre of mass during playing to the free playing position, it was found:

1. greater movements of the centre of mass in the transverse (right-left) axis – 58 times greater for MP1 and 61 times greater for MP2,
2. two times longer COM path length (2.12 more for MP1 and 2.38 for MP2),
3. four times greater ellipse area (4.37 more for MP1 and 4.04 for MP2).

Figure 4. Examples of data: from the left, standing, playing a piece of music no. 1, playing the piece of music no. 2



Analysing the results of the measurements of individual pupils, three showed significant differences (more than 20%) in the values of loads on the right and left limbs when playing the musical pieces. Furthermore, asymmetric foot loading during free-standing was also observed in four pupils. It may indicate a musculoskeletal system dysfunction during play or insufficient motor preparation for musical performance.

It should be noted that there was no correlation between the results evaluating posture and the musical qualities of the musical pieces played. However, it should be taken into account that pupils who were in the initial stage of music education were examined, so the musical pieces played were relatively simple. The abnormalities found in the functioning of the musculoskeletal system (foot loads and COM movement) can be translated into problems with the mastery of the playing technique at subsequent stages of music education.

Feliński et al. (1967), describing the correct posture when playing string instruments, note that: "The most important thing is the uprighting of the spine (as when standing at attention), but without feeling stiff" and "The player's posture and movements should be natural, their expediency and economy depend on this, as well as an aesthetic and harmonious appearance that does not blatantly have an artificial effect". Reinhardt (2005) notes that excessive tension on the musculoskeletal system and abnormal and unconscious posture not only affect artistic performance but can lead to injury, trauma and chronic musculoskeletal disorders, known as the overuse symptom in musicians. Therefore, in the case of musician education, it seems necessary to diagnose any abnormalities in the functioning of the musculoskeletal system early, preferably using biomechanical measurement tools. This approach to music education, with preventive methods, gives a chance to develop a quality musician and, most importantly, without the risk of injuries and trauma that can interrupt his career. Knowledge of proper posture and awareness of the risks associated with the musician's profession can influence the frequency of preventive measures (Reinhardt et al., 2002). To properly train a student as a musician, the instrument teacher should observe the student's posture in every lesson so that its regularity is not disturbed and, at the same time, minimise the risk of injury or illness. It is up to the teacher to ensure that correcting students' posture at the basic level of education during individual lessons will result in positive changes throughout the body. Awareness of the potential overloading of the musculoskeletal system and its injuries can be a preventive measure taken by the teacher. As Seidel et al. (2009) write, the frequency of preventive measures depends on awareness of the risks associated with the musician's profession and knowledge of proper posture.

To correct abnormalities in the functioning of the musculoskeletal system during playing, the orientation to world trends in violin teaching seems crucial. Following the words of Mazepa-Domagała (2021), the effectiveness of profesł sional work is influenced by their continuous based on continuous professional and personal development. One of the internationally recognised methods of teaching musical instruments is the Japanese Suzuki Method (Barber et al.,

1993; Brathwaite et al., 1988), at the heart of which is consistent attention to attitude by both the violin teacher and the child and their parent/guardian. The Suzuki method, based on a diverse repertoire using the development of well-known songs and their variations played from memory, helps students acquire technical skills while making students musical. Its guiding principle is the constant attention to the student's correct posture. Extensive motor exercises help achieve these goals when playing popular songs, inducing the student to adopt a natural posture and, thus, adapt to the instrument.

The main task of initial teaching is to prevent the development of undesirable oversized muscle tension. Since the human nervous system has an asymmetric structure, the result of muscle tension in one foot is muscle tension in the other. Therefore, the teacher must consistently observe the motor skills of the playing apparatus in every lesson at the initial stage of education. The mentioned methods for observing musculoskeletal performance during playing are difficult without objective measurement tools. The study results indicate that measuring devices and systems can be used. Research using such measurement tools can be a valuable source of information for violin teachers to enable early correction of incorrect playing posture. The research will allow the acquisition of knowledge in the field of preventive measures aimed at shaping the correct posture of musicians while playing, which teachers can use to correct posture in students and thus minimise the risk of musculoskeletal disorders. It will contribute to greater awareness among violin teachers and their students.

Conclusions

This work presented the possibility of applying biomechanical tests to support and enhance the education of playing instruments in the scope of correct body posture during playing. The results showed that it is possible to perform such an assessment based on the measurements of the COM movement in the human body and the loads exerted on the feet. The measurement data collected in this way enables quantitative evaluation of the posture and the COM movement during the playing activity. A detailed analysis of the results obtained by individual children revealed the diversity of values of the loads exerted on the movement of the feet and the COM during the playing activity.

What is alarming is that 4 in 8 children showed incorrect loads exerted on their feet in a free-standing position, which proves incorrect posture of their bodies and faulty functioning of the muscles that stabilise the body posture. That can negatively affect performance quality at further stages of their musical education. The evaluation of musical quality did not reveal any correlation be-

tween increased COM movement and asymmetrical loading of the feet during playing activity. However, it should be noted that the investigations were carried out during the performance of relatively short musical pieces, which were adjusted to the skills required in forms 1 to 3. Irregularities discovered during biomechanical tests will likely affect the quality of playing longer musical works. If they are not corrected, they will deepen and negatively influence the quality of the works performed in later phases of musical education and career.

Considering the weak condition of children and youth presented in reports evaluating the physical fitness of pupils and students in primary and secondary schools, it only seems reasonable to introduce physical exercises to strengthen the motor organs in pupils and students at the schools of music.

References:

Barber, B. (1993). Traditional & Suzuki Teaching: A comparison. *American Suzuki Journal, 22*(1), 33–39.

Brathwaite, A. (1988). Suzuki Training: Musical Growth or Hindrance? *Music Educators Journal, 75*(2), 42–45. https://doi.org/10.2307/3398060

Feliński, Z., & Gaertner, H. (1967). *Zasady gry skrzypcowej na podłożu fizjologii* [Principles of violin playing based on physiology]. PWM.

Feliński, Z., Górski, E., & Powroźniak, J. (2010). *Szkoła gry na skrzypcach cz. 1* [Violin school. Part 1]. PWM.

Korakakis, V., O'Sullivan, K., O'Sullivan, P. B., Evagelinou, V., Sotiralis, Y., Sideris, A., Sakellariou, K., Karanasios, S., & Giakas, G. (2019). Physiotherapist perceptions of optimal sitting and standing posture. *Musculoskeletal Science & Practice,* 39, 24–31. https://doi.org/10.1016/j.msksp.2018.11.004

Mazepa-Domagała, B. (2021). The Model of Specialised Artistic Competences of Early Childhood Teachers. Conceptual Approach. *The New Educational Review, 1*, 161––173. DOI: 10.15804/tner.2021.63.1.13

Michnik, R., Jurkojć, J., Wodarski, P., Gzik, M., Jochymczyk-Woźniak, K., & Bieniek, A. (2016). The influence of frequency of visual disorders on stabilographic parameters. *Acta of bioengineering and biomechanics, 18*(1), 25–33.

O'Sullivan, K., O'Sullivan, P., O'Sullivan, L., & Dankaerts, W. (2012). What do physiotherapists consider to be the best sitting spinal posture? *Manual Therapy, 17*(5), 432–437. https://doi.org/10.1016/j.math.2012.04.007

Reinhardt, U. (2002). Die Bedeutung der Haltungs- und Bewegungsqualität beim Instrumentalspiel für die Prophylaxe chronischer *Überlastungssyndrome. Musikphysiologie und Musikermedizin, 9*(4), 170–174.

Reinhardt, U. (2005). Das Bewegungsprofil als Bewertungsverfahren der Haltungs- und Bewegungsqualität beim Instrumentalspiel. Neue Ansätze zur Prävention chronischer *Überlastungssyndrome. Musikphysiologie und Musikermedizin, 12*(2), 71–79.

Seidel, E. J., Fischer, A., Wick, C., & Seidel, S. (2009). Rückenschmerz bei Musikern – Diagnose und präventive Strategien. Abstracts/Kurzfassungen. *Musikphysiologie und Musikermedizin, 16*(1), 45.

Zadoń, H., Miller, A., Nowakowska-Lipiec, K., Jochymczyk-Woźniak, K., & Michnik, R. (2023). Body Postures During Sitting in Different Positions. In M. Gzik, Z. Paszenda, E. Piętka, E. Tkacz, K. Milewski, J. Jurkojć (Eds.), *Innovations in Biomedical Engineering. Lecture Notes in Networks and Systems*. Vol. 409. Springer. https://doi.org/10.1007/978-3-030-99112-8_14

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