PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Harmonizing musculoskeletal health: transformative effects of 8-week intervention program on posture in music students

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Abstract

Background and Study Aim: Musculoskeletal complaints are common among music students, irrespective of gender. They develop due to intense practice over an instrument; spending long hours of practice may cause muscular imbalance, tension, and awkward posture. The repetitive nature of practice in music students may cause overuse and fatigue. This increases the risk of acute pain and can affect both quality of life and performance. Therefore, the present study aimed at evaluating the transformative effects of an 8-week intervention program on posture in music students.

Material and Methods: The 8-week intervention program with transformative effects was conducted over 8 weeks (from September 18 to November 12) on Mondays and Thursdays, for 45 minutes each session. The program aimed to benefit 25 music students, of whom (i) 15 were in the experimental group (with an average age of 24.20 years, average weight of 82.40 kg, and average height of 178.60 cm), and (ii) 10 were in the control group (with an average age of 24.60 years, average weight of 78.40 kg, and average height of 182.20 cm). All participants were enrolled in the second year of a master's degree program in Performing Arts. Standardized measures for evaluating posture (utilizing Klein and Thomas's method, as refined by Mayer) were conducted both before (Week 1, September 18) and after (Week 8, November 12) the intervention. The impact of the 8-week intervention program was assessed using the Wilcoxon Rank-Sum Test, Wilcoxon Signed-Rank Test, and Pearson's r.

Results: Significant differences ($p < 0.05, < 0.01$) between 25 music students (M); in particular experimental group ($n = 15$) and control group ($n = 10$), were in 4 (80%) segments of body in post-test: (i) Head and neck; (ii) Abdomen and pelvis; (iii) Curvature of spine; (iiii) Shoulders and scapulas. Insignificant differences ($p < 0.05$) between 25 music students (M) were in pre-test.

Conclusions: Significant differences ($p < 0.05, < 0.01$) indicated the transformative effects in the experimental group's ($n = 15$) posture. This emphasizes the potential of the 8-week intervention program in promoting musculoskeletal health of music students. Therefore, additional research is necessary to investigate the lasting resilience (sustainability) of advantages and enhance the intervention plan in music education.

Keywords: body posture, intervention program, musculoskeletal health, music students.

Introduction

Maintaining the posture (correct) is of upmost importance in promoting the well-being of music students, allowing to engage in music-making with comfort (ease); however, prevention of posture in not common in music students. Despite its importance, playing-related musculoskeletal disorders (PRMDs) persist in music students, leading to discomfort, pain, and career-limiting injury [1, 2, 3]. Recognizing the challenge, educators (researchers) turn attention to interventions (target) aimed at improving the posture in music students [1, 4, 5, 6].

Music-making (practice) is demanding because of intense practice over an instrument, i.e., spending long hours of practicing may cause muscular imbalance, tension, and awkward posture [7]. Maintaining the posture is important because of preventing the playing-related musculoskeletal disorders, maximizing the playing technique (routine), and understanding the importance of ergonomics [8, 9]; however, incorrect posture (awkward) may cause muscle tension, joint strain, and (even) chronic pain [9, 10, 11]. Incorrect posture in music students is common (± 58%), more in females [12]. ± 85% of first-year (freshman) music students enrolled in higher education (university, college) experience acute pain; ± 34% of them experience playing-related musculoskeletal disorders, either in advance of enrollment in bachelor's degree [13, 14, 15]. Prevalence of playing-related musculoskeletal disorders in music students may differ, depending on diverse factors; in particular, instruments played, intensity of practice, level of awareness, and preventive measures taken [1]. Responsibility

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for health (musculoskeletal) in music students is low; therefore, raising awareness and offering the instructions (target) in preventing the playing-related musculoskeletal disorders while studying may influence the careers of music students [11].

Despite its importance (maintaining the posture), correcting the incorrect posture is challenging; in particular, in music students who develop maladaptive postural habits over years of practice [6, 16]. Demands of music-making (practice) prioritize mastering over an instrument and artistic expression over well-being of music students, leading to overlook and/or dismiss the signs of discomfort. Learning environment (itself) may worsen the playing-related musculoskeletal disorders because intense practice over an instrument happens in settings with inadequate support (ergonomics). Educators (may) lack the training and/or awareness in addressing posture effectively, focusing on musical instructions over principles of biomechanics [17]. Differences in disciplines (e.g., anatomy, ergonomics) necessitate tailored approaches in correcting the posture, making it challenging to devise universal interventions [1]. Despite the challenges, the imperative in promoting the posture (correct) and preventing the playing-related musculoskeletal disorders compels the educators (researchers) to explore the innovative interventions tailored to needs of music students [4, 5, 18, 19, 20].

Interventions aimed at improving posture in music students; in particular, enrolled in higher education, represent important areas of research (science) in music education; however, research in Slovakia about this topic is not as advanced as it is in other countries [21]. Because many gaps remain in literature, in terms of Slovak scale (the best of authors' knowledge), the present study was aimed at evaluating the transformative effects (impact) of 8-week intervention program on posture in music students.

Materials and Methods

Participants

Regarding the study aim (see Introduction), 25 music students (M = male) participated in: (i) Experimental group (60%, n = 15) (24.20 years, 82.40 kg, 178.60 cm); (ii) Control group (40%, n = 10) (24.60 years, 78.40 kg, 182.20 cm), attending the master's degree (2nd year) in Performing Arts (Faculty of Performing Arts, Academy of Arts in Banská Bystrica, Slovakia) (Table 1). 25 music students consisted of convenience sample, recruited by institutional emails (Control group; 40%, n = 10) and elective subjects - "Musculoskeletal System - Prevention 1 - 4" and aimed at selective sampling; regarding age, gender, and year of study. String instruments were the most played by music students (Table 2).

Evaluating the impact (transofrmative effects) of 8-week intervention program on pusture in music students was carried out in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. All subjects provided written informed consent [22].

Table 1. Antropometric data of music students (100%, n = 25)

Anthropometric Data	Experimental group (60%, n = 15)	Control group (40%, n = 10)
Age (years)	24.20	24.60
Body weight (kg)	82.40	78.40
Body height (cm)	178.60	182.20

Table 2. Instruments played by music students (100%, n = 25)

Types of Instruments	Experimental group (60%, n = 15)	Control group (40%, n = 10)
Wind	3	2
String	7	5
Keyboard	5	3

Research Design

Evaluating the impact (transformative effects) of 8-week intervention program on posture in music students was carried out 8 weeks (September, 18 - November, 12), 2x (Mon, Thu)/ week/ 45 minutes, aiming at music students (100%, n = 25), utilizing the true experimental design (experimental vs. control group). Random assignment (week 1) was carried out because of allocating 25 music students into 2 groups: (i) Experimental group (60%, n = 15); (ii) Control group (40%, n = 10).

15 music students (60%) of experimental group underwent 8-week intervention program [1] under the guidance of lecturer - M. Marko; who informed the experimental group (60%, n = 15) of principles of 8-week intervention program. 8-week intervention program was chosen because of supporting the musculature (muscular system) of spine, neck, abdomen, and shoulders [4], allowing the experimental group (60%, n = 15) to exercise (low-load; early stage), advancing to patterns of resistance [5]. 8-week intervention program consisted of 5-minute warm-up, 35-minute intervention, itself (3 sets of 12 reps and/ or 3 sets of 6 reps - 1 min), and 5-minute cool down. 15 music students (60%) of experimental group documented the progress of 8-week intervention program, recording details; in particular, number of sets/ reps and possible problems. Experimental group (60%, n = 15) informed the lecturer in case of musculoskeletal discomfort and/ or pain and he (lecturer), in turn, monitored the signs of

fatigue; in particular, shaking, loss of control [6]. Social (group) setting as method of delivery was choosen because of its cost effectiveness. 8-week intervention program (transformative effects) was aimed at alterations in neuromuscular patterns and improvements in strength, in consequence of physiological adaptations.

Standardized measure (Klein and Thomas/ Mayer) [23] to evaluate the posture (static) was carried out; in particular pre- (September, 18 - Week 1) and post-test (November, 12 - Week 8). Standardized measure evaluates (visual) 5 segments of body: (i) Head and neck; (ii) Shape of chest; (iii) Abdomen and pelvis; (iiii) Curvature of spine; (iiiii) Shoulders and scapulas. Numerical values (1 - 4) detone the positions of segments, concerning the quality (their), while posture is indicated by postural scores (scale): (i) Correct posture, 5 points; (ii) Good posture, 6 - 10 points; (iii) Bad posture, 11 - 15 points; (iiii) Incorrect posture, 16 - 20 points [24].

Statistical Analysis

Evaluating the impact (transformative effects) of 8-week intervention program on posture in music students was by Wilcoxon Rank-Sum Test (2 independent samples, non-parametric), Wilcoxon Signed-Rank Test (2 dependent samples, non-parametric), Pearson's r, and descriptive statistics (Ibm Spss Modeler). Significant differences ($p < 0.05$, < 0.01) between 2 independent samples (experimental vs. control group) were evaluated by Wilcoxon Rank-Sum Test, of which the significance level (α) was 0.01 and 0.05. Significant differences ($p < 0.05$, < 0.01) between 2 dependent samples (Week 1, Week 8) were evaluated by Wilcoxon Signed-Rank Test, of which the significance level (α) was 0.01 and 0.05 [25]. Measuring of linear correlation between 2 sets of data (variable) was evaluated by Pearson's r [26]. Descriptive statistics (arithmetic mean, percentage) described the features (basic) of 25 music students.

Results

Table 3 illustrates the differences ($p < 0.05$, < 0.01) in posture between 2 independent samples (experimental vs. control group). Average values (1 - 4) in terms of quality of posture (static) of experimental group (60%, n = 15) was as follows: (i) Pre- (Week 1)/ Post- (Week 8) - (i-i) Head and neck - 2.20/ 1.40; (i-ii) Shape of chest - 1.60/ 1.30; (i-iii) Abdomen and pelvis - 2.20/ 1.20; (i-iiii) Curvature of spine - 2.20/ 1.20; (i-iiiii) Shoulders and scapulas - 1.80/ 1.20. Average values in terms of quality of posture of control group (40%, n = 10) was as follows: (ii) Pre- (Week 1)/ Post- (Week 8) - (ii-i) Head and neck - 2.80/ 2.80; (ii-ii) Shape of chest - 1.80/ 1.80; (ii-iii) Abdomen and pelvis - 2.80/ 2.80; (ii-iiii) Curvature of spine - 2.20/ 2.20; (ii-iiiii) Shoulders and scapulas - 2.20/ 2.20.

Regarding the results of repeated measure analysis (after 8 weeks) of changes in quality of posture in experimental group (60%, n = 15), significant changes ($p < 0.05$, < 0.01) occurred in all (5) segments. Significant decrease ($p < 0.01$) in measured values was at week 8 (post-test) compared to baseline (pre-, week 1) in experimental group (60 %, n = 15), as confirmed by post hoc analysis. Decrease was at 3.60 in postural score (index) after the intervention of 8-week program, as demonstrated by Z-score of 3.42 ($p < 0.01$, $r = 0.62$) (Table 3).

Table 3. Differences ($p < 0.05$, < 0.01) in posture between 2 independent samples

Experimental group			
Parameters	**Pre-; Week 1**	**Post-; Week 8**	**Wilcoxon S-R Test**
Head and neck	2.20	1.40	$Z = 3.36$, $p < 0.01$, $r = 0.62^{**}$
Shape of chest	1.60	1.30	$Z = 2.24$, $p < 0.05$, $r = 0.40^{*}$
Abdomen and pelvis	2.20	1.20	$Z = 3.06$, $p < 0.01$, $r = 0.56^{**}$
Curvature of spine	2.20	1.20	$Z = 3.42$, $p < 0.01$, $r = 0.64^{**}$
Shoulders and scapulas	1.80	1.20	$Z = 2.82$, $p < 0.01$, $r = 0.52^{**}$
Postural score (index)	9.80	6.20	$Z = 3.42$, $p < 0.01$, $r = 0.62^{**}$
Control group			
Parameters	**Pre-; Week 1**	**Post-; Week 8**	**Wilcoxon S-R Test**
Head and neck	2.80	2.80	n/a
Shape of chest	1.80	1.80	n/a
Abdomen and pelvis	2.80	2.80	n/a
Curvature of spine	2.20	2.20	n/a
Shoulders and scapulas	2.20	2.20	n/a
Postural score (index)	12.60	12.60	n/a

* - Significance (α) = 0.05; ** - Significance (α) = 0.01; n/a - Not available.

Table 4. Differences ($p < 0.05, < 0.01$) in posture between 2 dependent samples

Pre-; Week 1			
Parameters	**Experimental group**	**Control group**	**Wilcoxon R-S Test**
Head and neck	2.20	2.80	Z = -1.86, p > 0.05, r = -0.36
Shape of chest	1.60	1.80	Z = -0.28, p > 0.05, r = -0.04
Abdomen and pelvis	2.20	2.80	Z = -1.82, p > 0.05, r = -0.38
Curvature of spine	2.20	2.20	Z = -0.14, p > 0.05, r = -0.02
Shoulders and scapulas	1.80	2.20	Z = -1.80, p > 0.05, r = -0.34
Postural score (index)	9.80	12.60	Z = -1.84, p > 0.05, r = -0.38
Post-; Week 8			
Parameters	**Experimental group**	**Control group**	**Wilcoxon R-S Test**
Head and neck	1.40	2.80	Z = -3.84, p < 0.01, r = -0.86**
Shape of chest	1.30	1.80	Z = -1.42, p > 0.05, r = -0.28
Abdomen and pelvis	1.20	2.80	Z = -4.22, p < 0.01, r = -0.82**
Curvature of spine	1.20	2.20	Z = -3.84, p < 0.01, r = -0.84**
Shoulders and scapulas	1.20	2.20	Z = -3.86, p < 0.01, r = -0.82**
Postural score (index)	6.20	12.60	Z = -3.84, p < 0.01, r = -0.84**

** - Significance (α) = 0.01.

Repeated measure analysis of changes in quality of posture in control group (40%, n = 10) was insignificant ($p > 0.05$) (n/a). There was no significant decrease ($p < 0.05, < 0.01$) in measured values at week 8 (post-test) compared to baseline (pre-, Week 1) in control group (40%, n = 10) as confirmed by post hoc analysis.

Table 4 illustrates the differences ($p < 0.05, < 0.01$) in posture between 2 dependent samples. Measure analysis of changes in quality of posture in pre- (Week 1) test of experimental (60%, n = 15) and control (40%, n = 10) group was insignificant ($p > 0.05$) (5 segments). There was insignificance ($p > 0.05$) in measured analysis at week 1 (pre-) as comparing the experimental (60%, n = 15) and control (40%, n = 10) group (post hoc analysis). Difference of 2.80 in favor of experimental group (60%, n = 15) in postural score (index) between 2 dependent samples before the intervention of 8-week program was insignificant ($Z = -1.84$, $p > 0.05$, $r = -0.38$) (Table 4).

Regarding the repeated measure analysis (after 8 weeks) of changes in quality of posture at week 8 (post-) between 2 dependent samples, significant changes ($p < 0.01$) occurred; in particular: (i) Head and neck ($Z = -3.84$, $p < 0.01$, $r = -0.86$); (ii) Abdomen and pelvis ($Z = -4.22$, $p < 0.01$, $r = -0.82$); (iii) Curvature of spine ($Z = -3.84$, $p < 0.01$, $r = -0.84$); (iiii) Shoulders and scapulas ($Z = -3.86$, $p < 0.01$, $r = -0.82$). Difference of 6.40 in favor of experimental group (60%, n = 15) in postural score (index) between 2 dependent samples after the intervention of 8-week pro-gram was significant ($Z = -3.84$, $p < 0.01$, $r = -0.84$).

Discussion

Regarding the impact (transformative effects) of 8-week intervention program on posture in music students (100%, n = 25), the incidence rate of research (available) is low [27]; and because many gaps remain in literature, in terms of Slovak scale [21] (the best of authors' knowledge), the present study was aimed at evaluating the transformative effects of 8-week intervention program on posture in music students.

Research carried out by authors [13-15] underlines the prevalence of playing-related musculoskeletal disorders in music students and harmful effects of incorrect posture (see Introduction). ± 84% of music students surveyed the playing-related musculoskeletal disorders, with the spine, neck, and arms emerging as the most affected areas [28].

Recognizing the challenges, authors pay attention (more) to interventions (target) aimed at improving the posture in music students [4-6, 18-20]. Repeated measure analysis (after 8 weeks) of changes in quality of posture at week 8 (post-) between 2 dependent samples was significant ($p < 0.01$); in particular, difference of 6.40 in postural score (index) was significant ($Z = -3.84$, $p < 0.01$, $r = -0.84$) and in favor of experimental group (60%, n = 15). Similar study [29] involved 10 participants (n = 10); clarinetists experiencing the playing-related musculoskeletal disorders during the intense practice over an instrument. 6-week (3x/ week) intervention program consisted of autonomous exercises aimed at enhancing the mobility of joints, strengthening the posture; in particular, focusing on scapular region and limbs (upper). Standardized

measures consisted of posture (evaluation) and subjective pain perception. Measure analysis of 10 clarinetists (n = 10) discovered the significant changes ($p < 0.05$, < 0.01) in perceived pain levels ($p < 0.01$) and alternations in spine ($p < 0.01$). Another study [4] consisted of 85 musicians (professional, n = 85), divided into: (i) Experimental group (n = 30); (ii) Control group (n = 25). Intervetions lasted 9 - 12 weeks with 16 sessions of 35 minutes, focusing on exercises aimed at specific muscle groups. Musicians (100%, n = 55) perceived instructions (detailed) and documentation of exercises. Results (after 12 weeks) showed the significant changes ($p < 0.05$, < 0.01) of playing-related musculoskeletal disorders; however, effects were not sustained after 6 months.

Educational institutions (music schools, higher education) are in charge of teaching music students; in particular, professional subjects; however, how to take care of musculoskeletal health (posture, in our case) is absent [21, 30]; therefore, education institutions must take measures (active) in addressing the absence in education [1]. Addressing the absence, education institutions may incorporate the education of musculoskeletal health into curriculum. By educating (instrument-specific ergonomics, autonomous exercises), it may address the demands placed on music students [31]. Music students who receive tailored assessments and/or guidance by health professionals improve awareness of posture [9, 32]. Integration of musculoskeletal health education into curriculum is not just important, but necessary too.

Using evidence (available) of interventions in cooperation with medical experience and current best practice [33], 8-week intervention program was effective at improving posture in experimental group (60%, n = 15). According to results of 8-week intervention program (see Results), we may recommend it for practical use of static load in music students; however, it must be kept in mind that types of instruments are important in terms of designing of interventions because demands are not always equal [29].

Conclusions

Transformative effects of 8-week intervention program on posture in music students (100%, n = 25; M) emphasize the important role of interventions (target) in terms of promoting the musculoskeletal health. Effectiveness of 8-week intervention program in promoting the posture (correct) suggests that interventions may result in significant benefits ($p < 0.05$, < 0.01) in musculoskeletal health. 8-week intervention program incorporates the combinations of target exercises, ergonomic alterations, and educational aspects aimed at enhancing the posture awareness. Such interventions are important because of minimizing the danger of musculoskeletal disorders (MSDs) and optimizing the performance and well-being in music students.

Significant differences ($p < 0.05$, < 0.01) underscore the importance of prevention (early) and active measures in addressing the musculoskeletal issues in music students (100%, n = 25). Given the demanding nature of practice over an instrument, music students are susceptible (particularly) to developing the playing-related musculoskeletal problems (PRMDs). Implementing of 8-week intervention program (early) in music students' practice may help in terms of preventing the musculoskeletal issues; however, additional research is necessary in terms of investigating the lasting resilience (sustainability) of advantages and enhancing the intervention plan in music education.

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Conflict of interest

The authors declare no conflict of interest.

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