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Pedagogical methods of overcoming muscle tension in vocal students at the initial stage of training

Abstract. The aim of the study was to determine the effectiveness of a set of pedagogical methods for reducing muscle tension in vocal students at the initial stage of training. The methodology involved a quasi-experimental design with pre- and post-testing, implemented over 12 weeks during the academic semester. A combination of theoretical generalisation of approaches to the nature of muscle tension and empirical testing of the impact of the pedagogical complex was used in a sample of 48 students divided into experimental and control groups. The results showed that at the initial stage, medium and high levels of muscle tension prevailed, mainly in the neck, shoulder girdle and lower jaw. During the 12-week formative stage, the experimental group showed a decrease in the overall tension index from 2.1 to 1.2 points. The most pronounced changes concerned respiratory and phonation indicators: shoulder raising during inhalation decreased by 41% compared with 12% in the control group, jaw tension by 36% compared with 10%, and neck tension by 33% compared with 9%. Students in the experimental group also corrected body position and breathing independently in 64% of cases, while this figure did not exceed 27% in the control group. Subjective tension decreased from 6.8 to 3.9 points in the experimental group and only from 6.8 to 6.1 points in the control group, while the discrepancy between self-assessment and expert assessment decreased from 1.2 to 0.4 points. The practical significance of the study lies in the possibility of using a substantiated set of methods for the systematic formation of vocal-body coordination and the development of students' self-regulation skills

Keywords: respiratory coordination; phonation; articulation; sound production; body awareness; self-regulation

INTRODUCTION

The relevance of the study is determined by the need for the stable formation of basic vocal skills in students at the initial stage of training. It is during this period that muscle tension often disrupts respiratory coordination, sound formation, the work of the articulation apparatus and general bodily freedom during singing. The problematic of the study is that in pedagogical practice, muscle tension is often eliminated situationally – through individual exercises or teacher's remarks. This approach does not always develop the students' ability to recognise and control tension on their own. The study is needed to substantiate a system of pedagogical methods that help reduce muscle tension, prevent the consolidation of ineffective vocal habits, and

include work with bodily freedom in the main process of vocal training.

In the scientific literature, the problem of muscle tension in vocal singing is considered through the interaction of physiological, bodily coordination and pedagogical factors. N.P. Paolillo *et al.* (2021) showed that certain vocal phenomena, in particular inspiratory vocal fry, are associated with the anatomical and physiological organisation of the vocal apparatus and can be used to regulate voice production. This gave grounds to consider voice work not only as a technical training, but as a controlled process of coordination of breathing, phonation and muscle activity. This approach was deepened in the work of J. McGlashan *et*

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al. (2023), where the use of Complete Vocal Technique in cases of muscle tension dysphonia was associated with improved vocal function and reduced excessive tension. An important result was that structured pedagogical instructions helped to reduce compensatory muscle activity.

The importance of the pedagogical organisation of vocal work was also observed in the study by D. Kovalsky (2021). The author linked healthy vocal technique to stable voice development and emphasised that incorrect technical attitudes at an early stage can perpetuate ineffective motor patterns. At the same time, muscle tension cannot be explained by singing technique alone. In the study by T. Jeffery *et al.* (2024), singers' physical characteristics were analysed through the example of hypermobility, which was associated with pain, loss of vocal stability and restrictions in performance activity. This broadened the interpretation of muscle tension, as the singer's physical condition appeared as a factor that directly affects vocal function and must be considered in pedagogical work. The same logic was continued in the research by M. Kendüzler & S. Akkaş (2025), where a structured pedagogical model at the initial stage supported the acquisition of basic musical skills and reduced learning overload. Although not directly focused on vocal training, the results confirmed the importance of a clear sequence of activities, assessment criteria, and manageability of the learning process. A similar logic was supported by T. Fu (2025), who linked the effectiveness of vocal training to the variability of pedagogical methods. It has been shown that a combination of different strategies allows for better consideration of students' individual characteristics. The physiological dimension of the problem was specified by L. Tian (2025), who established the dependence of articulatory quality on the biomechanical coordination of the laryngeal muscles. Violation of this coordination led to increased tension and reduced accuracy of sound production. This confirmed that muscle tension does not occur in isolation, but as part of the overall motor organisation of singing. Breathing plays a special role in this system.

An analysis of the above studies showed that muscle tension was considered a multifactorial phenomenon related to breathing, posture, biomechanics, and general body condition. At the same time, most studies focused either on physiological mechanisms or on specific methods of exposure. The issue of integrating these approaches into a systemic pedagogical model focused on the initial stage of training remained insufficiently developed. The problem of developing students' ability to independently recognise and regulate muscle tension was also covered to a limited extent. The study aimed to examine the impact of a systematically organised set of pedagogical methods on reducing muscle tension in vocal students during the initial stage of professional training and to determine the conditions for their effective integration into vocal pedagogy. To achieve this goal, the following tasks were set: to summarise theoretical approaches to understanding muscle tension in vocal singing and identify pedagogical means of reducing it;

to empirically test the effectiveness of a set of pedagogical methods for overcoming muscle tension in vocal students.

MATERIALS AND METHODS

The study was conducted over 12 weeks during the spring academic semester (February-April 2025) and had a quasi-experimental design with pre- and post-testing. The methodological construction combined a theoretical generalisation of approaches to understanding muscle tension in vocal singing with an empirical test of the effectiveness of a pedagogically organised set of methods for reducing it. The theoretical block included the systematisation of scientific positions on the nature of muscle tension as a consequence of impaired coordination of breathing, phonation, articulation and postural organisation. On this basis, groups of pedagogical means of influence were identified: body-oriented practices, breathing and coordination exercises, vocal and technical tasks with controlled load, and verbal pedagogical modelling. The working criteria for assessing muscle tension were also formulated: bodily, respiratory, phonation and reflexive, which ensured the integrity of the subsequent analysis.

The empirical block was implemented on the basis of three specialised art institutions in the United States: Indiana University Jacobs School of Music, The Juilliard School and Curtis Institute of Music. The choice of these institutions was based on the availability of structured vocal training programmes, a combination of individual lessons and performance practice, as well as the possibility of attracting students from different educational fields within a single professional environment. This made it possible to ensure comparability of the data and at the same time take into account the variability of pedagogical conditions. The sample included 48 1-2 year bachelor's students aged 18-22 who were studying Vocal Performance, Vocal Arts and Music Education with a vocal specialisation. Students of the Vocal Performance programme were recruited from Indiana University Jacobs School of Music and Curtis Institute of Music, Vocal Arts students from The Juilliard School, and Music Education students from Indiana University School of Education. The participants were divided into experimental and control groups of 24 people each. The experimental group worked with an additional set of pedagogical methods, while the control group continued their studies according to the standard programme. Thus, the comparison was conducted between two training models: the standard vocal training model and the standard model supplemented with targeted methods for reducing muscle tension.

The study consisted of three stages. In week 1, the study was conducted as a baseline assessment: the initial level of muscle tension was recorded using pedagogical observation, expert evaluation of video recordings and student self-assessment. Weeks 2-11 were spent on the formative stage, during which a set of methods was implemented in the experimental group: exercises on body awareness, breathing coordination, vocal tasks with a limited load,

specific verbal instructions and keeping a reflective diary. At week 12, a control phase was conducted, which involved repeating the same or equivalent vocal tasks and comparing the obtained indicators with the initial results. Muscle tension was measured using four tools: pedagogical observation on a scale of 0-3, independent expert evaluation of video materials, student self-assessment on a ten-point scale, and vocal and pedagogical diagnostics that recorded sound stability, attack pattern, respiratory coordination, and degree of independence. The general index of muscular tension was calculated as the mean score of bodily, respiratory and phonation indicators recorded through pedagogical observation and expert assessment on a 0-3 scale. To compare students' subjective perception with external evaluation, self-assessment scores were correlated with expert assessment indicators at the baseline and control stages. The results were processed by comparing the mean values, analysing the dynamics of changes, and comparing the experimental and control groups by all indicators. Compliance with ethical standards was ensured by the voluntary participation of students, anonymisation of the data obtained and the use of video materials only for research analysis in accordance with the ethical provisions of the Code of Ethics of the American Sociological Association (1997), International Code of Market, Public, and Social Research and Data Analysis (2025) and the European Commission Guidelines on Ethics and Data Protection (European Commission, 2021). The applied methodology provided an opportunity to assess both external manifestations of muscle tension and internal mechanisms of its regulation in the conditions of a pedagogically organised educational process.

RESULTS

Theoretical basis for the interpretation of muscle tension in vocal singing. The formation of vocal technique at the initial stage of training is associated with the need to coordinate respiratory, phonation and articulation processes. In this context, muscle tension is seen as an indicator of impaired internal coordination, which manifests itself in the overactivation of certain muscle groups. Its presence changes the nature of sound formation, complicates breath control and affects the stability of performance. The theoretical positions underlying the interpretation of the results made it possible to consider muscle tension not as an isolated phenomenon, but as a component of an integral system of vocal activity. Muscular tension in vocal performance is seen as a consequence of impaired coordination between breathing, phonation, articulation and postural organisation. When working optimally, these components mutually support each other: inhalation is not accompanied by shoulder raising, exhalation ensures even sound production, the articulatory apparatus remains mobile, and the position of the head and body does not create additional pressure on the vocal apparatus. If this coherence is disturbed, the student begins to compensate for the instability of the sound with

excessive muscle effort. This is most often manifested in clenching the lower jaw, neck tension, fixation of the shoulder girdle, a hard attack of sound, a shallow inhalation, or uneven exhalation. For example, if there is insufficient respiratory coordination, a student may try to "hold" a phrase by straining the throat or amplifying the sound with the neck muscles. Such an action sometimes gives a short-term acoustic result, but gradually reinforces an ineffective motor pattern. At the initial stage of training, such manifestations occur more often because the student does not yet have stable skills in controlling breathing, resonance, articulation, and sound dynamics. For more trained singers, the tension usually becomes more localised: it can appear during complex interval transitions, work in the upper register, or the performance of long phrases. Thus, the level of training affects not only the intensity of the tension, but also its localisation, frequency of occurrence, and the student's ability to control it. From a pedagogical point of view, muscle tension requires not only a physiological explanation, but also methodological elaboration, as it is directly related to the formation of vocal skills (Crocco & Meyer, 2021). In this context, muscle tension is seen as a result of the learning process, not just a biomechanical phenomenon. This position allows for the integration of bodily, respiratory, and vocal technical aspects into a single system.

In the practice of vocal training, the reduction of muscle tension is achieved through a combination of several approaches, each of which is aimed at a specific component of vocal action and has its own mechanism of pedagogical influence. The body-oriented approach is based on developing the student's ability to be aware of their own bodily state while singing. Its essence lies not only in performing relaxation exercises but also in developing sensorimotor control. The student learns to fix the position of the head, the level of tension in the neck, the mobility of the jaw, the stability of the shoulder girdle, and to correlate these sensations with changes in the sound. For example, while performing the same exercise, he can deliberately change the degree of tension and compare the result. This approach forms a connection between bodily sensations and the acoustic result, which allows you to gradually move from external control to internal self-regulation. The breath-coordination approach is aimed at stabilising the interaction between inhalation, exhalation and the onset of sound. Its implementation involves systematic work with a soft, uncontrolled inhalation, avoiding shoulder raising, and forming an even and controlled exhalation (Zhang *et al.*, 2022). An important element is to synchronise the beginning of the sound with the exhalation phase without an additional muscle impulse. In practice, this is achieved through short vocal phrases, long exhalation exercises, and singing on closed or semi-closed vowels. As a result, the need to compensate for the lack of respiratory support by straining the larynx or neck is reduced. The vocal-technical approach involves organising the teaching material in such a way as to avoid situations in which the student is forced to use

excessive muscle effort. Its essence lies in the gradual complication of tasks: at first, exercises in the middle register with a limited range are used, then interval transitions are added, the amplitude of sound is expanded, and dynamic variations are introduced. It is important that each new task is introduced only if stable coordination is maintained. This approach allows to form a technique without overloading the vocal apparatus and prevents compensatory stresses from becoming fixed (Friman, 2025). The combination of these approaches ensures coordinated work with the body state, breathing and sound production, which creates conditions for a sustainable reduction in muscle tension. Verbal pedagogical instruction determines how clearly the student understands the required vocal and bodily action. Generalised instructions often have limited corrective value because they do not specify the parameter that needs to be changed. More effective pedagogical guidance is based on precise indication of the relevant component of vocal action, such as posture, breathing, articulation, phonation onset or the degree of muscular effort. In this case, the teacher's verbal feedback performs a regulatory function: it focuses the student's attention on a specific element of performance and supports the transition from external correction to conscious self-control. Each approach affects a separate aspect of vocal training: body-oriented exercises develop self-observation, breathing exercises stabilise coordination, vocal-technical tasks reduce the risk of overload, and precise instructions increase the controllability of the learning action. Their combined use makes it possible to address muscle tension as a systemic pedagogical problem rather than as a set of isolated manifestations during the lesson (Crocco & Meyer, 2021).

Despite the availability of different approaches to reducing muscle tension, their use often remains insufficiently systematic. Individual breathing, relaxation, posture, or sound formation exercises are used as a reaction to a specific student's mistake, rather than as part of a consistent pedagogical programme. Because of this, tension may decrease during a particular lesson, but reappear in another vocal task: when moving to a higher register, singing a longer phrase, or increasing the volume. Another limitation is related to the lack of a clear algorithm for the initial stage of learning. A beginner student does not yet understand how breathing, phonation, articulation and body position interact. If the pedagogical actions do not have a certain sequence, the student receives individual corrections, but does not form a holistic way of vocal action. In this case, they may correct the position of the jaw but maintain neck tension; stabilise the inhalation but continue to force the sound. A significant limitation is also the predominance of external control by the teacher. The student follows the instruction during the lesson, but is not always able to independently determine where the tension has arisen and what caused it. Therefore, correction depends on the constant presence of the teacher. A separate problem is the gradual complication of vocal tasks without

sufficient development of body awareness. When a student moves to a wider range, more complex dynamics, or longer phrases without self-regulation skills, tension builds up and becomes a habitual way of performing (Chapman & Morris, 2021). This highlights the need for a systematic approach that combines different methods into a single pedagogical model.

The problem of muscle tension in vocal students is considered according to four working criteria: bodily, respiratory, phonation and reflective. The bodily criterion covers the state of the neck, shoulder girdle, lower jaw, facial muscles and general posture during singing. Its indicators are shoulder lifting while inhaling, excessive neck extension or clamping, jaw fixation, body stiffness, and violation of the natural head position. The respiratory criterion reflects the quality of the interaction between inhalation, exhalation and the onset of sound. Its indicators include a sharp or shallow inhalation, uneven exhalation, breath holding before phonation, amplification of sound due to pressure, and loss of stability in longer vocal phrases. Such manifestations indicate that the student has not yet developed sufficiently stable respiratory coordination. The phonation criterion relates directly to the quality of sound production. It includes a hard attack of sound, instability of timbre, narrowing of the dynamic range, forcing of sound, violation of legato and loss of uniformity during the transition between sounds. This criterion determines the extent to which muscle tension affects the vocal and technical result. The reflexive criterion characterises the student's ability to be aware of their own bodily state while singing. Its indicators are the ability to identify the area of tension, to relate it to a specific vocal action, to adjust the body position or breathing method after pedagogical instruction. The more accurately a student recognises his or her own tension, the higher is their readiness to control their vocal technique independently. The application of these criteria makes it possible to evaluate muscle tension not only by external signs, but also by its impact on breathing, sound and the student's ability to self-regulate (Summersgill *et al.*, 2023).

The totality of theoretical positions suggests that muscle tension in vocal singing is formed as a result of a disturbance in coordination between the main components of voice production and is supported by compensatory muscle activity. Existing approaches to its reduction include physical, respiratory, technical and verbal aspects, but their application is not always systematic. The identified limitations are related to the fragmentation of methods, lack of a clear pedagogical structure and insufficient development of students' independent control. The proposed system of criteria allows to integrate different aspects of muscle tension assessment and creates a basis for further analysis of empirical results.

Empirical results of the study of muscle tension in vocalists. The empirical results characterised the changes in muscle tension in vocal students at the initial stage of

professional training under conditions of targeted pedagogical influence. The study involved students from three specialised artistic institutions in the United States: Indiana University, The Juilliard School, and Curtis Institute of Music. This sample made it possible to trace the manifestations of muscle tension in different educational environments, but within related vocal and pedagogical programmes. The obtained indicators reflected the initial state of bodily, respiratory and phonation coordination, as well as the dynamics of its changes during the formative stage. The main attention was focused on how pedagogically organised methods influenced the reduction of tension in the neck, shoulder girdle and lower jaw, breathing stability, the nature of sound formation and the ability of students to independently recognise their own body

clamps. The results also made it possible to compare the effectiveness of two training models: conventional vocal training and training with an additional set of methods aimed at overcoming muscle tension. This made it possible to assess not only the external reduction of certain manifestations of tension, but also changes in the way the vocal action is organised, in particular in the interaction of breathing, phonation, articulation and reflective self-control. At the initial stage, it was important to establish how widespread muscle tension is among vocal students and what level of its severity prevails. Such fixation made it possible to assess the initial state of vocal-body coordination before the implementation of the pedagogical complex and to determine whether the problem requires systemic corrective action (Fig. 1).

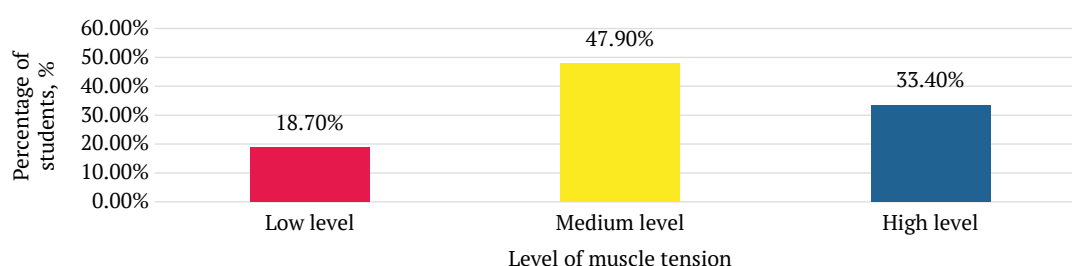


Figure 1. Distribution of students by the level of muscle tension at the baseline stage

Source: compiled by the author

The distribution also indicated that students with a medium level of muscle tension constituted the largest group (47.9%), whereas the proportion of students with a low level remained comparatively small (18.7%). This suggests that at the beginning of vocal training, balanced vocal-body coordination had not yet become stable for most participants, even in the absence of critically pronounced tension. At the same time, the relatively high proportion of students with severe manifestations of tension (33.4%) pointed to the risk of consolidating compensatory motor patterns

during the early stages of skill formation. Such a distribution demonstrated that muscle tension was associated not only with isolated technical difficulties, but also with the general organisation of breathing, posture and phonation in novice singers. The localisation of muscle tension enables the identification of body regions most actively involved in compensatory activity during singing. Such a distribution makes it possible to identify typical areas of tension in students at the initial stage and correlate them with the peculiarities of respiratory and phonation coordination (Fig. 2).

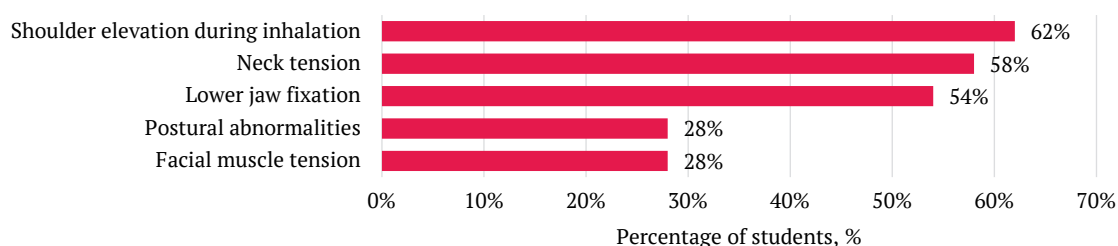


Figure 2. Localisation of the most pronounced manifestations of muscle tension at the assessment stage

Source: compiled by the author

The distribution of indicators also demonstrated that the most frequent manifestations of tension were associated with compensatory reactions occurring during the coordination of breathing and phonation. The predominance of shoulder elevation during inhalation (62%) together with high rates of neck tension (58%) and lower jaw fixation (54%) indicated that students tended to stabilise sound

production through excessive muscular effort rather than coordinated respiratory support. At the same time, lower rates of postural abnormalities and facial muscle tension (28% each) suggested that global body imbalance was less pronounced than localised tension directly involved in vocal action. This pattern indicates that, at the initial stage of training, difficulties were concentrated primarily in the

mechanisms responsible for the initiation and maintenance of sound rather than in general body organisation. Comparison of muscle tension manifestations across the Vocal Performance, Vocal Arts and Music Education programmes made it possible to clarify how the type of vocal tasks and the format of training influenced the bodily

organisation of singing. In Vocal Performance, tension was mainly associated with technically complex vocal tasks; in Vocal Arts, it appeared in combination with movement and stage performance; and in Music Education, it was more often expressed as generalised body tension with unstable breathing and unclear localisation (Table 1).

Table 1. Differences in the manifestations of muscle tension depending on the educational programme

Educational program	Type of muscle tension	Main manifestations
Vocal performance	Localised, technically induced	Tension in specific areas (neck, jaw) during technically complex vocal tasks
Vocal arts	Combined with motor activity	Tension arises in interaction with movement and stage performance
Music education	Generalised, diffuse	Overall body tension, unstable breathing, lack of clear localisation

Source: compiled by the author

The comparison across educational programmes also demonstrated that muscle tension developed through different compensatory mechanisms depending on the dominant learning activities and performance requirements. In the Vocal Performance programme, tension was more often localised and appeared during technically demanding vocal tasks, which indicated a direct connection between muscular overload and the pursuit of technical precision. In Vocal Arts, the integration of singing with movement and stage performance created additional coordination demands, causing tension to emerge through the interaction of vocal and motor activity. By contrast, students of Music Education more frequently demonstrated

diffuse and less clearly localised tension patterns, suggesting insufficiently stabilised vocal-body coordination and a lower level of differentiation between breathing, posture and phonation processes. These differences indicate that muscle tension in beginning singers is shaped not only by vocal technique itself, but also by the broader educational and performative context in which vocal skills are formed. The correlation between students' self-assessment and external expert evaluation made it possible to determine the level of reflexive control during vocal training. Comparison of these indicators makes it possible to establish how adequately students perceive their own bodily state during singing (Fig. 3).

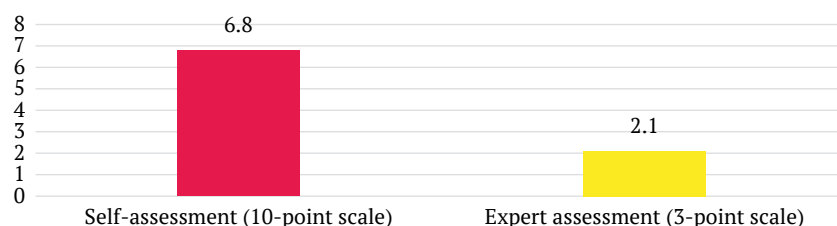


Figure 3. Correlation of self-assessment and expert assessment of muscle tension at the statement stage

Source: compiled by the author

The comparison of self-assessment and expert evaluation demonstrated a noticeable discrepancy between students' subjective perception of muscle tension and the externally observed manifestations of vocal-body imbalance. While students assessed their tension at 6.8 points on a ten-point scale, the expert evaluation reached 2.1 points on a three-point scale, which corresponded to a relatively high level of objectively recorded tension manifestations. This difference indicated that students tended to perceive muscular discomfort in a generalised way without sufficiently differentiating its localisation, intensity or connection with specific vocal actions. The results also suggested that beginning vocalists experienced difficulties in recognising compensatory muscular patterns during singing, particularly those related to breathing coordination, neck tension and jaw fixation. Such indicators point to an insufficiently developed reflective component of vocal training and

confirm the importance of pedagogical methods aimed at strengthening body awareness, self-observation and conscious regulation of vocal action.

During the 12 weeks of the formative stage, the experimental group recorded a gradual decrease in the overall muscle tension index from 2.1 to 1.2 points. The dynamics of changes was not uniform, as different components of the vocal action responded to the pedagogical influence at different rates. At weeks 1-3, the most noticeable changes concerned respiratory coordination. The frequency of shoulder raising during inhalation decreased, exhalation became more even, and the beginning of the sound became less sharp. This indicated a primary decrease in the compensatory activity of the shoulder girdle and neck. At 4-7 weeks, phonation changes became more pronounced. Students started the sound more steadily, used a hard attack less often, and were better able to hold short vocal phrases without additional forceful pressure. During this

period, the overall level of tension decreased more slowly, but the changes became more stable. At 8-10 weeks, articulatory and postural indicators began to change more noticeably. There was an improvement in mandibular control, a decrease in neck tension, and stabilisation of the head and body position during vocalisations. These components took longer to develop as they were associated with habitual motor patterns. At 11-12 weeks, the results became more stable in different performance conditions. In the exercises and vocalisations, the reduction of tension was more pronounced, while in the artistic fragments some manifestations of tension were still present. The students'

ability to identify their own tension increased from 3.2 to 6.9 points on the self-assessment scale, which showed the development of reflexive control and gradual coordination between the inner feeling and external manifestations of vocal action. Comparison of changes in the general muscle tension index between the control and experimental groups made it possible to evaluate the effectiveness of different approaches to the organisation of vocal training. Fixing the indicators before and after the formative stage made it possible to establish the extent to which targeted pedagogical influence affects the level of coordination and tension reduction (Fig. 4).

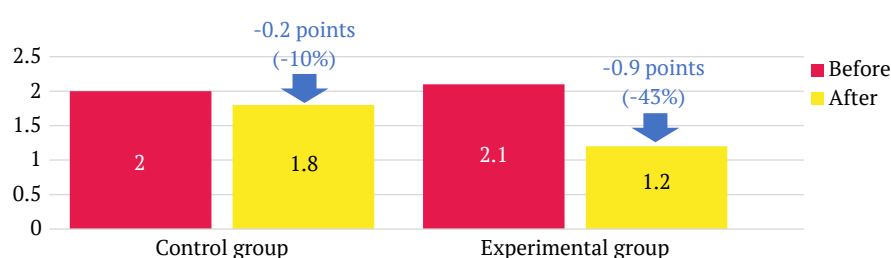


Figure 4. Dynamics of the general index of muscular tension in the control and experimental groups before and after the formative stage

Source: compiled by the author

The dynamics presented in Figure 4 showed that both groups demonstrated a decrease in the general index of muscle tension, but the scale of change was different. In the control group, the index decreased from 2.0 to 1.8 points, which amounted to a reduction of 0.2 points or 10%. In the experimental group, the decrease was considerably more pronounced: from 2.1 to 1.2 points, with a reduction of 0.9 points or 43%. Thus, the experimental group showed more than four times greater improvement than the control group. This indicates that the additional

set of pedagogical methods had a stronger effect on reducing muscle tension than standard vocal training alone. Qualitative changes in vocal technical indicators reflect not only a decrease in muscle tension, but also a restructuring of the way the vocal action is organised. Comparison of these changes between the control and experimental groups made it possible to determine how different teaching models influenced the stability of sound production, the nature of the onset, and the level of student autonomy (Table 2).

Table 2. Qualitative comparison of changes in vocal and technical indicators between groups

Vocal-pedagogical indicator	Experimental group	Control group
Sound stability	Noticeable improvement; sound became more even in exercises, vocalises, and short repertoire excerpts	Improvements were inconsistent and mainly observed in simple exercises
Onset of tone (attack)	Reduced hardness of attack; onset became softer and more coordinated	Hard attack persisted in more complex tasks and at higher dynamics
Phrasing	More even phrasing with improved breath distribution	Phrasing remained dependent on continuous teacher guidance
Articulatory freedom	Reduced jaw fixation; articulation became more flexible	Jaw tension persisted, especially in more demanding vocal passages
Dependence on teacher feedback	Increased ability to self-correct posture, breathing, and jaw position	Corrections mostly occurred after direct teacher intervention

Source: compiled by the author

The comparison of vocal-pedagogical indicators demonstrated that the experimental group showed more stable and coordinated changes across all analysed parameters. Sound production became more even not only in isolated exercises but also in vocalises and short repertoire excerpts, whereas in the control group improvements remained limited mainly to simpler technical tasks.

Differences were also observed in phonation quality: students in the experimental group demonstrated a softer and more coordinated onset of tone, while hard attack continued to appear in the control group during more demanding passages and increased dynamics. In phrasing, the experimental group achieved more balanced breath distribution and greater continuity of vocal lines, whereas students in

the control group still relied heavily on continuous teacher guidance. Changes in articulation also differed between the groups: jaw fixation decreased and articulatory movements became more flexible in the experimental group, while persistent jaw tension remained characteristic of the control group, especially in technically complex fragments. The data additionally showed a reduction in external pedagogical dependence. Students in the experimental group independently corrected posture, breathing and jaw position in 64% of cases, compared with 27% in the control group, where correction predominantly occurred only after direct teacher intervention.

The most pronounced initial effect was provided by breathing and coordination exercises, as they affected the basic mechanism of vocal action – the coordination of inhalation, exhalation and sound onset. The students gradually reduced the need to compensate for breathing instability by tensing the neck, shoulder girdle or larynx. The most rapid changes were in such indicators as shoulder raising during inhalation, abrupt onset of phonation, and uneven exhalation. This showed that breathing work was of primary importance for reducing the overall level of muscle tension. The body awareness method had a less rapid, but more lasting effect. Its result was manifested not only in the reduction of individual clamps, but also in a change in the way students observed themselves. They could more accurately identify the area in which tension arose, associate it with a specific vocal action, and respond more quickly to pedagogical instruction. The most noticeable effects of this method were on the control of the lower jaw, head position, shoulder girdle, and overall postural organisation. Verbal pedagogical modelling proved to be effective when the instructions were specific. Generalised instructions such as “relax” did not provide stable correction, as they

did not indicate the exact action to the student. Instead, phrases such as “leave your shoulders still when you inhale”, “don’t lock your lower jaw”, “start the sound softer” provided a clear reference point and reduced the number of repeated errors. This increased the controllability of the learning process. Vocal exercises with a low level of forcefulness helped to stabilise sound production. Short chants in the middle tessitura, humming, singing on comfortable vowels and legato in a small range allowed students to perform tasks without forcing the sound. However, their effect was most consistent when they were combined with breathing exercises and body control. The isolated use of such exercises reduced tension only within a specific task. The reflective vocal diary enhanced the students’ ability to record their own changes. The post-class notes helped to track in which situations tension arose most often, which exercises produced tangible results, and which pedagogical instructions were most understandable. Thanks to this, the students gradually moved from passively following instructions to consciously controlling their own vocal and bodily state. The integrated application of the methods provided a cumulative effect. Breathing exercises reduced the primary tension, body awareness helped to recognise it, verbal instructions directed correction, vocal exercises consolidated the new way of sound formation, and the diary supported reflective control. It was the combination of these methods that proved to be most effective, as it affected not a single manifestation of tension, but the entire structure of vocal action. Self-assessment made it possible to record students’ perception of their bodily state during singing and to determine the extent to which their ability to recognise muscle tension changed after the formative stage. These data complemented the results of the external assessment, as they reflected the internal level of vocal-bodily control (Table 3).

Table 3. Students’ self-assessment data on muscle tension

Indicator	Experimental group	Control group	Interpretation of results
Subjective perception of tension before the formative stage	6.8 points	6.8 points	The initial level of subjective tension was the same in both groups
Subjective perception of tension after the formative stage	3.9 points	6.1 points	The reduction was more pronounced in the experimental group
Dynamics of subjective tension	-2.9 points	-0.7 points	The set of pedagogical methods contributed to a greater reduction in internal discomfort
Discrepancy between self-assessment and expert assessment	from 1.2 to 0.4 points	slight decrease	A more accurate perception of one’s own condition was formed in the experimental group
Role of the reflective journal	Systematic recording of tension zones, causes, and correction strategies	Not applied	The journal supported the development of self-observation and reflective control

Source: compiled by the author

The results showed that in the experimental group the subjective feeling of tension decreased and the accuracy of self-observation increased. This confirmed that the pedagogical complex influenced not only the external manifestations of tension, but also the development of students’ reflexive ability to control their own state while singing. The generalisation of the data obtained showed a decrease

in the overall level of muscle tension in the experimental group, improvement of respiratory coordination and stabilisation of sound production. Respiratory and phonation indicators responded most quickly to the pedagogical influence: shoulder raising during inhalation decreased, exhalation became more even, sound onset was softer, and vocal phrases were more stable. Postural and articulatory

changes were formed more slowly. Neck tension, lower jaw fixation and unstable body position proved to be more persistent manifestations, as they were associated with fixed motor habits. Their correction required not only repetition of exercises, but also the development of body awareness and self-observation. The best results were achieved with a regular combination of several methods: breathing and coordination exercises, body awareness, vocal tasks with low strength load, specific pedagogical instructions and a reflective diary. It was the comprehensive use of these tools that ensured not a situational reduction of tension, but a gradual change in the way of vocal action. The overall dynamics showed the transition of students from dependence on external prompts from the teacher to more independent regulation of their own state. Students more accurately identified areas of tension, responded more quickly to pedagogical instructions, and more often corrected their breathing, body position, and sound production.

DISCUSSION

The obtained results made it possible to specify the pedagogical interpretation of muscle tension as a consequence of impaired coordination of vocal-body processes and to correlate it with modern approaches to vocal pedagogy. The established dominance of medium and high levels of tension at the initial stage of training was consistent with the provisions of M. Urbano & Y. Bensoussan (2025), who emphasised that muscle tension in singers is systemic and requires an interdisciplinary approach. At the same time, this study showed that even within the framework of pedagogical influence without the involvement of medical interventions, a significant reduction in tension is possible, which clarified the limits of the effectiveness of purely pedagogical means. The results, which showed a gradual decrease in tension through a combination of breathing, body and verbal methods, correlated with the findings of N. Molins-Macau (2025), who proved the effectiveness of body-mind approaches in vocal practice. However, in contrast to the generalised conclusions about the positive impact of body methods, the data obtained showed their differentiated effect: body awareness provided not a rapid reduction of tension, but stabilisation of the ability to recognise it. This made it possible to clarify the function of such approaches as a tool for long-term regulation rather than operational correction.

Observations on the localisation of stress in the neck, shoulder girdle and jaw were consistent with the results of N. Henry (2021), where these areas were identified as key in the formation of technical problems. However, the present study showed that their role changes depending on the stage of training: at the initial level, the tension is generalised, while in more trained students it becomes localised. This complemented the previous findings by introducing the factor of learning dynamics. The analysis of phonation changes, in particular the reduction of the stiffness of the sound attack, correlated with the position of J. Seesholtz (2022), who considered hyperduction as a consequence

of excessive muscle effort. At the same time, the results demonstrated that the correction of this phenomenon is possible not only through work with the vocal folds, but also through changes in respiratory coordination. This conclusion expanded the understanding of cause-and-effect relationships in the formation of phonation disorders.

The revealed dependence of the effectiveness of pedagogical influence on the sequence and load of vocal tasks was consistent with the approach of K. Lawrence (2022), where vocal activity was considered through the prism of load physiology. However, the results of the study showed that the principles of gradual complication should be complemented by the development of body awareness, otherwise even an optimally constructed load can lead to the accumulation of tension. The results on the effectiveness of the combination of methods correlated with the findings of C. Gassull *et al.* (2024), where body practices were considered as an auxiliary tool for voice optimisation. However, this study showed that the isolated use of individual methods does not provide a sustainable result. This made it possible to clarify their role as components of a single pedagogical system, rather than autonomous means. The concept of functional unity of voice proposed by B.M. Doscher (2023), found confirmation in the established interdependence of respiratory, bodily and phonation indicators. At the same time, the empirical data concretised this idea by showing that the violation of unity had different intensity depending on the component, which opened up the possibility of differentiated pedagogical influence.

The comparison of the results between the experimental and control groups was consistent with J. Sear (2024), where the structured nature of vocal training was considered a condition for improving the quality of learning. In the present study, this thesis was specified: it was not the orderliness of the classes that proved to be effective, but the organisation in which breathing, body-oriented, vocal-technical and reflective methods were combined into a single sequence. In the control group, maintaining the usual programme resulted in only a slight decrease in tension, while in the experimental group, the complex impact contributed to a more noticeable restructuring of the vocal action. This made it possible to clarify the concept of pedagogical design: it should include not only the selection of exercises and repertoire, but also the logic of the transition from external teacher correction to student self-regulation. The identified role of respiratory coordination correlated with the results of Y. Wang (2024), who emphasised the importance of conscious breath control in vocal training. At the same time, the data obtained showed that breath control had a lasting effect only if it was bodily integrated. Excessive concentration on breathing without simultaneously working with the position of the shoulders, neck, jaw, and body did not completely eliminate compensatory clamps. This clarified the boundaries of cognitively oriented approaches: breathing awareness was necessary but not sufficient without sensorimotor control. The psychological aspect of muscle tension, considered by

D. Çelik (2025), was confirmed by the change in students' self-esteem. In this study, bodily tension in vocal performance was related not only to the physical state, but also to the nature of self-perception, the level of internal control, and the psycho-emotional response to performance. The results of the present study confirmed this conclusion: after the formative stage, the subjective feeling of tension in the experimental group decreased, and the discrepancy between self-assessment and expert assessment became smaller. This indicated that the pedagogical influence changed not only the external manifestations of tension, but also the students' ability to recognise their own vocal-bodily state more accurately. The inclusion of mindfulness elements in vocal training, substantiated by X. Wang (2025), correlated with the effect of the reflective diary used in this study. In previous work, the emphasis has been placed on the connection between mindfulness practices and improved performance stability and well-being. The results obtained refined this approach, as the reflective practice produced a measurable pedagogical effect: students more often associated tension with specific vocal actions, responded more quickly to instructions, and corrected their breathing, body position, and articulation more independently. Thus, mindfulness manifested itself not as a general psychological resource, but as a tool for developing vocal self-regulation.

The reduction in dependence on the teacher was consistent with the approach of M. Hoch *et al.* (2025), in which student-centred learning was associated with the development of autonomy, awareness and students' participation in managing their own vocal development. In the present study, this position was empirically clarified: autonomy was not formed only through a change in the teacher's role or through greater freedom in learning. It developed gradually through work with specific mechanisms of vocal action, including breathing, body position, jaw position, sound attack and recognition of tension. The reduced need for constant pedagogical prompts showed that a student-centred approach required not only changes in communication, but also a methodically organised system of self-regulation.

The conclusions of T.J. Clark (2024) about the need to modernise vocal pedagogy were also confirmed by the results obtained. In the previous study, modernisation was associated with updating the content, methods and principles of vocal training in accordance with the needs of modern music education. The results of the present study have specified which components of such modernisation were effective at the initial stage: breathing coordination, body awareness, accuracy of verbal instructions and reflective self-assessment. Thus, the renewal of vocal pedagogy proved to be effective when it was aimed at restructuring the way of vocal action, and not just at expanding the methodological arsenal. The problem of training future teachers, considered by M.N. Hinds (2025), received an additional explanation through the results of this study. The work emphasised the need to strengthen the vocal and pedagogical training of students who will work with

the voice of other performers in the future. The findings concretised this thesis: pedagogical competence had to include not only knowledge of vocal technique, but also the ability to recognise muscle tension as a systemic phenomenon. It was about the ability to see the connection between breathing, posture, phonation, articulation, and the student's level of self-control. This clarified the content of the future teacher's training, since working with tension required not situational remarks, but a consistent selection of pedagogical methods. In general, the comparison of the results revealed that current research captures certain aspects of the problem of muscle tension, while the data obtained demonstrated it as an integrative pedagogical phenomenon. This made it possible not only to confirm the existing provisions, but also to clarify them in the direction of systematic organisation of vocal training.

CONCLUSIONS

It was established that muscle tension in vocal singing resulted from impaired coordination of breathing, phonation, articulation and posture. It appeared as compensatory tension in the neck, shoulder girdle and jaw, which initially supported sound production but later became fixed as an ineffective motor pattern. Its reduction required breathing and coordination exercises, body awareness, controlled vocal tasks, precise verbal instructions and reflective practices. The empirical test confirmed the effectiveness of the proposed complex. In the experimental group, the overall tension index decreased from 2.1 to 1.2 points, compared with 2.0 to 1.8 points in the control group. Shoulder raising during inhalation decreased by 41%, jaw tension by 36% and neck tension by 33%, while in the control group these indicators changed by 12%, 10% and 9%. Students in the experimental group independently corrected body position and breathing in 64% of cases, compared with 27% in the control group. Subjective tension decreased from 6.8 to 3.9 points, and the discrepancy between self-assessment and expert assessment declined from 1.2 to 0.4 points. It was found that the integrated use of methods ensured the greatest pedagogical effect. Breathing exercises reduced primary tension, body awareness and reflective diary entries strengthened self-observation, verbal instructions improved correction accuracy, and vocal exercises consolidated new coordination. Consequently, the overall tension index decreased from 2.1 to 1.2 points, subjective tension from 6.8 to 3.9 points, and students independently corrected body position and breathing in 64% of cases. The study was limited by the small sample of beginner students, the 12-week observation period and the absence of instrumental physiological measurements. Further research was considered promising in terms of expanding the sample, including students with different levels of training, extending the observation period and applying instrumental methods for assessing muscle activity.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Педагогічні методи подолання м'язової напруги у студентів-вокалістів на початковому етапі навчання

Анотація. Метою дослідження було визначення ефективності комплексу педагогічних методів для зменшення м'язової напруги у студентів-вокалістів на початковому етапі навчання. Методологія передбачала квазіекспериментальний дизайн з попереднім та підсумковим тестуванням, що реалізовувався протягом 12 тижнів навчального семестру. Було використано поєднання теоретичного узагальнення підходів до природи м'язової напруги та емпіричного тестування впливу педагогічного комплексу на вибірці з 48 студентів, розділених на експериментальну та контрольну групи. Результати показали, що на початковому етапі переважали середній та високий рівні м'язової напруги, переважно в області шиї, плечового пояса та нижньої щелепи. Протягом 12-тижневого формувального етапу в експериментальній групі спостерігалось зниження загального індексу напруги з 2,1 до 1,2 бала. Найбільш виражені зміни стосувалися показників дихання та фонації: підняття плечей під час вдиху зменшилося на 41 % порівняно з 12 % у контрольній групі, напруга щелепи – на 36 % порівняно з 10 %, а напруга шиї – на 33 % порівняно з 9 %. Студенти експериментальної групи також самостійно коригували положення тіла та дихання у 64 % випадків, тоді як у контрольній групі цей показник не перевищував 27 %. Рівень суб'єктивної напруженості знизився з 6,8 до 3,9 балів в експериментальній групі та лише з 6,8 до 6,1 балів у контрольній групі, тоді як розбіжність між самооцінкою та експертною оцінкою зменшилася з 1,2 до 0,4 балів. Практичне значення дослідження полягає в можливості використання обґрунтованого комплексу методів для систематичного формування голосово-тілесної координації та розвитку навичок саморегуляції у студентів

Ключові слова: дихальна координація; фонація; артикуляція; звукоутворення; тілесна свідомість; саморегуляція