

# Singers' Vocal Function Knowledge Levels, Sensorimotor Self-awareness of Vocal Tract, and Impact of Functional Voice Rehabilitation on the Vocal Function Knowledge and Self-awareness of Vocal Tract

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**Summary: Objectives/Hypothesis.** This study investigated vocal function knowledge and vocal tract sensorimotor self-awareness and the impact of functional voice rehabilitation on vocal function knowledge and self-awareness.

**Study Design.** This is a prospective, randomized study.

**Methods.** Twenty singers (study group [SG]) completed a questionnaire before and after functional voice rehabilitation. Twenty additional singers, representing the control group, also completed the questionnaire without functional voice rehabilitation at a 3-month interval. The questionnaire consisted of three parts. The first part evaluated the singers' attitude to the anatomical and physiological knowledge of the vocal tract and their self-esteem of the knowledge level. The second part assessed the theoretical knowledge of the singers' vocal tract physiology. The third part of the questionnaire assessed singers' sensorimotor self-awareness of the vocal tract.

**Results.** The results showed that most singers indicated that knowledge of the vocal tract's anatomy and physiology is useful (59% SG, 67% control group). However, 75% of all participants defined their knowledge of the vocal tract's anatomy and physiology as weak or inadequate. In the SG, vocal function knowledge at the first assessment was 45%. After rehabilitation, the level increased to 67.7%. Vocal tract sensorimotor self-awareness initially was 38.9% in SG but rose to 66.7%.

**Conclusions.** Findings of the study suggest that classical singers lack knowledge about the physiology of the vocal mechanism, especially the breathing patterns. In addition, they have low sensorimotor self-awareness of their vocal tract. The results suggest that singers would benefit from receiving services from phoniatrists and speech-language pathologists during their voice training.

**Key Words:** vocal tract self-awareness—singers' functional voice rehabilitation—singing voice—education—knowledge.

## INTRODUCTION

Through the ages, a great number of singers trained their voices by controlling their vocal production by listening particularly to their voice quality. Additionally, to achieve the desired voice quality in a young singer, singing teachers refer to the student's imaginations (eg, sing in a closer position). Recently, an increasing number of singing teachers emphasize the importance of the anatomy and physiology of the vocal tract in singing voice training.<sup>1,2</sup> It has been hypothesized that if voice training was based on auditory training combined with learning the correct movements and adequate tension within the vocal tract structures, improvement of sensorimotor self-awareness of the singer's body, relaxation, and respect for vocal and life hygiene, then the singer's vocal production would be more effective.<sup>1</sup>

Various authors have described the benefits of the improvement of vocal function knowledge among professional voice users for more than 20 years. Chan found evidence that 1.5-hour workshops

conducted among kindergarten teachers, with short lectures on the anatomy and physiology of the vocal tract along with vocal hygiene and explanation of the consequences of vocal abuse, contributed to the improvement of the voice quality in this group of subjects.<sup>3</sup> Andrews also reported that young voice users benefit from voice production knowledge and vocal hygiene education.<sup>4</sup>

Previous studies have used various questionnaires to determine the singers' attitudes to seek out vocal function knowledge and to evaluate vocal function knowledge.<sup>5-7</sup> Classically trained singers more often search for information about voice (62%) compared with nonsingers (10%).<sup>5</sup> Braun-Janzen and Zeine found that professional singers are more interested in gaining further knowledge on vocal function and dysfunction. They noted that the perceived knowledge of vocal dysfunction is low among singers.<sup>6</sup> According to Braun-Janzen and Zeine's study of a group of singers, knowledge of vocal tract anatomy and physiology overall was 45% using a standard questionnaire. This level is slightly higher among professionals (51%) than among amateurs (41%).<sup>6</sup> Kwak et al demonstrated no statistically significant difference in the vocal knowledge across three levels of voice training.<sup>7</sup>

The previous studies suggest a need for further understanding of singers' knowledge of vocal function. The present study examined the understanding of vocal function following a voice rehabilitation program.

Previous investigators found evidence supporting the fact that if in motor learning, the learners' attention was directed to the

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effects of their movements and not to the details of their own action, then, the learning process was more effective.<sup>8–11</sup> Watkins<sup>12</sup> and Chen and Singer<sup>13</sup> in their studies showed that the perception of self-control enhances the learning process. McNevin *et al* emphasized that the self-awareness of the body motion is crucial in those who need to change incorrect body movements. They suggested that in the first stage of voice rehabilitation, “internal focus of attention is introduced because focusing on effects of one’s action would, from the therapist’s perspective, defeat the goal of the treatment, which is as much about movement retraining as it is about teaching patients how to perform each activity safely.”<sup>14</sup> Currently, none of the studies indicated the level of sensorimotor self-awareness of the vocal tract in singers, or the impact of the functional voice rehabilitation on the vocal function knowledge or on the sensorimotor self-awareness.

## OBJECTIVES

The objectives of the present study were to (1) assess vocal function knowledge and self-esteem of the knowledge level in singers who report to the phoniatics clinic; (2) evaluate vocal tract sensorimotor self-awareness in singers who report to the phoniatics clinic; and (3) determine the changes in knowledge and sensorimotor self-awareness in singers following functional voice rehabilitation.

## METHOD

The Polish Regional Ethics Committee approved this study (No. KB 226/2010), and each participant gave written consent to participate. Forty singers performing classical music (solo or in choir) participated in the study. [Table 1](#) contains subjects’ biographical information. They were recruited from singers who submitted to the phoniatics clinic of the Medical University of Warsaw in 2010–2013 with disorders related to their singing voice. Inclusion criteria for participation in the study were voice disorders in singing, 1 year minimum signing experience, and consent by

the singer for participation. Exclusion criteria included a normal singing voice and less than 1 year of singing experience. The study group (SG) consisted of subjects who volunteered for functional voice rehabilitation. Singers who did not opt for vocal rehabilitation consisted of the control group (CG).

The singers were diagnosed with muscle tension dysphonia in singing. In addition, seven singers (three in SD and four in CG) were diagnosed with vocal nodules. The diagnosis was made after collecting the medical history, physical otorhinolaryngology examination with palpation of the vocal tract structures, perceptual speaking and singing voice assessment, maximal phonation time, acoustic analysis, videolaryngostroboscopy, flexible fiberoptic evaluation of the pharynx and the larynx, and the voice handicap index score.

## The questionnaire

All subjects completed the questionnaire shown in the Supplementary [Appendix](#). The questionnaire had been established for 2 years before the onset of the study. The questionnaire consisted of three parts. The first part evaluated the singers’ attitude toward the anatomical and physiological knowledge of the vocal tract and their self-esteem of the knowledge level. The second part assessed the theoretical vocal tract physiology knowledge. The last part of the questionnaire evaluated the singers’ sensorimotor self-awareness of the vocal tract.

The results of the survey’s third part were compared with palpation of the neck and fiberoptic nasopharyngeal assessment. In the palpation and fiberoptic examination, the movements and tensions of individual vocal tract structures were assessed. To minimize the subjectivity, the second palpation of the neck assessment was conducted without prior knowledge of the results of the first assessment. Results of the initial and final palpation of the vocal tract structures and the questionnaire’s answers were compared after conducting the second full phoniatic evaluation.

The questionnaire’s first part consisted of two questions, the second part consisted of 14 questions, and the last, the third part, consisted of nine questions. Singers obtained 2 points for each correct answer to most questions from the survey’s second and third parts. For correct answers to questions 6, 12, and 16 (Q6, Q12, and Q16), subjects could get respectively 3, 3, and 5 points, which depended on the amount of selected responses (Q12 and Q16) and, in the authors’ opinions, the importance of questions (Q6). A participant could obtain 1 point for Q4 and Q7 (low degree of difficulty) and Q23 (very high degree of difficulty, requiring very careful observation of the singer’s body). After responding all questions from the second part of the survey correctly, participant obtained up to 30 points. Maximal score from the assessment of self-awareness of the vocal tract (questionnaire’s third part) was 18 points, and it could be achieved after answering nine questions correctly.

The questionnaire evaluated a singer’s knowledge of the vocal function and sensorimotor self-awareness of the vocal tract during the first voice assessment. Following completion of the questionnaire, functional voice rehabilitation was initiated in the SG. The SG completed the questionnaire a second time following the rehabilitation. In CG, the knowledge assessment was conducted twice, with an interval of at least 3 months (the interval

**TABLE 1.**  
**Biographical Information**

	Study Group (N = 20)	Control Group (N = 20)
Age		
Mean ± SD	23.8 ± 8.8	25.2 ± 8.8
Median	21	24
Range	15–56	15–48
Gender		
M	N = 7	N = 4
F	N = 13	N = 16
Individual singing training		
Mean ± SD (y)	1.15 ± 1.46	3.25 ± 2.89
Median	0.5	3
Range (y)	0–4	0–11
Singing time		
Mean ± SD (y)	6.95 ± 4.61	8.65 ± 5.91
Median	7	9
Range (y)	1–16	1–20

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