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Potential link between playing wind instruments and vocal tract disorders. A literature review

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Abstract

Introduction and purpose: Currently, we can distinguish three basic groups of instruments. These are wind instruments, percussion instruments, and plucked instruments. In the case of wind instruments, the source of sound is a vibrating column of air, which is created by blowing by the player. It is suspected that such vibration may cause specific vocal and laryngeal symptoms. The aim of the study was to present the current state of knowledge regarding the potential relation between playing wind instruments and vocal tract disorders.

Material and methods: The article reviews 19 publications available on the PubMed and Google Scholar, Web of Science databases meeting assumed criteria: published as a full text,

without time limit and conducted on humans. The studies were found using initially established searching strategies as well as subsequent manual searching in order not to miss adequate articles.

State of knowledge: Laryngeal symptoms may be combined with vocal symptoms. The main raised vocal manifestations among instrumentalists are dysphonia, hoarseness, and altered voice quality. Comparing a group that used wind instruments with control, VHI-10 (Voice Handicap Index) and F0 (fundamental frequency) and HNR (harmonics-to-noise ratio) were higher while jitter % and shimmer %, which are perturbation parameters, were lower in the study group. The majority of studies has a limitation because they were performed in a limited number of volunteers.

Conclusions: The symptoms of the vocal tract related to playing wind instruments are characterized by a low frequency of occurrence and intensity. However, further research is needed to assess this relation.

Key words: health; voice disorders; wind instrument

Introduction and purpose:

Wind instruments form a large group of instruments in which the sound is created as a result of vibrations of the blown air. Due to the material from which the mouthpiece is made, wind instruments are divided into brass and woodwind instruments [1]. Wind players are able to sustain high intraoral pressures with the purpose of generating the sound, but it may lead to some associated complications including throat clearing, hoarseness, dysphonia, and vocal failures [2,3]. That is why throughout the last decades, there has been increasing interest in the health issues of musicians and instrumentalists [1,4,5,6].

It is noted that the susceptibility to the mentioned manifestations may be associated with prior vocal alteration and inappropriate vocal habits [3]. Moreover, another factor influencing the risk of vocal complaints is the period of time from which the instrument is played. It is predicted that less experienced musicians more often use the inadequate technique of extracting sound as well as have no necessary conditioning while playing [7]. As a result, it may contribute to excessive glottic tension [8]. It is also mentioned that hours of practicing impact on the condition of the vocal tract [3]. Therefore, diagnosis of vocal problems should include aspects related to personal issues as well as work organization [3,9].

The aim of the study was to present the current state of knowledge concerning the potential relation between playing wind instruments and vocal and laryngeal symptoms.

Material and methods:

The search was conducted on 13 December 2021. The following keywords were used: “wind instruments” OR “wind instrumentalists” AND “vocal” OR “voice” OR “laryngeal symptoms” OR “voice disorders”. The materials available in the PubMed, Web of Science,

and Google Scholar databases were analyzed, meeting the inclusion criteria as follows: papers published as full text, spanning the last 15 years of research, conducted on humans and delving into wind instruments and their potential influence on the development of voice disorders. Manual searching of retrieved studies was performed not to miss matching studies. Original and review papers were referred to while letters to the editor were not included as well as papers with an annotation as “preprint”. Eventually, 256 results were obtained, of which, after reading the abstracts, 19 works were selected for analysis, fulfilling the assumed criteria.

State of knowledge:

Laryngeal and vocal symptoms

In the study by Lonsdale et al., the aim of the study was to evaluate playing-related health problems in a group of 98 student musicians at a university in Malaysia (29 woodwind, 14 Brass instruments; age 18–50, average 21.9). Furthermore, their knowledge as well as awareness of such problems were assessed simultaneously. The methodology of this study was based on a self-report online survey that was addressed to instrumental music students enrolled in undergraduate and postgraduate university music courses including flute, oboe, clarinet, saxophone, trumpet, trombone, and other instruments’ players [10]. The survey consisted of the following aspects: history of physical problems, lifestyle factors, playing experience, and many other issues. Twelve students had experienced throat discomfort, four playing-related tension, and five complained of pain. However, it was not indicated whether these symptoms had manifested only in wind instruments’ players or affected other students [10].

Measurement of vocal-tract influence during saxophone performance was described in the study by Scavone et al. The experiments were based on a measurement system that enabled a comparison of the upstream windway and downstream air column impedances during normal playing conditions. This approach investigated the vocal-tract impact on the full range of the saxophone. The results revealed that instrumentalists may generate an upstream windway resonance being strong enough in order to override the downstream system in controlling reed vibrations [11]. In another study by Weikert, laryngeal movements were assessed by video-endoscopy while playing saxophone. The larynx was referred to as a vital structure, in which constant low position during blowing makes it possible to play complicated and demanding phrases on saxophone [12]. Nevertheless, the aforementioned way of using the larynx can lead to laryngeal symptoms and vocal disorders such as dryness, sore throat, throat irritation, altered vocal quality, hoarseness, dysphonia, throat clearing [7, 9, 10, 13, 14].

The evaluation of vocal parameters was conducted by Tuhanioglu et al. in order to analyze the impact of wind instruments on vocal tract function and compare these results with the control group. The study was carried out in an otolaryngology outpatient clinic with 60 volunteers, men, age range 18-53 (30 musicians and 30 healthy subjects who had never played a wind instrument) [15]. The patients with a prior history that may have influenced the outcome, were excluded from the examination. The following structures were assessed in all

participants: oral cavity, nasal cavity, nasopharynx, and larynx. Moreover, the Turkish modification of the Voice Handicap Index 10 (VHI-10) scale was used to quantify between 0 and 4 the vocal symptoms of the subjects. Subsequently, the fundamental frequency F0, shimmer %, jitter %, and harmonics-to-noise ratio (HNR) were measured on acoustic voice analysis [15]. What was obtained is an increase in VHI-10 as well as an increase in F0 and HNR while a decrease in jitter and shimmer in musicians was noted in subjects who played wind instruments [15].

On the contrary, the impact of playing an instrument was demonstrated in the study by Trollinger who examined vocal fold paresis in voice patients. One hundred and three subjects who underwent laryngeal EMG were enrolled (47 wind instrumentalists and 56 non-wind instrumentalists). It was proved that playing wind instruments in voice patients with paresis is associated with increased severity of laryngeal nerve damage [16]. Furthermore, the kind of wind instrument played was statistically significant, however moderately correlated to the recruitment rating scale [16].

Playing wind instruments may contribute to changes within the vocal tract. Palate paralysis among woodwind players, pharyngocele, laryngocele, polyps as result were described by Gallivan as complications. It was highlighted that degrees of glottic opening, closure, configuration, and function varied depending on the kind of instrument played [17], starting from alto saxophone through a French horn to a standard B-flat trumpet. In the study by Costa et al., it was claimed that trumpet and clarinet players demonstrated larger diverticula through videofluoroscopic, on the right as well as left side [18].

Cappellaro et al. assessed vocal tract discomfort and quality of life in the voice of wind instrumentalists in a cross-sectional study. The 37 musicians of the orchestra took part in a nonstandard questionnaire involving professional information, the Vocal Tract Discomfort (VTD) scale, the Voice-Related Quality of Life (V-RQOL). The participants achieved high scores in the V-RQOL survey. Some of the symptoms assessed by the VTD were in a negative correlation with V-RQOL scores and with the length of orchestra membership [7].

In another study by Chapman, the aim of the study was to recognize problems concerning the improper use of the glottis and implement adequate practice strategies. There are many trumpet players who show signs of misuse of the glottis when trying to play the high register by generating weak and pinched sound [19]. The problem can be caused by engaging the Valsalva maneuver by musicians. Eckley and co-workers conducted a similar study in which wind instrument players were evaluated using videolaryngoscopy [13]. It was noted that in all the subjects musical tones were played with adducted vocal folds. Furthermore, the greater the technical difficulty raised by the musician, the more it was related to constriction in the vocal tract and increased lateral tension in the larynx [13].

Factors associated with vocal and laryngeal symptoms in wind instrumentalists

Apart from the reasons arising from the playing of wind instruments itself, there are many factors influencing vocal and laryngeal symptoms indirectly. It is indicated to distinguish two aspects: related to work organization and personal issues [3]. The first is the working time, intense use of the instrument while the second aspect involves previous altered

voice, inappropriate vocal habits, and cervical pain [3]. Besides, the wind instrument categories were not considered in most studies. However, woodwind instruments may have slightly different symptoms compared to brass instruments, but this requires research taking into account factors that interfere with the final result [3]. Delving into this issue, there are changes in the air column depending on the instrument used, which may contribute to inefficient sound production [3,15].

Conclusions:

Symptoms of vocal tract disorders are characterized by low frequency and intensity of occurrence among wind instrumentalists. The relationship between playing and voice manifestations should be confirmed based on the exclusion of incorrect practice habits as well as improper work organization. There is a high need for further studies assessing the impact of playing wind instruments on laryngeal symptoms and vocal discomfort including analysis of individual factors that may strengthen the prevalence of such manifestations.

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