

Vocal Quality in Theater Actors

*Evelien D'haeseleer, *Iris Meerschman, †Sofie Claeys, *Clara Leyns, *Julie Daelman, and
*‡Kristiane Van Lierde, *†Ghent, Belgium, and ‡Pretoria, South Africa

Summary: Objectives. The purpose of this study was to investigate vocal quality, vocal complaints, and risk factors for developing voice disorders in theater actors. Secondly, the impact of one vocal performance on the voice was investigated by comparing objective and subjective vocal quality before and after a theater performance.

Study Design. Prospective study of the actors' voice prior to and after a performance

Methods. Speech samples of 26 theater actors (15 men, 11 women, mean age 41.9 years) were recorded before and after a theater performance of one and a half hour and analyzed using the software program *Praat*. Speech samples consisted of the combination of sustained phonation and continuous speech. For each speech sample, the Acoustic Voice Quality Index was calculated. Auditory perceptual evaluations were performed using the GRBASI scale. Questionnaires were used to inventory vocal symptoms and influencing factors.

Results. Acoustic analysis showed a mean Acoustic Voice Quality Index (AVQI) of 3.48 corresponding with a mild dysphonia. Fifty percent of the theater actors reported having (sometimes or regularly) vocal complaints after a performance. The questionnaire revealed a high presence of vocally violent behavior and poor vocal hygiene habits. Objective vocal quality, measured by the AVQI, did not change after a theater performance. The auditory perceptual evaluation of the overall grade of dysphonia showed a subtle amelioration of the vocal quality.

Conclusions. The results of this study showed the presence of mild dysphonia, regular vocal complaints, and poor vocal hygiene habits in theater actors. A theater performance did not have an impact on the objective vocal quality.

Key Words: Vocal quality—Acoustic analysis—Vocal symptoms—Theater actors—Theater performance.

INTRODUCTION

Theater actors are a special group of elite vocal performers where the slightest vocal difficulty can have serious professional consequences. Dysphonia in theater actors can reduce the quality of the theater performance or in worst case scenario result in a cancellation of the entire show. Secondly, it can result in occupational, emotional, and moral problems.¹ Little is known about the presence of voice disorders in actors. Novak et al² found that vocal fatigue as a result of laryngeal hyperfunction was a frequent symptom in well-trained actors. According to Hoffman-Ruddy et al,¹ some of the more prevalent voice disorders experienced by elite vocal performers are dehydration, chronic laryngitis, and chronic laryngeal muscle tension. However, there are no exact prevalence data. Van Houtte et al³ investigated the prevalence of laryngeal pathology in patients consulting with dysphonia at the ear, nose, and throat department. Professional voice users accounted for 41% of the patients, of which 16% were artists (including actors). There is a need for more precise information about the presence of voice disorders and vocal complaints in theater actors.

Some authors described vocal pathology and vocal habits in a group of acting students. Lerner et al⁴ performed a retrospective study and found an increased prevalence of videostroboscopic

abnormalities like incomplete glottal closure (62%), laryngeal hyperfunction (59%), and decreased mucosal wave (55%) in first-year drama students. Timmermans et al⁵ compared the vocal quality of future musical and theater actors with nonvocal professionals and found worse objective vocal quality in the first group as well as a higher prevalence of inflammatory lesions (27%). Moreover, questionnaires revealed poor vocal hygiene habits in the acting students. The actor students took less precautions for the care of their voices. According to Timmermans et al,⁵ they smoke too much, shout and talk too much, they have bad eating habits, and underestimate the risks to their voices. The question remains whether poor vocal quality, bad vocal hygiene habits, and views on vocal care change during their later professional carrier. It is clear that this group of (future) elite vocal performers is at risk for developing voice disorders.

Vocal demands in this special group of voice users are unique. Theater actors must be able to adjust their voice production to theaters of varying size while maintaining the ability to express the full range of human emotion.⁶ On stage, they project their voice over the crowd's noise, sometimes accompanied by extreme physical efforts, or sudden emotional outbursts, such as screaming, crying, and laughing.⁷ Sometimes they imitate voices or use a forced voice. Roy et al⁷ describe this as vocally violent behavior. Performances often require long rehearsals characterized by intensive vocal use (and or vocal abuse). The stage environment is an important influencing factor for voice production in elite vocal performers.¹ Theaters are sometimes dusty and amplification can be improper. On stage, smoke during a theater performance can also affect the vocal quality. The costumes of actors are sometimes difficult to tolerate because of the weight, dust, or certain physical restrictions. Finally, makeup that restricts facial movements can make projection and articulation more difficult.¹ These are risk factors possibly causing changes to laryngeal anatomy and physiology.¹

Accepted for publication November 8, 2016.

This work is presented at the 45th Annual Symposium of the Voice Foundation in June 2016 and at the congress of the IALP in August 2016.

From the *Department of Speech, Language and Hearing Sciences, Ghent University, Ghent, Belgium; †Department of Otorhinolaryngology and Head and Neck Surgery, Ghent University Hospital, Ghent, Belgium; and the ‡Department of Speech-Language Pathology and Audiology, University of Pretoria, Pretoria, South Africa.

Address correspondence and reprint requests to Evelien D'haeseleer, Department of Speech, Language and Hearing Sciences, Ghent University, De Pintelaan 185, 2P1, 9000 Ghent, Belgium. E-mail: Evelien.Dhaeseleer@ugent.be

Journal of Voice, Vol. 31, No. 4, pp. 510.e7–510.e14

0892-1997

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<http://dx.doi.org/10.1016/j.jvoice.2016.11.008>

The purpose of this study was to investigate vocal quality, vocal complaints, and risk factors for developing voice disorders in theater actors. Secondly, the impact of one vocal performance on the voice was investigated by comparing objective and subjective vocal quality immediately before and after a theater performance of one and a half hour.

METHODS

Subjects

Voice samples from 33 actors in Flanders were collected before and after a theater performance of one and a half hour (mean: 96 minutes, SD: 25 minutes). Signal-to-noise ratio (SNR) was calculated for each speech sample. Speech samples with an SNR below 20 were excluded from the study ($n = 7$). Eventually, speech samples from 26 theater actors (15 men, 11 women) were retained for further analysis. All subjects were professional theater actors who earn a living by acting, with a minimum of 2 years of experience (Table 1). The mean age of the actors was 41.9, ranging from 23 to 69 years. Each actor had a leading role in the theater performance. Education level of the subjects is presented in Table 1. Because the inclusion criterion was having a leading role in the play, the actors were recruited from different theater performances. The speaking duration of the subjects during the performance is presented in Table 1. Each performance was a theater play (without singing) and with a duration of one and a half hour. Musical performances were excluded because this genre is characterized by different vocal use and vocal load (ie, combination of acting and singing).

Methods

This study was performed according to the Declaration of Helsinki and approved by the Ethics Committee of the Ghent University Hospital (registration number: B670201526000). Informed, written consent has been obtained from each participant. The study design is a prospective study of the actors' voice prior to and after a performance.

Voice recordings

Voice recordings were performed immediately before and after the theater performance in the same room. All voice samples were

recorded using a Samson C01U USB condensator microphone, digitalized at a sampling rate of 44.1 kHz using the software program *Praat* (Institute of Phonetic Sciences, University of Amsterdam, The Netherlands). The subjects were instructed to produce the sustained vowel /a/ at habitual pitch and loudness. A midvowel segment of 3 seconds was retained for further analysis. Secondly, continuous speech during reading was recorded. The subjects were asked to read aloud a Dutch phonetically balanced text "Papa en Marloes"⁸ at habitual pitch and loudness. Each final speech sample consisted of the combination of the midvowel /a/ segment and continuous speech during the first two sentences of the text.

Acoustic measures

For the acoustic analysis of the speech samples, consisting of a combination of a sustained vowel and continuous speech, the procedure of Maryn and Weeninck⁹ was used. All analyses were performed in *Praat* by the same speech-language pathologist (ED). Objective measurement of vocal quality consisted of the following six parameters: smoothed cepstral peak prominence (CPPS), harmonics to noise ratio (HNR), shimmer local (SL), shimmer local dB (SLdB), general slope of the spectrum (slope), and tilt of the regression line through the spectrum (tilt). Because some of the above acoustic measures are only valid for voiced segments of the continuous speech sample, the algorithm of Maryn et al¹⁰ for detection, segmentation, and concatenation of the voiced samples was used in *Praat*. Secondly, the speaking fundamental frequency (SFF in Hz) of the continuous speech sample was calculated. For each speech sample, the SNR was calculated.

Finally, the Acoustic Voice Quality Index (AVQI) was calculated. AVQI is a recently developed objective method to quantify the severity of overall dysphonia using a multiparameter approach based on both continuous and sustained vowel recordings. Several studies have shown that AVQI is a robust and valid method to measure overall dysphonia in speech.⁹ The AVQI is constructed as $9.072 - 0.245 \times \text{CPPS} - 0.161 \times \text{HNR} - 0.470 \times \text{SL} + 6.158 \times \text{SLdB} - 0.071 \times \text{Slope} - 0.170 \times \text{Tilt}$ ⁹ and ranges from 0 to 10. The higher the score of the AVQI, the worse is the overall vocal quality. The cutoff score between normal and dysphonic voices is 2.70.⁹

TABLE 1.
Characteristics of Professional Voice Use in Theater Actors

	Mean	Median	Minimum	Maximum	SD
Acting (hours in a week)	10.5	8	2	30	6.8
Rehearsals (hours in a week)	19.9	20	5	49	13.1
Duration of the performance (minutes)	96	95	50	150	25
Speech duration during the performance (minutes)	70.45	75	30	120	29.36
Experience (years)	20.4	19.5	2	50	11.9
Education, n (%)					
College/university degree in drama	23 (69.7)				
College/university degree in directing	2 (6)				
Drama courses	1 (3)				
No education in drama	7 (21.2)				

SD, standard deviation.

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