

Pathological Vibratory patterns of the Vocal Folds Observed by the High Speed Digital Imaging System

Seiji Niimi, M.D., D.M.Sc

Department of Speech Physiology, Faculty of Medicine,
University of Tokyo, Japan

Introduction

It is generally known that many cases of pathological rough voice are characterized not by simple random perturbations but by quasi-periodic perturbations in the speech wave. However, there are few studies on the characteristics of perturbations in vocal fold vibrations associated with this type of voice. We have been conducting studies of pathological vocal fold vibration using a high-speed digital image recording system developed by our institute. Compared to the ordinary high-speed-motion picture system, the present system is compact and simple to operate and thus, it suited for pathological data collection.

The purpose of the present study is to clarify the production mechanism of the pathological voice especially highly rough voice.

Method

The high-speed digital image recording system was used to record the vibration pattern of the vocal folds. The system consists of a camera with photosensor, a computer which scan the image at pretty high scan rate and convert the image information into digital information and digital information into image as well, and an image memory pack with store the digitalized image information.

The frame rate, spacial resolution and the recording time are in the trade off relation. In this study the temporal resolution was 2500 images per second and recording time was 7 sec.

The edges of the vocal folds are detected automatically by the computer and the time courses of the movements are displayed with the acoustic signals.

Subjects of the present study were two cases of unilateral vocal fold palsy, a case of unilateral thyroarytenoid muscle palsy, a case of unilateral vocal fold polyp, a

case of unilateral monocorditis and two cases of "bamboo node lesion". All these patients were out patients of the voice and speech clinic in the Tokyo University Hospital whose voice demonstrated severe hoarseness and occasional diplophonia.

Results

Vibratory patterns of the vocal folds could be classified into two different groups. Group 1 showed asymmetric vibration between right and left vocal fold which produced the quasi-periodic perturbations of the acoustic. Group 2 did not show the difference between both vocal folds. However, the front and back portion of the glottis moved differently. It also produced the quasi-periodic perturbations of the acoustic signals.

Discussion and conclusions

There are various acoustic parameters which could be responsible to induce the acoustic impression of roughness. In this study, we focused on the quasi-periodic perturbations of the acoustic wave form. By using the high speed digital imaging technique, it was clarified that not only the asymmetric vibrations between both vocal folds but the different vibration patterns observed at the front and back portion of the glottis can contribute to make rough voice