Acoustic and Perceptual Characteristics of the Voice in Patients With Vocal Polyps After Surgery and Voice Therapy

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Summary: Objective. The aim of the study was to assess the effect of endolaryngeal phonomicrosurgery (EPM) and voice therapy in patients with vocal fold polyps using perceptual and acoustic analysis before and after both therapies.
Methods. The acoustic tests and perceptual evaluation of voice were carried out on 41 female patients with vocal fold polyp before and after EPM and voice therapy. Both therapy strategies were performed. Used acoustic parameters were Jitter percent (Jitt), pitch perturbation quotient (PPQ), shimmer percent (Shim), amplitude perturbation quotient (APQ), fundamental frequency variation (vF0), noise-to-harmonic ratio (NHR), Voice Turbulence Index (VTI). For perceptual evaluation, GRB scale was used.
Results. Results indicated higher values of investigated parameters in patients' group than in the control group ($P < 0.01$). Good correlation between the perceptual hoarseness factors of GRB scale and objective acoustic voice parameters were observed. All analyzed acoustic parameters improved after the phonomicrosurgery and voice therapy and tend to approach to values of the control group. For Jitt percent, Shim percent, vF0, VTI, and NHR, there were statistically significant differences. Perceptual voice evaluation revealed statistically significantly ($P < 0.01$) decreased rating of G (grade), R (rough) and B (breathy) after surgery and voice therapy.
Conclusions. Our data indicated that both acoustic and perceptual characteristic of voice in patients with vocal polyps significantly improved after phonomicrosurgical and voice treatment.
Key Words: Acoustic voice analysis–Perceptual voice evaluation–Vocal polyps–Voice–Phonomicrosurgery.

INTRODUCTION

Polyps are caused by submucosal bleeding of the vocal cords, in combination with infection, allergy, pollution or endocrine disorders, voice misuse, and smoking.[1] They can vary in size, shape, and color. Some polyps are roundish, limited, pedunculated, whereas some can be attached on a wider stem covering a larger part of the vocal fold.[2] In size, they vary from a pinhead to those of a corn grain. They are usually located 3 mm behind the anterior commissure on the free edge or the subglottic surface of the vocal fold and most frequently unilateral.[3] The clinical features are dominated by more or less prominent hoarseness, roughness, breathiness, depending on the size or position of the polyps. The increase in mass of one vocal fold tends to lower vocal pitch and to restrict pitch range. Acoustic analysis profile shows increase of Jitter and Shimmer measures because the polyp tends to lag behind the vocal fold vibration and has its own vibratory pattern, the successive vibrations of which are often aperiodic.[3,4] The incompetent vocal fold adduction allows air to leak, causing an increase in noise in the vocal note, which is reflected in a reduced harmonic-to-noise ratio.[3] Vocal polyps are usually removed surgically, after which the patient is referred to a vocal therapist who is then to decide on the necessity, type, and duration of voice therapy.[2,3] In view of the phonation complexity and of the vocal folds structure, it is necessary to plan the implementation of phonosurgical procedure very carefully and for each patient individually, because such procedure sometimes is not justified. It is also vital to determine the right timing for the procedure.

Vocal polyps may also be treated with reflux medication and voice training when polyp is sessile and small.

There is no general agreement with regard to which method is most appropriate for evaluating the outcome of voice therapy and the phonosurgical procedure. Several studies evaluated therapy effect using perceptual analyses performed by trained voice specialist.[5] However, the definitions of the perceptual vocal measures (eg, hoarseness, strain, and roughness) may vary considerably among different professionals. These methodological issues present an obstacle for comparing different studies concerning voice quality. The GRBAS scale for subjective voice evaluation containing five voice quality parameters, G (grade), R (rough), B (breathy), A (asthenic), and S (strained) is most widely used voice scaling method.[6]

Acoustic analysis has the benefit of measuring and quantifying subtle differences in voice quality more precisely than perceptual measures. The attempts of objective acoustic evaluation of pathologic voice have been performed for about 20 years.[7] The computerized multidimensional acoustic voice analysis enables visual and numeric information on the analyzed voice. The aim of such analysis program is to provide objective data and to support perceptual voice evaluation.[8,9] Multi-Dimensional Voice Program (MDVP) is one of the instruments which provide the detailed acoustic analysis on all parameters. The MDVP appears to have potential for rapid quantitative assessments of voice in both research and clinical applications.[10,11]

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