Die Diagnostik der gestörten Stimmfunktion

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Summary. Dysfunction of the voice is expressed by a deterioration of vocal performance due to incorrect respiratory, laryngeal, and/or articulatory movement patterns. Analysis and documentation of such dysfunctional phonatory behavior are goals of functional diagnostics. After reviewing physiology and pathophysiology of the phonatory apparatus, the numerous technical methods of voice examination are discussed, by which it is tried to complement and improve the auditory, visual, and palpatory examination methods having been mainly used up to the present. Incorrect breathing movements during rest and during phonation change breathing frequency and depth; regularity and shape of the breathing cycle; the relation between the respiratory movements of the abdominal and the chest wall; and the respiratory level. Such faulty breathing patterns are documented and evaluated by recording the respiratory motion of the abdominal and the chest wall synchronously (pneumography, relative motion diagram). Dysfunction of the glottal generator can be recognized: (1) by a pathological alteration of aerodynamic parameters (subglottal pressure, mean flow rate, glottal resistance) with a corresponding deterioration of the phonatory efficiency; spirometric, pneumotachographic and plethysmographic measuring methods as well as direct or indirect measurement of the subglottal pressure are able to yield diagnostically usable data in this connection; (2) by a pathologically altered vibration mode of the vocal folds which can be observed stroboscopically, documented by means of strobo-cinematography, and exactly analyzed by high speed cinematography or photokymography; (3) by a change of the area function resulting from the pathological vibration pattern with a correspondingly less effective conversion of air volume into sound energy. An exact analysis of the area function is only possible by high speed cinematography, but also glottographic measurements of the various time sections and time quotients (opening, speed, rate quotient) may yield criteria for the evaluation of the sound generating function of the glottis. The electromyography of the laryngeal muscles is useful mainly for the differential diagnosis between neurological and functional motion disturbances; additionally, in certain
cases it obviously permits the proof of discoordinated activity in laryngeal muscles. The electro-acoustic analysis of the voice is supposed to document quantitatively a complete profile of vocal performance as well as to give indirect information about the function of the glottis and the operational efficiency of the phonatory control system: by means of fundamental frequency analysis (eventually combined with recording of the sound pressure level) the general and special performances of the speaking and singing voice can be recorded as well as the vocal reaction to ambient noise, the accuracy and the stability of voice. The mode of vocal attack being determined by fundamental frequency analysis, by aerodynamic or by glottographic measuring methods gives qualitative information about the neuromuscularly controlled prephonatory tuning of the phonatory apparatus. Pathological qualities of the vocal sound (hoarseness, nasality, and other changes of vocal sound) are documented and quantified by means of spectrum analysis (filter analysis, sonography, fast-Fourier-transformation). Especially for a quantitative evaluation of hoarseness the analysis of periodicity (pitch perturbations) appears to be feasible. The efficiency of a voice is expressed by the relative amplitude of the partials within the 3 kHz-area of the vocal spectrum. As the timbre of voice depends upon the adjusting behavior of the vocal tract spectrum analysis also reveals something about the phonatory function of the vocal tract. Additional informations about a pathological (or pathogenic) discoordination of articulatory movements are drawn from mechanical, roentgenological, photographic, and aerodynamic observation methods. With regard to the complexity of the phonatory process, an evaluation of vocal function appears to be only possible by holistic consideration of several function parameters.

**Key words:** Physiology of voice — Pathophysiology of voice — Diagnosis of vocal function — Pneumography — Aerodynamic measurements of glottal function — Glottography — Stroboscopy — High speed cinematography — Laryngeal photography — Photokymography — Laryngeal electromyography — Electroacoustic analysis of the voice