A Video-tape Recording System for Laryngo-stroboscopy

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In order to keep a record of stroboscopic images, we developed a video-tape recording system. This system can be utilized in the following manners:

1. The physician can use not only verbal but also visual means of explanation of the patient's laryngeal condition.
2. Teaching the various aspects of vocal fold vibration can be enhanced with the use of this dynamic method.
3. More accurate information can be gleaned by allowing for more than one specialist to view the vocal fold in motion at the same time. In addition, this system permits repeated viewings at convenient times.
4. One can compare vibratory patterns between different time points, including pre- and post-therapeutic examinations.

We also developed an additional system with which any waveforms displayed on an oscilloscope can be superimposed on the stroboscopic images.

Stroboscopic examination, as a routine clinical test, is the most practical modality for examination of the vibratory mode of the vocal folds. It was as early as 1898 that a laryngo-stroboscope first came into use as a mean of observing normal vibrations of the vocal folds\(^1\). In the early stages, mechanical devices were adopted to obtain the stroboscopic light. It was, therefore, very difficult to examine pathological vibrations associated with irregular cycle-to-cycle variations. Application of electronic devices to laryngo-stroboscopes in the 1950's made it feasible to utilize stroboscopes for observation of pathological vibrations\(^2\)\(^3\).

There are two major shortcomings associated with stroboscopy:

1. One can not observe the movements within each vibratory cycle, but instead, one sees a kind of averaged vibratory pattern over many successive cycles, and (2) it is rather difficult to keep a record of the images observed with a stroboscope. The former is inherent in stroboscopic observation. The latter, however, can be solved as technology progresses.

Since 1977, we have attempted to use a video-tape recording system in connection with a laryngo-stroboscope\(^4\)\(^5\). The present paper describes our current system for the recording of stroboscopic images of the vibrating vocal folds.

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Apparatus

Outline of the Entire System

The basic system consists of a laryngo-stroboscope, a video-camera, a video-recorder and a television monitor set (Figure 1, the upper part surrounded by a dotted square).
It is worthwhile making simultaneous recordings of the signals related to voice production. Included in these signals are the waveform of the acoustic output, that of the subglottic pressure, the supraglottic pressure, and so on. With this purpose in mind, we have developed an additional system. It consists of a cathode ray oscilloscope, a second video-camera, a tape synchronizing adaptor and a video-camera wiper (Fig. 1, lower portion). With this system, one can record the signals superimposed on the stroboscopic images.

Data including the name of the subject, the date of examination, the conditions for examination etc., can also be recorded with the provision of a data printer.
Stroboscope (PENTAX LS-1A)

An improved version of our stroboscope is adopted in the present system. The light is bright enough to enable visualization in an ENT office. The light can be directed to a laryngeal mirror or introduced into a fiberscope. The range selection of the fundamental frequency is automatically regulated, and the fundamental frequency is indicated by digital numbers. Most functions of the stroboscope can be manipulated by a pedal during observation.

Laryngoscope (Improved version of NAGASHIMA SFT-1)

The laryngoscope contains more optical fibers than the regular type $(\phi=4\text{mm})$. For typical examinations the angle of the prism at the tip of the laryngoscope is $70^\circ$. A laryngoscope with a prism angled by $60^\circ$ is available when closer observation of the vocal fold is required.

Video-camera (SONY AVC-1550)

The video-camera has an extremely high sensitivity to light. Any field which gives light brighter than 1 lux to the lens can be clearly visualized.

Video-recorder, Monitor television

Any type of video-recorder or monitor television made on a commercial basis is applicable.

System for simultaneous recordings

An important consideration when making simultaneous recordings of stroboscopic images and wave signals, is to note the particular phase point which corresponds to the pictured image. Our stroboscope is designed so that the phase point of each flash light is indicated on the wave(s) superimposed on the images. (Fig. 4)

Procedure

The examiner and the subject sit facing each other. The examiner inserts a laryngoscope into the subject's mouth while the subject pulls his tongue. The laryngoscope is connected to a video-camera and a light source through the light guide fiber. If the video-camera is held up-side-down, the anterior commissure is located at the top of the image as in mirror examination. The camera weighs only 700g, and can, therefore, be easily held with one hand. A camera for color-video (SONY BVP-300) weighs approximately 5kg.

The location of the laryngoscope is monitored either by visualization of the larynx through the finder of the camera or by watching the monitor TV screen. When the desired image appears on the screen tape-recording can be started.

Figure 5 demonstrates examples of recorded images. On these pictures, the left vocal fold is viewed on the left side unlike to normal mirror examination.

Comments

This video-tape recording system for laryngostroboscopy can be utilized in the following manners:
吉田義一論文付図(1)
Fig. 5B
吉田義一論文付図(3)
吉田義一論文付図(4)

Fig. 5 D
The physician can use not only a verbal but also a visual means of explanation of the patient's laryngeal condition.

Teaching the various aspects of vocal fold vibration can be enhanced with the use of this dynamic method.

More accurate information can be gleaned by allowing for more than one specialist to view the vocal fold in motion at the same time. In addition, this system permits repeated viewings at convenient times.

One can compare vibratory patterns between different time points, including pre- and post-therapeutic examinations.

A video system is advantageous over filming in terms of ease of repeated observations, disuse of developing procedures, and less hazardous editing and copy making. On the other hand, a video image is not as sharp as an image on a film. For quantitative measurements of vocal fold vibration, filming modalities, including ultra high speed photography and stroboscope photography, should be recommended. Nevertheless, the system for simultaneous recordings may yield some important informations related to vocal fold vibration in various normal and pathological conditions.

**Legends**

Figure 1. A block diagram of the entire system.

Figure 2. Laryngoscope, video camera and light guide fiber.

Figure 3. A view during stroboscopy.

Figure 4. Examples of the image in which the acoustic output is superimposed. The light spots indicate the phase point when the image is viewed. The number indicates fundamental frequency of phonation.

Figure 5. Examples of cases.

A. Normal, a 23-year-old male.

B. Vocal fold polyp, left, a 42-year-old female.

C. Recurrent laryngeal nerve palsy, left, a 26-year-old male.

D. After hemilaryngectomy, a 75-year-old male, ventricular fold vibration.

**References**


