

Effect of Changes in Vocal Fold Tension on Mucosal Wave

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Vocal fold vibration is essentially the propagation of a mucosal wave, starting from the lower surface of the vocal fold. The mucosal upheaval (MU), where the mucosal wave starts and propagates upward, appears only when the vocal fold vibrates. We investigated the location of the mucosal upheaval in response to variations in vocal fold tension. Vibrations were elicited under three conditions: during bilateral thyroarytenoid (TA) muscle contraction, without TA muscle contraction and during vocal fold lengthening. TA muscle contraction was obtained by direct electrical stimulation of the muscle. The vocal fold was lengthened by cricothyroid approximation. The vibrations were recorded from the tracheal side by high-speed cinematography. The larynx was prepared for histologic observation in the frontal plane. Tattooed marks on the lower surface of the vocal fold were used to locate macroscopically observed landmarks with reference to microscopic structures. The MU shifted laterally toward the tracheal side during TA muscle contraction compared with that of without TA muscle contraction. When the vocal fold was lengthened, the MU shifted medially toward the free edge compared with that of without lengthening of the vocal fold. Histologic examination showed that the MU in the absence of TA muscle contraction arose slightly above the area where the muscular layer approached the epithelial layer. When the TA muscle contracts, the vibrating area expands toward the tracheal side, and a more dynamic mucosal wave occurs in the vertical direction. In contrast, when the longitudinal tension of the vocal fold increases, vibration occurs in a limited area around the free edge of the vocal fold. We concluded that a part of the "Body" and the "Cover" are involved in the vibratory movement of the vocal fold under TA muscle contraction.