IMMEDIATE EFFECTS OF HUMMIMG ON THE PREPHONATORY VOCAL FOLD MOTIONS UNDER HIGH-SPEED DIGITAL IMAGING IN PATIENTS WITH MUSCLE TENSION DYSPHONIA

M. Ogawa[1], T. Iwahashi[1], K. Hosokawa[2], H. Inohara[1]
[1]Department of Otorhinolaryngology - Head and Neck Surgery, Osaka University Graduate School of Medicine, Suita, Japan
[2]Department of Otorhinolaryngology, Osaka Police Hospital, Osaka, Japan
Email: mogawa@ent.med.osaka-u.ac.jp

INTRODUCTION: Humming is a vocal training technique that facilitates the production of a resonant voice. Our recent study using high-speed digital imaging compared the prephonatory vocal fold motions at vocal onset between natural/loud vowel and humming phonation in nondysphonic speakers, and demonstrated that the change in the angle between the bilateral vocal folds showed polynomial-like or sigmoid curves for loud or natural/humming phonation, respectively, and that humming decelerates the vocal fold adductive motion compared with natural phonation, repositioning the vocal folds close to the median line. However, the immediate effects of humming at vocal onset in muscle tension dysphonia (MTD) remain to be assessed. In this study, we attempted to verify the following: (1) whether or not MTD patients show a 'hard glottal attack' sign, (i.e. an accelerating vocal fold adductive motion followed by collision); (2) whether or not MTD patients show different values for the maximum/minimum vocal fold angle from nondysphonic speakers; and (3) whether or not these abnormalities are corrected by humming.
METHODS: Twenty normal healthy adults and 12 MTD patients showing both vocal roughness and supraglottic compression during natural phonation were recruited. After a transnasal flexible fiberscope connected with high-speed camera was inserted, each participant was asked to perform three phonatory tasks: natural /e:/, loud /e:/ and humming /m:/ phonation in order while high-speed laryngeal movies (4,000 frame/sec) were recorded. Using a motion analysis software program, the change in the angle between the bilateral vocal folds at vocal onset was analyzed. In addition, the maximum/minimum vocal fold angle, and the vocal fold angular velocity in the 3 ranges of 100%-80%. 80%-20%, and 20%-0% from all of the angular changes were calculated. These measurements were compared between the three tasks and between the two groups.
RESULTS: In the MTD patients, the vocal fold angle changes showed sigmoid and polynomial-like curves for natural/humming and loud phonation, respectively, as observed in nondysphonic speakers. The angular velocity in the 20-0% and 80-20% region was the highest, with statistical significances during loud and natural/humming phonation, respectively. In the comparison between the two groups, none of the average regional angular velocities showed any significant differences. The maximum vocal fold angle showed no significant difference between both groups, whereas the minimum vocal fold angle was the largest during humming phonation in both groups.
DISCUSSION: The present study demonstrated that MTD patients did not show a 'hard glottal attack' sign during sustained natural vowel phonation, suggesting that the pathophysiology of MTD can be explained by excessively medial prephonatory positioning of the vocal folds, but not a high velocity of the vocal fold adduction. In addition, it was demonstrated that humming is decelerates the velocity of vocal fold adduction, repositioning the vocal folds smoothly in a phonatory position close to the median line, leading to improvement of the vocal quality in MTD.