MORPHOLOGICAL ANALYSIS OF THE VOCAL TRACT OF FEMALE SINGERS

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The configuration of the vocal tract plays an important role in the production of voice while speaking and singing. Little is known about the changes in the vocal tract of female singers, in particular the hypopharyngeal and epilaryngeal area.

This study investigates 11 students of classical singing at the „Hochschule Carl Maria von Weber in Dresden“ at the beginning of their study.

The subjects were asked to produce the german vowels /a/, /e/, /i/, /o/ and /u/ in a singing and speech-like phonation (on pitch A4 or E4) while MRI scans were made.

By means of the software programs „IPTools“, „Netfabb“ and „ImageJ“ the MRI pictures could be evaluated. The volumes, areas and distances of different regions of the vocal tract were measured: the cranial epilaryngeal area (ELA1) that marks the entrance into the epilarynx tube, a second epilaryngeal area (ELA2) between the false vocal folds and the volume between these areas (ELV); the caudal hypopharyngeal area (HPA2) that is placed slightly above the arytenoids, a more cranial hypopharyngeal area (HPA1) that is about 1 cm above it. The volume between these areas was also measured (HPV). Moreover, the volume of the caudal part of the piriform sinus was measured on both sides.. Furthermore, data about the position of the larynx, the larynx tilt, the opening of the lips and jaw were obtained.

Comparing singing to the speech-like phonation on can see an increase of the following morphological structures of the vocal tract: the pharyngeal volume (HPV) by 17,5%, the epilaryngeal volume (ELV) by 36,4%, the caudal part of the piriform sinus (SP) by 30%, the cranial hypopharyngel area (HPA1) by 20%, the caudal hypopharyngeal area (HPA2) by 17,8%, the cranial epilaryngeal area (ELA1) by 22,3%. Changes of the caudal epilaryngeal area (ELA2) were not significant. During singing the jaw opening was bigger by 2,4% whereas the lip opening did not change significantly. An average lowering of the larynx by 6mm was seen in the singing condition, however the larynx tilt did not show any significant changes.

The Data display systematic adjustments of the lower vocal tract during singing in the female voice.