Effect of Chin-Down Position on Vocal Mean Pitch and Intensity

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Abstract

Background Voice, a unique characteristic of each individual, is an outcome of the configuration and function of various components of the vocal tract. Pitch and loudness, being integral parts of voice, vary with changes in factors such as muscle tension, subglottal pressure, and position. Chin down is often the recommended voice therapy for lowering pitch. But there is no literature available as to by how much does it actually change the mean pitch and intensity. The present study was undertaken to understand the effect on the vocal mean pitch and intensity when head position is changed to chin-down position.

Methods Thirty women aged 18 to 25 years were included in this preliminary study. Individuals having any history of voice disorder were excluded. Voice samples were collected using clinical microphone and acoustically analyzed using the Praat software. The participants were instructed to phonate and count numbers in neutral position and chin down position.

Results It was observed that there was no change in the acoustic or perceptual measure of pitch with change in the head position. However, there was a significant reduction in the intensity for phonation task in the chin-down position.

Conclusion Speech language pathologists need to provide chin down as a facilitative technique for lowering larynx along with other voice therapies which are proved to effectively lower pitch.

Keywords
- chin down
- mean pitch
- intensity
- lowering of pitch
- head positioning techniques

Introduction

Voice is composed through pulmonary airstream by laryngeal modulated functions and is further altered by the configuration of the vocal tract.[1] The larynx positioned atop the trachea serves to sustain breathing, filtration during swallowing, and housing the vocal folds for speech production.

The larynx spotted within the muscles of neck is positioned vertically in adults at the level of C4 to C6 vertebrae in adults, being higher in children, at C2 to C3 position.[2] As the larynx descends in the neck, along with a change in the size and shape, it leads to slightly lower pitch in women and a marked low pitch in men post puberty; length, mass, and vocal fold tension being the key determinants for vocal frequency fluctuation. So the lengthening of vocal fold decreases its mass and increases its tension, thereby vibrating the vocal folds so that a faster varied frequency range occurs.[3] Similarly supraglottic regulation including adjustments of subglottic pressure, medial compression of vocal folds along with its speed, and degree and duration of vocal fold closure contribute to changes in vocal loudness.[4]

Changing the head position by flexion or extension of the neck can have an immediate positive effect on voice quality.[5] Unilateral vocal fold paralysis, functional voice disorders, and other neurological voice disorders can be mended using different head positions within a varied range of period.[6] Chin down is flexion of the head such that the chin touches the chest. It facilitates the lowering of pitch by easing the

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lowering of the position of larynx to C4 to C6. Altering the position of larynx, that is flexing of neck, might facilitate a better low-pitched voice in mutational falsetto population.[7] In singers and other professional voice users who have to do pitch modulations from head register to chest register, flexion of the head facilitates the rapid pitch change.

But does chin down actively lower pitch as compared with neutral position or does it only facilitate the mechanism that actually lowers larynx? There is no research to provide evidence that the pitch actually lowers, and even if it drops, by how much. Nor is there any study to state the effect of the chin-down position on the vocal loudness. Though anatomically if assumptions are made related to the effect of change on the laryngeal muscle tension and length on vocal folds, the exact effect of chin-down position, which is recommended by many speech language pathologists (SLPs) for lowering of pitch in cases of puberphonia and for vocal coaching, does not seem to established.

As SLPs, we require the acoustic and perceptual evidence as to whether chin down can actually result in a lower pitch so that it can be recommended as a voice therapy technique. The present study is just a preliminary step to set the base for a wider study related to effects of head position on vocal pitch and loudness.

Methods

The scientific committee of the institution approved the research proposal and gave ethical clearance. The purpose and the nature of the study were explained to the participants in their native language and informed consent was taken orally.

Participants of the study were 30 undergraduate female students of the Nitte Institute of Speech and Hearing, in the age range from 18 to 22 years. Individuals who reported of any kind of voice disorders were excluded from the study. The recording of voice samples was done using the Shure c606 microphone. The Pratt software was used for the acoustical analysis of voice samples.

The recordings of the voice samples were done in a sound-treated room. The voice sample was taken in two different head positions, namely, neutral position and chin-down position. In neutral position, the first task for the participants was to phonate the vowel /a/. The participants were instructed to sit in a straight comfortable posture, to take a deep breath, and to phonate /a/ for as long as possible. The second task in neutral position was number count. In the second position, that is chin-down, the participants were instructed to sit in a comfortable posture and to touch chin to chest and to repeat both the tasks. The microphone was held in front of the participant's mouth at a distance of around 10 cm.

Moreover, two examiners perceptually compared the change in the pitch and loudness when the head position was changed from neutral to chin down. They rated the voice to be:

1. Pitch is lower/same/higher in chin-down position as compared with neutral position for both the tasks.
2. Loudness is lower/same/higher in chin-down position as compared with neutral position for both the tasks.

Results

The data collected from the 30 samples were subjected to descriptive and inferential statistical analysis using the SPSS 16 software (IBM Corporation, United States) to compare the change in the vocal mean pitch and intensity at neutral position and chin-down position for the tasks of /a/ phonation and number count.

The mean, maximum, minimum, and standard deviation of f0 and intensity for the two tasks are given in ►**Table 1**.

The paired student's *t*-test was applied to the collected sample to determine whether there was any statistically significant difference in the mean pitch and intensity of recordings obtained in the two different positions. The significance was calculated at the *p*-level of 0.05, meaning that if the *p*-value is less than 0.05 then the null hypotheses will be rejected and that there is indeed a significant difference between the two sets of data. The result of *t*-test is shown in ►**Table 2**.

From the analysis it can be seen that there was no significant change in mean pitch at neutral position and

Table 2 Values of paired *t*-test

	/a/ phonation	Number count
Change in mean pitch	0.32	0.08
Change in intensity	0.00[a]	0.13

[a]Significant at $p < 0.05$.

Table 1 Descriptive analysis of mean pitch and intensity

	/a/ phonation				Number count			
	Mean pitch (Hz)		Intensity (dB)		Mean pitch (Hz)		Intensity (dB)	
	Head forward	Chin down	Head forward	Chin down	Head forward	Chin down	Head forward	Chin down
Minimum	174.54	162.07	60.7	56.35	119.58	128.58	59.68	51.49
Maximum	273.54	277.5	77.21	73.82	254.3	265.81	71.13	73.35
Mean	223.41	227.34	68.86	65.56	215.89	224.51	63.62	62.57
SD	23.64	23.45	4.82	3.64	24.52	33.45	3.23	4.31

Abbreviation: SD, standard deviation.

chin-down position for the tasks of phonation and number count. Similarly, there was no significant change in the intensity during the number count task. However, there was a significant lowering of vocal intensity at chin-down position for the task of /a/ phonation. Perceptually, both the examiners reported that they did not perceive any change in the pitch or loudness between neutral and chin-down positions for both the tasks.

Discussion

The results of the study reveal that there was no significant change in the mean pitch when the head position was changed from neutral to chin down. The perceptual analysis also correlated with acoustic changes observed that there was no perceived change in the pitch. Thus, flexion of head to chin-down position does not directly lower the pitch. As seen in literature, however, chin-down position may provide a more comfortable and conducive mechanism for lowering pitch, in cases such as puberphonia or muscle tension dysphonia, where the larynx may be at a higher position in the neck as compared with normal. It results in reduction in the tension of vocal folds, change in configuration of vocal tract, and provides ease to sternothyroid muscles to lower the larynx from an elevated position by passively lowering the larynx in the vocal tract as compared with the neutral position.[8] In vocal coaching, sliding of the larynx in the neck region to shift from a higher pitch to a lower pitch also becomes less effortful as the flexion of head helps relaxing the vocal folds tension in case the professional voice user uses head extension to hit a falsetto or head register.

In the present study, in the chin-down position, the loudness was significantly reduced as compared with neutral position for the phonation task. This may be attributed to the resistance to airflow by reduction of the airway opening in the chin-down position. To overcome this resistance, the vocal folds need to contract slightly more to produce necessary loudness and may be the reason for the slightly increased mean pitch in the chin-down position.

The perceptual report of no noticeable change in the pitch and loudness also points to the fact that chin down does not actively lead to lowering of pitch or change in the loudness. However, in some cases people might report perception of very slight deepening voice quality. This may be due to the change in the configuration of the vocal tract due to the flexion of the head.

Conclusion

From the present preliminary study which was undertaken to determine the effect of chin down on vocal mean pitch and intensity, it can be stated that chin down does not lead to significant change in the mean pitch both on acoustic and perceptual measures. But there is a significant reduction in the intensity. Chin down may be recommended by SLPs not as a voice therapy technique that can directly change the vocal pitch but as a facilitating position for achieving lower pitch with less effort for professional voice users and in cases of mutational falsetto along with other pitch lowering techniques such as digital laryngeal manipulation. This, however, cannot be considered to be conclusive unless the data are collected from a larger population and include male participants as well. Moreover, if visual/imaging evidence of change in the vocal fold vibration is possible, it would further provide clearer effect of chin down on vocal mean pitch and loudness.

Conflict of Interest
None declared.

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