INTRODUCTION

Inhalation phonation, also known as inspiratory or inverted phonation, occurs when air is passed through the adducted vocal folds during inhalation. It is a paradoxical process as the airflow pattern for phonation is opposite of that seen in normal phonation and the vocal folds are adducted instead of abducted as normally found during inspiration. Similarly, paradoxical vocal fold movement (PVFM) disorder is a unique etiology of dyspnea due to aberrant adduction of vocal folds during respiration. While voicing during inspiration can be volitional, as referred to as reverse phonation, inhalation phonation may be observed in both normal states such as laughing and crying or in pathologic states such as laryngomalacia. However, persistent inhalation phonation as a pathologic entity is rare. Here we report two patients with severe PVFM with simultaneous inhalation phonation.

CASE REPORT

Case 1
58F presented with 6 months of dyspnea and dysphonia. Laryngeal stroboscopy exam (Figure 1) was significant for persistent vocal fold adduction during both inhalation and exhalation, with inhalation phonation noted. The voice handicap index (VHI) score was 40. After consistent weekly respiratory retraining and therapeutic measures to elicit phonation during exhalation including semi-occluded vocal tract exercises, voice returned to normal. However, 3 months later PVFM during respiration persisted and the patient was ultimately indicated for Botox injection to each thyroarytenoid muscle. At 5 month follow up, both patient’s voice and breathing were much improved.

At 11 month follow up normal phonation was noted, but the patient continued to have dyspnea due to persistent vocal fold adduction during respiration, even during rest. At this point, a trial with laryngeal Botox injection to each thyroarytenoid muscle was pursued. Minimal improvement to respiration was noted following laryngeal Botox injection and the patient was ultimately treated with tracheotomy placement at 18 months from presentation.

Case 2
44F presented with a 2 month history of persistent severe dyspnea, hoarseness and inability to coordinate respiration with phonation. The symptoms were sudden in onset and followed an upper respiratory infection. The patient pursued medical evaluation and was admitted to an outside hospital’s intensive care unit for severe respiratory distress. Laryngeal stroboscopy exam (Figure 2) revealed persistent vocal fold adduction during inhalation, exhalation and phonation. The patient underwent respiratory retraining therapy including resistance breathing exercises with much improvement in voice. Figure 3 shows pre-treatment aerodynamic data. This data is characteristic of inhalation phonation. Figure 4 shows post treatment aerodynamic data. At 1 month follow up, after therapy, the voice was much improved.

DISCUSSION

Normal phonation is produced as the vocal folds adduct and air is driven from the lungs inferiorly, through the glottis into the supraglottis. Inhalation phonation has opposite air flow and occurs when air is unintentionally driven from the supraglottis, through the vocal folds, into the subglottis, with inspiration. PVFM is a well-known unintentional phenomenon involving aberrant vocal fold adduction during inspiration. We describe two patients with inhalation phonation, both of whom experienced concurrent severe unreleenting PVFM.

In the English literature, there have been no reports of this to date. Isolated inhalation phonation has been described in one patient in the French literature without an associated respiratory component. Both patients in our series were successfully rehabilitated from a phonatory standpoint after respiratory training. However, in both cases, the respiratory component of PVFM needed further intervention.

In its essential roles for speech and respiration, the larynx balances both voluntary and reflexive intrinsic muscular actions. If considered a form of laryngospasm, PVFM may represent an abnormal excitation of the laryngeal closure reflex or it may represent a loss of inhibition of the reflex. While central mechanisms may normally control these reflexes during volitional laryngeal tasks such as voice production, sensory feedback can elicit reflexive control. More likely, the sensory feedback can supersede the central mechanism. Perhaps for extreme cases, the aberrant sensory feedback that is received in PVFM may also affect the voluntary muscle control that would otherwise dictate phonation, thus, presenting as in our cases with aberrant inhalational phonation.

CONCLUSION

Inhalation phonation is defined by inversion of the airflow pattern during voicing. It is rarely seen as normal voicing pattern during crying or laughing. It is employed as a volitional voice therapy technique called reverse phonation. However, in our two cases, it presented as a pathologic affliction associated with extreme cases of paradoxical vocal fold motion. Semi-occluded vocal tract exercises and respiratory retraining are beneficial in treatment.