Morphological Recovery of Rabbit Vocal Fold Epithelium after Acute Phonotrauma

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Background
The epithelium is routinely susceptible to damage during phonation. Excessive and prolonged vibration exposure is considered a significant predisposing factor in the development of vocal fold pathology.

Excessive and prolonged vibration
We previously reported that repetitive trauma during phonation leads to compromise of vocal fold epithelial structure, which adversely affects barrier function in an in vivo rabbit model.

Evoked Phonation Method
Electrodes were placed into the cricothyroid muscle and membrane Neurovascular stimulation to elicit vocal fold closure Humidified air flow
- Control: approximation of the vocal folds without phonation (stimulation only and no airflow)
- Modal Intensity: Vocal intensity 59.6 dB (SD= 0.83)
- Raised Intensity: Vocal intensity 69.98 dB (SD= 3.40)

Methods

Objective
It is unknown how acute episodes of phonotrauma affect the recovery of the vocal fold at the ultrastructural level. This study utilized electron microscopy to describe morphological changes in the vocal fold following phonation-induced trauma in an in vivo rabbit model.

Methods

120 min.
modal intensity phonation
N=5
N=5
N=5
N=5
N=5
N=5

120 min.
raised intensity phonation
N=5
N=5
N=5
N=5
N=5
N=5

No phonation: Normal N=5

65 New Zealand white breeder rabbits were randomized to normal, modal intensity, or raised intensity phonation for 120 minutes. Larynges were harvested at 0, 4, 8, 24, 72, 168 hr following phonation and were compared to normal.

Results

Raised intensity phonation resulted in extensive damage to the vocal fold immediately following phonation. However, the epithelium after raised intensity phonation shared relatively similar recovery patterns with the modal intensity phonation group at approximately 24 hours. Both phonation groups returned to normal between 3 and 7 days.

Conclusion
The protection from further injury during the first 24 hours in recovery may be critical in successfully restoring the epithelium after raised intensity phonation. Results revealed a critical time point between 3 and 7 days in which morphological epithelial damage begins to recover. Because this study examined the wound healing response following biomechanically-induced injury during acute phonotrauma, it may help to direct future research on vocal fold recovery and voice rest.