Acute vocal fold scar restoration with injectable basic fibroblast growth factor hydrogel

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Introduction

There continue to be therapeutic challenges in the management of vocal fold scarring. We previously showed that basic fibroblast growth factor (bFGF) injection have therapeutic potential for vocal fold scarring. However, the working time of bFGF is very short, and multiple injections were required in many cases to obtain the regenerative effect. An efficacious delivery system for bFGF has yet to be established. We designed a method of sustained delivery of bFGF by using a gelatin hydrogel. Hydrogel have been developed for targeted delivery and controlled release of bFGF. Hydrogel of the particle type is also injectable and commercially available.

The current study aims to investigate the effects of a single injection of bFGF-DDS on acute vocal fold scarring using a canine model.

Result 1: Vibratory Examinations

Vocal fold vibration was examined with an excised larynx. An endotracheal tube was inserted into the trachea. The vocal fold vibrations were generated via airflow through the tube and were recorded with a high speed digital imaging system (4000 fr/sec).

Three parameters were examined.

- Phonation Threshold Pressure (PTP)
- Normalized Mucosal Wave Amplitude (NMWA) = (d2-d1)/L × 100
- Normalized Glottal Gap (NGG) = a/L2 × 100

Result 2: Histological Findings

Material and Method

Vocal folds from eight beagles were unilaterally scarred by stripping the entire layer of the lamina propria. One month after hydrogels (0.5ml) containing 10μg of bFGF were injected into the scarred vocal folds of four beagles (FGF-hydrogel group), saline (0.5ml) were injected into the other four beagles (sham group). Histological and vibratory examinations on excised larynges were performed for each group at 6 months after scarring.

Discussion

Comparative analysis with previous data of vibratory examinations by FGF solution

(Suehiro A et.al. Acta Oto-Laryngologica, 2010)

FGF hydrogel group showed higher ratio of NMWA than FGF solution group.

Conclusion

- A single injection of bFGF hydrogel has the regenerative effect for acute vocal fold scar.
- Comparative analysis with previous data by FGF solution injection suggested stronger effects of the current drug delivery system.

FGF hydrogel is more effective drug delivery system.