

Short Communication

Human Evolution and Laryngeal Functions: A Simple Solution for Problems Caused by Physiological Aging

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ABSTRACT

Purpose: Physiological ageing affects function of the evolved human larynx with respect to both speech communication and swallowing. Those decrease the quality of life in human being. For the latter, it increases the tendency for aspiration. This will increasingly become a problem as lifespan increases and a growing number of people suffer from physiological ageing. Here I suggest a simple solution for such ageing problems.

Methods: Based on my previous research (National Hospital Organization Japan program, Randomized control trial) and clinical experiment.

Results: As a substitute for laryngeal elevation, we recommend that people draw in the jaw during the act of swallowing. A vocal exercise therapy allowed vocal cords to adduct and improved glottal closure insufficiency.

Conclusion: “Just keep communicate to speak in old age”, which prevent the vocal fold and the intrinsic laryngeal muscles atrophy for the volume and adduction of vocal folds movement for the satisfactory glottal closure.

Keywords: Larynx; Human evolution; Swallowing; Physiological aging; Dysphonia; Aspiration; Voice therapy

Introduction

In the course of evolution, the larynx developed and the acquired the ability to vibrate [1]. In humans, the larynx descended in the neck, resulting in an effective articulatory system, the ability to communicate through speech was achieved.

The primary role of the larynx is to separate the air passage for breathing from that for food and drink intake, and to prevent aspiration into the lower respiratory system. In general, the mammalian larynx is located at about the height of the jaw bone; in other words the larynx is located in the mouth. This position makes it possible for some mammals including very young human infants to breathe and swallow simultaneously. In contrast to other mammals, the adult human larynx is located in the neck (Figure 1). As a result, humans need to elevate the larynx and move it anteriorly during swallowing to prevent aspiration [2]. This motion causes the epiglottis, which is sandwiched between the base of the tongue and framework of the larynx to protect the lower airway. The vocal folds themselves also participate in prevention of aspiration during swallowing by closing the glottis. When aspiration does occur, action of the true and false vocal folds operates as part of the cough mechanism to expel foreign bodies (water, oral secretions, food etc.). Laryngeal elevation and glottal closure are indispensable for human beings. While evolution brought us the long and flexible vocal tract, which is necessary for speech, it brought a tendency for mis-swallowing in comparison with other mammals.

Unfortunately, physiological ageing has bad influence on function of the evolved human larynx with speech communication and swallowing. It affects to decrease the QOL (quality of life) as human being.

Here I propose an easy and cost effective way for healthy aged citizens to prevent aspiration.

The laryngeal problem of human evolution in ageing

Atrophy of the extrinsic laryngeal muscles with age lowers the position of the larynx [3] and weakening of the muscles results in difficulty in elevating the larynx to prevent aspiration while swallowing. Normal aging on oropharyngeal events in swallowing, total duration of oropharyngeal swallowing was found to be significantly longer in the oldest age group than in any other age group [4]. Thus the aged population needs great distance and more time to elevate the larynx to prevent aspiration.

Original purpose of the glottal closure was to prevent aspiration while swallowing. Age-related atrophic changes in the intrinsic laryngeal muscles commonly cause glottal closure insufficiency. Anatomical and functional problems result from glottal closure failure include not only breathy hoarseness [5] but also more frequent laryngeal inflow and difficulty in expectoration, the latter due to insufficient subglottic pressure to remove aspirated substances through coughing [6]. The result continued aspiration can lead to the development of pneumonia, more specifically so-called aspiration pneumonia of the aged [7]. To achieve successful expectoration, effective glottal closure is necessary.

Previous surgical solutions for the problem

A laryngeal suspension procedure was developed as a surgical treatment, laryngeal suspension surgery based on the support and lifting mechanism acting on the hyo-laryngeal unit. The idea was applied not only for major surgical resection but also life-threatening aspiration [8]. However this procedure necessitates a temporal tracheotomy.

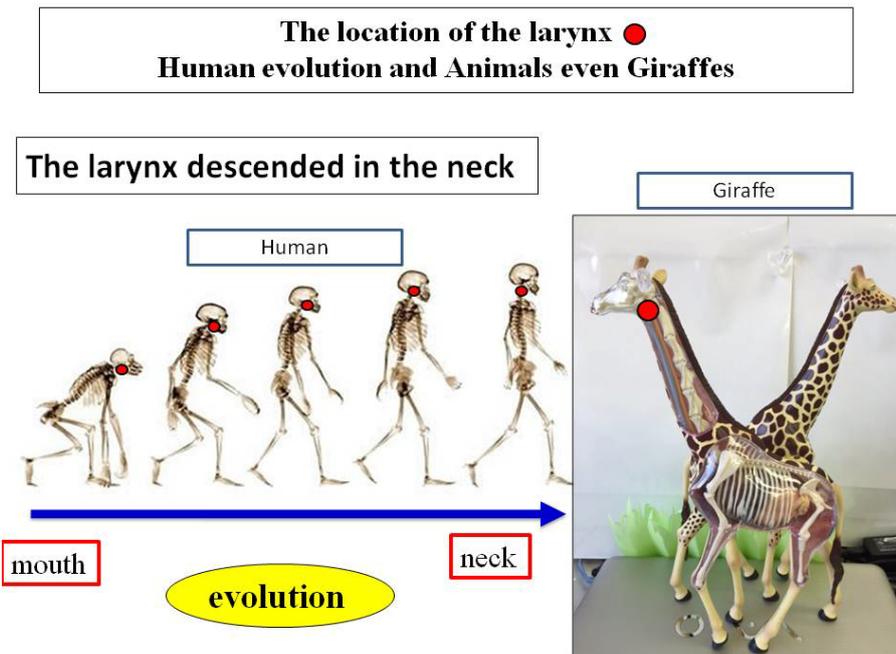


Figure 1: The location of the larynx (red circle): In humans, the larynx descended in the neck, resulting in an effective articulatory system and, the ability to communicate through speech was achieved. This evolution had an adverse effect on human swallowing function, because elevation of the laryngeal framework was needed to prevent aspiration [1].

Various surgical treatments are available for insufficient glottal closure. However in elderly patients their cells transplanted are also aged [5].

Simple techniques to deal with the problem

As a substitute for laryngeal elevation, we recommend that patient draw in the jaw during the act of swallowing [9]. It was clear more than a quarter century before however it was not quite performed in clinical primary care situation so I strongly insist the point. Actually our National Hospital Organization (NHO) program in Japan worked on this action routinely for preventing aspiration pneumonia and effective results had been obtained [10]. This action creates a shorter distance between the tongue base and larynx like in other mammals so it's necessary to elevate larynx to prevent aspiration.

Glottal incompetence cannot get enough subglottic pressure to cough out the foreign bodies. Independent exercise for the solution of this physiological aged problem (vocal fold atrophy) therapy (http://www.kankakuki.go.jp/video_nhk_eng.html) allowed vocal cords to adduct effectively and improved glottal closure insufficiency, it reduced the hospitalization rate for pneumonia in this 6 month. [10].

Conclusion

Human evolution achieves speech communication. We got ability for conversation as a result of evolution, but became less able to prevent aspiration. "Just keep communicating in old age".

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ETHICAL APPROVAL

This article does not contain any studies with human participants or animals performed by any of the authors.

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