**Review Article**

# The Impact of Speaking Valves on Psychological and Swallowing Functions in ICU Tracheostomy Patients

**Fu Li, Longcheng Tao, Junhui Yan\* and Xuefei Han**

*Department of Critical Care Medicine, The Third Affiliated Hospital of Shenzhen University, China*

**\*Corresponding author:** Junhui Yan, Department of Critical Care Medicine, The Third Affiliated Hospital of Shenzhen University, Shenzhen, China.

### Abstract

**Objective:** To analyze the application effects of speaking valves in ICU tracheostomy patients at a tertiary hospital in Shenzhen.

**Methods:** A total of 40 ICU tracheostomy patients from April 2022 to February 2024 at a tertiary hospital in Shenzhen were selected as study subjects. They were divided into a control group and an experimental group using a random number table method. The control group (20 patients) received routine airway care after passing the Spontaneous Breathing Trial (SBT) for weaning, while the experimental group (20 patients) received routine airway care along with the use of a speaking valve. The swallowing function and anxiety incidence of the patients were observed.

**Results:** The swallowing function in the experimental group was significantly better than that in the control group (P<0.05). The anxiety incidence in the experimental group was significantly lower than that in the control group (P<0.05).

**Conclusion:** The use of speaking valves (phonatory valves) in ICU tracheostomy patients can improve swallowing function and reduce the incidence of anxiety.

**Keywords:** Speaking valve; Tracheostomy patients; Swallowing function; Anxiety incidence

## Introduction

ETracheostomy is a critical clinical procedure for maintaining airway patency in critically ill patients. It can relieve airway obstruction, alleviate dyspnea, facilitate the drainage of airway secretions, improve patient comfort, and reduce the use of sedatives and analgesics. However, it may also weaken or even eliminate airway protective reflexes, leading to dysphagia and an increased risk of aspiration [1]. Therefore, when the patient's condition improves and ventilation and gas exchange functions are restored, it is necessary to remove the tracheostomy tube as soon as possible to restore normal respiratory physiological functions and reduce the incidence of complications. The Passy-Muir Speaking Valve (PMV) is a one-way ventilation device that can be connected to a tracheostomy tube. When the patient inhales, air enters through the tracheostomy tube; when exhaling, air exits through the glottis. This allows the patient to regain speech function and exercise swallowing function [2]. This study selected 40 ICU tracheostomy patients from February 2022 to February 2024 at a tertiary hospital in Shenzhen to analyze the application effects of speaking valves (phonatory valves) in these patients. The results are detailed below.

## Materials and Methods

### Study Subjects

A total of 40 ICU tracheostomy patients from February 2022 to February 2024 were selected as study subjects. Inclusion criteria:

(1) Age>18 years; (2) Glasgow Coma Scale (GCS) score>9; (3) Successful weaning from mechanical ventilation. Exclusion criteria: (1) Patients with myasthenia gravis; (2) Patients with laryngeal edema or airway deformities; (3) Patients with psychiatric disorders. This study was approved by the hospital ethics committee, and informed consent was obtained from patients and their families. The patients were divided into a control group (20 patients) and an experimental group (20 patients) using a random number table method. There were no significant differences in baseline characteristics between the two groups (P>0.05) (Table 1).

**Table 1:** Comparison of Baseline Characteristics Between the Two Groups.

| Group | Control Group (n=20) | Experimental Group (n=20) | $\chi^2$/t Value | P Value |
|---|---|---|---|---|
| Gender (Male/Female) | 14-Jun | 15-May | 0.152 | 0.697 |
| Age (Years) | 68.5±2.8 | 64.44±2.54 | 1.234 | 0.225 |
| APACHE II Score | 16.76±2.32 | 16.65±2.76 | 0.123 | 0.902 |
| GCS Score | 12.23±2.12 | 12.43±2.32 | 0.287 | 0.775 |

**Research Methods**

**Control Group:** This group received routine airway management after passing the SBT for weaning: (1) High-flow oxygen therapy (AIRVO2); (2) Suction as needed, with tracheostomy dressing changed daily (qd), and secretions above the cuff cleared before deflating the cuff; (3) Extubation criteria: Good respiratory function, good airway protection ability, stable hemodynamics, resolution of the underlying condition, and good patient consciousness; (4) A cuff leak test was performed before extubation. During extubation, secretions in the airway and mouth were suctioned, as well as secretions at the cuff of the tracheostomy tube. The tube was occluded for 24–48 hours, and nasal oxygen therapy was administered. The patient's respiration, oxygen saturation, coughing, sputum production, and any discomfort were closely monitored. If the patient remained stable and tolerated the occlusion, the tracheostomy tube was removed according to the extubation protocol.

**Experimental Group:** This group received routine airway management after passing the SBT for weaning, along with the use of a speaking valve. It was ensured that the patient had no contraindications for the speaking valve. The patient was positioned correctly, primarily in a semi-recumbent position. Secretions in the tracheostomy tube, oral cavity, and subglottic area were suctioned in sequence, and the cuff was slowly deflated to ensure airway patency. After placing the speaking valve, the operator gently secured the tracheostomy tube with one hand and placed the speaking valve at the tube entrance with the other hand, rotating it clockwise. The patient was asked to vocalize to assess airflow at the glottis. The initial trial duration was limited to less than 30 minutes, and the wearing time was gradually increased based on patient tolerance. The speaking valve could be worn at any time except during nebulization and sleep.

**Observation Indicators**

1)      Swallowing Function: The Standardized Swallowing Assessment (SSA) scale was used to evaluate swallowing function. Patients were asked to swallow 5mL of water three times, and laryngeal movement was observed. The total score ranged from 5 to 11, with higher scores indicating more severe swallowing dysfunction.

2)      Anxiety Incidence: The Self-Rating Anxiety Scale (SAS) was used to assess anxiety in both groups. A score above 50 indicated the presence of anxiety.

**Statistical Methods**

Data were processed using SPSS 23.0 software. Measurement data were expressed as mean ±standard deviation (±s) and analyzed using t-tests. Count data were expressed as percentages (%) and analyzed using chi-square tests ($\chi2$). A P-value<0.05 indicated a statistically significant difference.

## Results

**Comparison of Swallowing Function Between the Two Groups**

(Table 2)

**Table 2:** It shows that the swallowing function in the experimental group was significantly better than that in the control group (P<0.05).

| Group | Number of Cases | Swallowing Function (Score) |
|---|---|---|
| Experimental Group | 20 | 6.45±1.23 |
| Control Group | 20 | 9.45±2.43 |
| t Value | | 4.92 |
| P Value | | 0.001 |

**Comparison of Anxiety Incidence Between the Two Groups**

(Table 3)

**Table 3:** It shows that the anxiety incidence in the experimental group was significantly lower than that in the control group (P<0.05).

| Group | Number of Cases | Anxiety Incidence (%) |
|-------|-----------------|----------------------|
| Experimental Group | 20 | 5.0% (1 case) |
| Control Group | 20 | 30.0% (6 cases) |
| $\chi^2$ | | 4.33 |
| P Value | | 0.037 |

## Discussion

For patients undergoing tracheostomy, traditional extubation methods have more drawbacks and greater risks. Occluding the tube with a plug can create respiratory obstacles, even if a small hole (about 2mm) is left. This can lead to impaired gas exchange, causing breathlessness, cyanosis, and decreased oxygen saturation [3]. Secretions may become difficult to expectorate, increasing the risk of suffocation and hypoxia. Oxygen supply is crucial for bodily functions, especially for the brain, which consumes about 20%–25% of the body's oxygen. Hypoxia can cause headaches, restlessness, fainting, convulsions, and even death in severe cases [4]. Initially, speaking valves were widely used in Western countries to improve swallowing and speech functions. In recent years, they have been gradually adopted in respiratory and critical care rehabilitation departments in China. Studies have shown that speaking valves not only improve swallowing and speech functions and reduce the risk of aspiration-related pneumonia but also enhance patient confidence, social abilities, and respiratory function [5]. The use of speaking valves, especially leak-free valves, can increase subglottic pressure, which is beneficial for clinical rehabilitation. Before using a speaking valve, the tracheostomy cuff must be deflated, which reduces its interference with laryngeal elevation. Research has found that for tracheostomy patients, swallowing function training with a speaking valve can also achieve direct training effects [6]. In this study, the use of speaking valves in hospital and community tracheostomy patients showed that the experimental group had better swallowing function (P<0.05) and lower anxiety incidence (P<0.05) compared to the control group. This suggests that speaking valve intervention is more effective than conventional methods. Based on this study and related research, it is concluded that tracheostomy can impair respiratory and swallowing functions, such as the inability to generate subglottic pressure during swallowing and weakened cough reflexes. This may increase the risk of swallowing disorders, leakage, and aspiration. However, speaking valves can help restore subglottic positive pressure, thereby improving swallowing function. ICU tracheostomy patients often experience anxiety, irritability, and depression due to physical trauma, communication barriers, and rehabilitation challenges. The use of speaking valves can help restore speech communication, allowing patients to better express their needs and thoughts. This restoration of communication can alleviate anxiety, enhance patient confidence, and motivate rehabilitation. Additionally, effective communication between healthcare providers and patients allows for better understanding of psychological needs, enabling more personalized psychological support and care, further reducing anxiety [7,8].

## Conclusion

In conclusion, the use of speaking valves in ICU tracheostomy patients can improve swallowing function and reduce the incidence of anxiety.

## Acknowledgements

None.

## Conflict of Interest

None.

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