A Novel, Multifunctional Tracheal Tube Based on Directive Sound Wave Monitoring Technique

Zhang, Yuqian (School: The Affiliated High School of South China Normal University)

More than a hundred thousand patients do tracheotomy every year for throat cancer or mouth cancer, and they need to wear tracheal tubes after surgeries. But the current tracheal tube has led to skin festering, coughing, sputum, and the disability to shower. Even worse, the excreta may obstruct the tube and lead to asphyxia. Therefore, the novel tracheal tube in this project is designed with the functions of breath monitoring, shower protection, and heating, humidification, and filtration. By external, switchable units on the current tracheal tube, the novel tracheal tube can fulfill the demands of patients for both showering and daily lives. The heating, humidification, and filtration unit is combined with the breath monitoring unit in the same structure—a “tee-valve” high-throughput filter, where a tiny electret microphone is implanted at the end of a whistle structure. It detects the breathing sound of patients, and by sound - electricity transformation and amplifying, the electric signals are sent to the single-chip microcomputer. The system can adapt to different individuals, through autonomous learning to acquire patients’ respiration data and intelligent analysis to calculate breathing frequency. Setting the respiratory standard learned from patients, the system can evaluate whether the patients are hyperventilating or breathing slowly, and send alerts by light and sound. If the patients are taking shower, the shower-protection unit can ensure that the tracheal tube is waterproof while ventilate, by its ball-shape cover with 28 artificial holes opened at the bottom. The novel tracheal tube brings endless possibilities for the patients to enjoy much better and safer lives under different situations.

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