

Using an intelligent anti-snoring pillow for positional therapy in patients with obstructive sleep apnea

Objective: Obstructive sleep apnea (OSA) is a common and serious sleep disorder characterized by repeated pauses in breathing during sleep, leading to intermittent low oxygen levels. In addition to impairing sleep quality, memory, and psychomotor performance, OSA also increases the risks of myocardial infarction, stroke, and hypertension. Despite the notable effectiveness of continuous positive airway pressure (CPAP) therapy in treating sleep apnea, approximately 20-60% of patients are reluctant to use it for various reasons. Around 56% of OSA patients have position-dependent OSA (POSA), where the severity of airway obstruction is much worse when sleeping in a supine position compared to sleeping on their side. For patients with POSA, positional therapy can be considered to prevent them from sleeping in the supine position. This therapy typically involves specific devices designed to promote side sleeping, thereby reducing the likelihood of upper airway collapse and ultimately improving oxygenation.

Methods: This study aims to modify an existing commercially available smart pillow (Jing Jia Technology: Elevating Pillow) to assist patients with sleep apnea in achieving the benefits of positional therapy. Equipped with sensors, the pillow detects the sleeper's shoulder position and adjusts airbags and pumps inside to modify the slope and angle of the pillow surface when a supine position is detected. The goal of this modified pillow is to encourage side sleeping and reduce sleep apnea and low oxygen levels in POSA patients. Participants who met the criteria for positional therapy were invited to join the study. A total of 50 participants were recruited, some of them had prior experience with CPAP therapy. Therefore, we compared sleep quality and the severity of the apnea-hypopnea index (AHI) among three conditions: pre-treatment, using the intelligent anti-snoring pillow, and receiving CPAP therapy.

Results: The results showed that the intelligent anti-snoring pillow increased the side sleeping ratio by 2.7 times, reduced AHI by 57%, and decreased snoring by 31.2%. CPAP remains the gold standard treatment for sleep apnea, providing the greatest improvement in AHI and hypoxemia. Nonetheless, the intelligent anti-snoring pillow outperformed CPAP in terms of sleep efficiency and reducing sleep disruptions.

Conclusion: Our research suggests that the intelligent anti-snoring pillow can serve as an alternative therapy with good compliance and adherence for patients with mild to moderate OSA. It effectively reduces AHI and hypoxemia while significantly improving sleep quality.

中文題目：智慧型止鼾枕用於睡眠呼吸中止症患者睡姿治療法之應用研究

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