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Article

Effect of Nursing Intervention Combined with Voice Training on Voice Recovery in Patients with Unilateral Vocal Cord Paralysis after Thyroid Surgery

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Abstract: Objective: To assess the recovery of voice in patients with unilateral vocal cord paralysis after thyroid surgery following treatment with nursing intervention combined with voice training. **Methods:** Thirty patients with unilateral vocal cord paralysis and hoarseness for 6-12 months post-thyroid surgery were selected. They first underwent two weeks of psychological and cognitive intervention, followed by a psychological resilience assessment, and then proceeded with 12 weeks of voice training. This training primarily included muscle relaxation exercises, breathing training, and phonation exercises. A comparative analysis was conducted on the patients' voice parameters before and after the training, including jitter, shimmer, maximum phonation time (MPT), noise to harmonic ratio (NHR), and the Voice Handicap Index (VHI) scores. **Results:** After psychological and cognitive intervention, scores for optimism, resilience, and self-strength among the 30 patients increased. Post-voice training, reductions were observed in jitter, shimmer, NHR, and VHI scores, the Maximum Phonation Time (MPT) increased compared to pre-training, with the difference being statistically significant ($P < 0.05$). **Conclusion:** Nursing intervention combined with voice training can effectively improve voice quality in patients with unilateral vocal cord paralysis after thyroid surgery.

Keywords: nursing; voice training; post-thyroid surgery; vocal cord paralysis

Thyroid surgery can lead to unilateral vocal cord paralysis, a common clinical complication due to injury to the recurrent laryngeal nerve. This paralysis is characterized by incomplete vocal cord closure, resulting in difficulties in phonation, coughing, aspiration, etc., significantly impacting the patients' quality of life. Some patients' voices may improve to a certain extent after about six months, possibly due to the compensatory function of the healthy vocal cord. For patients not showing improvement, intervention is usually considered 6-12 months after the onset of hoarseness, but surgery should not be the immediate choice of treatment [1–3]. This study focuses on patients with unilateral vocal cord paralysis 6-12 months post-thyroid surgery. The first phase involves psychological and cognitive intervention, followed by voice training in the second phase. The improvement in voice quality is assessed through the analysis of both subjective and objective voice parameters.

1. Data and Methods

1.1. Study Subjects

Thirty patients with unilateral vocal cord paralysis post-thyroid surgery (13 males, 17 females), aged between 32-64 years (median age 41 years), with a history of 6-12 months, were selected for the study. They were treated from May 2019 to January 2023 at the Liangxiang Hospital in Fangshan District, Beijing. Inclusion criteria: ① Diagnosed with unilateral vocal cord paralysis by electronic laryngoscopy, with good movement of the opposite vocal cord; ② Persistent hoarseness for 6-12

months; ③ No prior voice training or surgical treatment for vocal cord paralysis. All patients initially underwent two weeks of psychological and cognitive intervention, after an assessment of psychological resilience, a 12-week voice training program is then conducted. Objective and subjective voice assessments were conducted before and after the training.

1.2. Psychological and Cognitive Interventions

1.2.1. Psychological Assessment

Nurses communicated with the patients and their families to clarify the current psychological state of the patients and to identify potential factors that might impact subsequent treatment, including lack of confidence in treatment, postoperative social anxiety, and insufficient understanding of postoperative complications. Emotional changes were observed and recorded to grasp the psychological dynamics. (Each patient's emotional and psychological changes during treatment were observed and recorded by two nurses, with timely feedback to the doctors. Prompt interventions for negative emotions, and if necessary, specialized psychological counselors were consulted for guidance.)

1.2.2. Encouragement and Guidance

Patients were guided to realize that the source of their negative psychological and emotional states was due to cognitive errors. They were instructed in rational-emotive imagination techniques and disputing irrational beliefs methods to alleviate negative emotions and to establish correct and healthy beliefs[4]. A WeChat group was formed to promptly understand and resolve patient concerns during treatment. Through the guidance, encouragement, and sharing of treatment methods by patients who had successfully undergone treatment, patient compliance was improved, ensuring treatment effectiveness. (Weekly online meetings were held where patients could share their experiences, insights, and confusions during treatment, with the treatment team addressing any difficulties encountered.)

1.2.3. Lifestyle Guidance

Involve family members to provide the patient with encouragement and confidence, enhance communication and care, and help the patient overcome psychological despair and social phobia. Regularly offer positive psychological suggestions to boost their confidence. Conduct weekly recreational activities among peers to strengthen their relationships, enabling patients to feel happiness and security during group activities, thus improving treatment compliance.

1.2.4. Cognitive Intervention

① Through repeated communication, help patients accept the reality of vocal cord paralysis and regain confidence by introducing success stories (weekly offline meetings, mainly through personal explanations from patients who have successfully undergone treatment, to alleviate concerns and strengthen confidence). ② Assist patients in understanding their personality traits, encouraging them to be confident and avoid impatience and anger in daily life. Simultaneously, conduct health education to make patients fully aware of the harm of smoking and alcohol on their voice, assisting them in quitting smoking and drinking.

1.2.5. Psychological Resilience Assessment

Utilize the Chinese version of the Connor Davidson Resilience Scale (CD-RISC) to assess the psychological resilience of patients before and after nursing intervention. This scale includes three dimensions: optimism, perseverance, and strength, corresponding to 4, 13, and 8 items, respectively. Each item is scored from 0 to 4, with higher scores indicating better psychological resilience[5], making the patient more suitable for the next phase of voice training.

1.3. Voice Training

Conducted by a speech and language therapist over 12 weeks, with three sessions per week, each lasting two hours. The specific steps are as follows.

1.3.1. Muscle Relaxation Exercises

Massage the throat to relax the laryngeal muscles, eliminating excessive tension in the muscles and spirit during phonation. During training, we instruct patients to slightly tilt their heads, relax the neck muscles, and place their index finger and thumb between the thyroid cartilage and hyoid bone. Using consistent force and gentle motions, they massage the space between the two bones repeatedly to achieve the goal of increasing the gap and relaxing the throat muscles[6].

1.3.2. Breathing Training

Abdominal breathing allows full activation of the diaphragm, achieving greater lung capacity to meet the needs of voice support. During training, the speech and language therapist first demonstrates abdominal breathing, then guides patients to place their palms on both sides of the abdomen. As patients inhale, the abdomen rises, and as they exhale, the abdomen contracts. This process helps patients feel the coordination between abdominal muscles and breathing, establishing the correct breathing rhythm, maintaining steady and sufficient breathing, and avoiding actions like excessive shoulder elevation or large-scale expansion and contraction of the thorax[7].

1.3.3. Upon mastering the above two exercises, patients proceed to phonation exercises, including

① Forced coughing; ② Producing single vowels /i/, /e/, /a/, /o/ after coughing; ③ Producing short sounds with hard attack /kà/, /kè/, /kò/, /gà/, /gè/, /gò/; ④ Producing double sounds with hard attack /kakà/, /kekè/, /kokò/; ⑤ Producing long sounds with hard attack /ka/, /ki/; ⑥ Slowly reciting five-character Tang poems, then moving to seven-character Tang poems, prose, and newspaper articles, gradually increasing speaking speed to approach or reach the standard of normal conversational speed. Practice for 20 minutes each session, three times a day[8].

1.4. Objective and Subjective Voice Assessment

1.4.1. Acoustic Analysis of Voice

Using German Xion acoustic analysis software for pre- and post-treatment voice analysis. Subjects sit in a quiet examination room, with the microphone 30cm from the mouth, producing a steady and comfortable vowel /a/ for over 3 seconds, recording jitter, shimmer, and NHR.

1.4.2. Maximum Phonation Time (MPT) Test

Using the American KayPENTAX speech aerodynamics system, patients are instructed to take a deep breath, then tightly cover their mouth and nose with a mask, and produce a comfortable /a/ sound until they can no longer vocalize. Repeat three times and record the longest phonation time, taking the maximum value of the three attempts.

1.4.3. VHI-10 Scale

Self-assessment of the severity of voice disorders through 10 questions. A higher score indicates a greater impact of the vocal pathology on the patient.

1.5. Statistical Methods

SPSS 19.0 software is used for statistical analysis of the data. Comparisons of pre- and post-treatment results are made using paired t-tests, with $P < 0.05$ indicating statistically significant differences.

2. Results

2.1.

All 30 patients, after undergoing two weeks of psychological and cognitive intervention, showed increased scores in optimism, perseverance, and strength (Table 1). They were able to accept the fact of vocal cord paralysis and cooperated well with the subsequent voice training. Ultimately, all patients completed the voice training program.

Table 1. Comparison of Psychological Resilience Before and After Intervention ($\bar{x} \pm s$, score).

Group	Optimism	Perseverance	Strength
Before Intervention	7.16±1.43	19.27±2.18	12.43±2.86
After Intervention	20.47±2.08*	38.07±4.11*	26.28±1.72*
t/p	6.436/0.000	5.011/0.001	8.253/0.000

Note: *Compared to before intervention, $P < 0.05$.

2.2. Comparison of Acoustic Parameters Before and After Voice Training

After voice training, there was a significant increase in the Maximum Phonation Time (MPT), and a notable decrease in jitter, shimmer, and Noise to Harmonic Ratio (NHR) compared to pre-training values, with statistical significance ($P < 0.05$) (Table 2).

Table 2. Comparison of Objective and Subjective Assessment Parameters Before and After Voice Training ($\bar{x} \pm s$).

Group	jitter (%)	shimmer (%)	NHR(dB)	MPT (s)	VHI-10 (分)
Pre-Training	6.26±2.01	5.87±1.43	0.34±0.03	5.41±2.78	30.15±5.27
Post-Training	2.33±0.98*	2.09±1.05*	0.12±0.06*	11.08±3.11*	13.75±3.51*
t/p	3.981/0.011	2.421/0.002	3.673/0.000	5.153/0.001	3.792/0.000

Note: *Compared to pre-training, $P < 0.05$.

2.3. Comparison of VHI Scores

After voice training, the total score of the Voice Handicap Index (VHI) in the functional, physical, and emotional aspects significantly decreased compared to pre-training, with the difference being statistically significant ($P < 0.05$) (Table 2). Patients reported a perceived improvement in voice quality.

3. Discussion

Injury to the recurrent laryngeal nerve is a common complication of thyroid surgery, with an incidence rate of up to 6.6%[9]. Common causes of such injury include severance, ligation, cauterization, clamping, contusion, and traction, with the prognosis related to the extent of nerve damage. In mild cases, vocal cord movement may recover, but in severe cases, the vocal cords may become permanently fixed[10]. Currently, there is no unified standard for the optimal timing to start voice training for patients with unilateral vocal cord paralysis. Some scholars believe that early voice training is beneficial for the recovery of vocal function[11,12]. Clinically, we also observe that some patients gradually improve their hoarseness within six months post-surgery, and some even recover completely. This could be due to the fact that the recurrent laryngeal nerve was not completely severed during surgery but was clamped, bruised, or pulled, and the nerve reinnervation naturally recovers postoperatively, or the healthy vocal cord compensates. The natural recovery time generally

takes 3-6 months, during which the degree of hoarseness in the patient's voice also gradually recovers or improves as the nerve function restores or the healthy vocal cord compensates[13]. Based on these reasons, this study chose patients with a disease duration of 6-12 months. Patients with vocal cord paralysis post-thyroid surgery, often due to unilateral thyroidectomy for thyroid cancer, generally experience significant psychological stress and negative emotions, and are unable to self-regulate. Although voice training is a non-invasive treatment method, patients often lack enough confidence and compliance due to negative emotions and insufficient understanding, thus failing to cooperate effectively with the speech therapist, which impacts the treatment outcome. Therefore, before voice training, we conducted two weeks of psychological and cognitive intervention, accepting the fact of vocal cord paralysis and preparing them with a positive attitude for subsequent treatment while providing health education.

Recent studies have shown that voice training is beneficial in improving the vocal function of patients with unilateral vocal cord paralysis and is effective for those with injuries within one year[14,15]. This study also found that for patients with a disease duration of 6-12 months, voice training had a significant effect. After 12 weeks of regular voice training, all 30 patients with unilateral vocal cord paralysis showed improvement in voice quality. The Voice Handicap Index-10 (VHI-10) score decreased from (30.15±5.27) before training to (13.75±3.51) post-training, indicating a statistically significant difference. In patients with unilateral vocal cord paralysis, due to the fixation of one vocal cord and the relaxation of the affected side during closure, there is a reduced amplitude and weakened mucosal wave, leading to increased jitter and shimmer. The presence of various degrees of hoarseness and increased noise components due to incomplete glottal closure results in a higher Noise to Harmonic Ratio (NHR). Voice training, as a non-invasive treatment, can help patients with unilateral vocal cord paralysis after thyroid surgery through muscle relaxation, breathing exercises, and localized phonation training. This method enhances the coordination of laryngeal muscles and nerves, establishing a correct and scientific method of phonation, thereby allowing for tighter glottal closure and more stable vocal cord status, ultimately improving voice quality[16]. The results of this study indicate that after voice training, the 30 patients with unilateral vocal cord paralysis post-thyroid surgery showed a significant extension in Maximum Phonation Time (MPT), and notable decreases in jitter, shimmer, and NHR, with statistical significance compared to pre-training ($P<0.05$), consistent with the above conclusions.

In summary, for patients with unilateral vocal cord paralysis 6-12 months post-thyroid surgery, nursing intervention combined with voice training effectively improves voice quality. Clinically, the importance of nursing intervention must be emphasized, with timely correction of patients' negative psychology and misconceptions. However, the effectiveness of this treatment method for patients with a history of more than 12 months still requires further research.

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