

Effect of Mouth Opening Training Stick Combined with Oral Massage on Mouth Opening Difficulty in Head and Neck Cancer Patients after Treatment

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Abstract

Objective: To study the application effect of mouth-opening training sticks combined with oral massage on patients with mouth-opening difficulty after treatment for head and neck cancer. **Methods:** Using convenient sampling, 60 patients with mouth-opening difficulty after treatment for head and neck cancer admitted to the Oncology Department from February 2022 to October 2023 were selected for a 2-week exercise and nursing program. The patients were divided into a control group (February 1, 2022 to November 30, 2022) and an observation group (December 1, 2022 to October 31, 2023), with 30 patients in each group. The control group underwent routine mouth-opening functional exercises combined with cork for oral support training, while the observation group underwent routine mouth-opening functional exercises combined with oral massage and mouth-opening training sticks for oral support training. The mouth-opening degree, mouth-opening difficulty level, comfort level, compliance, and quality of life were observed in both groups. **Results:** Before the intervention, there were no statistically significant differences in mouth-opening degree and mouth-opening difficulty level between the two groups ($P > 0.05$). After the intervention, the mouth-opening degree, mouth-opening difficulty level, oral comfort level, compliance, and QLICP-HN scores in the observation group were all better than those in the control group, with statistically significant differences ($P < 0.05$). **Conclusion:** The combination of mouth-opening training sticks and oral massage with mouth-opening functional exercises can effectively improve the degree of mouth-opening difficulty, enhance oral comfort, increase compliance with mouth-opening exercises, and improve quality of life.

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Keywords

Head and Neck Cancer, Difficulty in Opening the Mouth, Open Mouth Training Stick, Oral Massage, Rehabilitation Effect

1. Introduction

Head and neck cancer (HNC) is a general term for a series of malignant tumors, mainly originating from the oral cavity, nasopharynx, oropharynx, larynx and hypopharynx including the lip [1]. In clinical treatment, comprehensive sequential therapy with surgery as the core is the main method. However, due to the influence of tumors and the possible side effects of surgery and radiotherapy, such as masticatory muscle injury, skin graft, surgical scar, and fibrosis after radiotherapy, it often leads to temporomandibular joint sclerosis, which in turn restricts the movement of the temporomandibular joint, makes the joint tense, and reduces the incisor distance of opening the mouth [2], which eventually leads to the dysfunction of opening the mouth of patients. The incidence of this problem is as high as 58.5%, which seriously affects the quality of life of patients [3]. It has been confirmed by many studies that mouth-opening exercise is an effective way to prevent and reduce mouth-opening difficulties [4]. Traditional exercise methods mainly include oral opening exercises by patients themselves and oral support training with auxiliary tools (such as tongue depressor, cork, and metal mouth opener). However, self-initiated mouth-opening exercises are often difficult for patients to adhere to due to their lack of attention, cancer-related fatigue, sore throat, and other radiation therapy reactions such as radiation dermatitis, which make patients feel uncomfortable. This makes it difficult for patients to carry out regular exercises according to the plan, resulting in unsatisfactory effects [5]. At the same time, traditional auxiliary tools often cause muscle soreness due to problems such as narrow support occlusal surface, poor stability, and low comfort, and the effect is not significant [6]. In view of this, our department is actively seeking improvement methods, trying to use food-grade silicone mouth-opening training sticks, combined with oral massage and autonomous mouth-opening function exercise, to intervene in patients with mouth opening difficulties after head and neck cancer treatment, the effect is remarkable.

2. Materials and Methods

2.1. Subjects

The study used the convenience sampling method. Patients with difficulty in opening their mouths after treatment for head and neck cancer admitted to our department from February 2022 to October 2023 were selected as research objects. Inclusion criteria: 1) Pathologically confirmed patients with newly diagnosed head and neck cancer; 2) Gender is not limited, age 18 - 70 years old; 3)

Difficulty opening the mouth after oral surgery and radiotherapy; 4) clear mind, no history of mental illness, good cognitive understanding ability; 5) 90% of the upper and lower incisors still exist, and the incisor pitch can be accurately measured; 6) Patients and their families informed consent, voluntarily participated in this study and cooperated with the investigation. Exclusion criteria: 1) Consciousness, language expression disorders, psychiatric history; 2) Those who cannot successfully complete the expected treatment plan due to social or family and economic reasons; 3) Combined with other serious diseases; 4) Allergy to the material under study. Patients admitted from February 1, 2022 to November 30, 2022 were used as control groups in order of admission time. Patients admitted from January 1 to October 31, 2023 were used as the observation group, with 30 cases in each of the two groups. In the control group, there were 21 males and 9 females; Aged 42 - 72 years, mean (51.34 ± 3.69) years; in the observation group, there were 24 males and 6 females; Aged 36 - 70 years, mean (50.41 ± 3.81) years. There were no statistically significant differences in general information between the two groups ($P > 0.05$), making them comparable.

2.2. Methodology

2.2.1. In Control Group

Patients received routine nursing during the peri-radio therapy period from the first day of admission. The responsible nurse first evaluated the degree of mouth opening of the patients and determined the classification accordingly. Subsequently, according to the incisor distance of the patients, the nurses selected a conical cork of appropriate size, placed it between the upper and lower incisors or in the bilateral molar area, and carried out alternating support exercises, instructing the patients to occlude the cork correctly, 5 times a day, 10 minutes each time. At the same time, patients should do self-exercise of mouth-opening function, and the responsible nurse should provide one-on-one guidance for the patients to do six-step exercises, including mouth-opening, cheek puffing, teeth knocking, tongue flicking and neck stretching. The nurse should guide the patients to watch the video of music and commands recorded by the department, helping them better follow the training rhythm, timely correcting any deviation of the actions, and ensuring that the patients can correctly and standardly grasp the methods of functional exercise.

2.2.2. In Observation Group

A set of comprehensive oral training methods were implemented, including oral support training with mouth opening training stick, oral massage, and oral opening function exercise. Compared with the control group, the observation group used mouth-opening training stick instead of cork for oral support training, and added oral massage on the basis of the original mouth-opening function exercise. The specific implementation is as follows: 1) mouth opening training stick oral support training. According to the incisor distance of the patient, select a suitable size of the mouth opening training stick (Ampinuo Nursing

Products Store, ZL202030058772.7, Q/Y IGATE 20-2022), slowly put the clean mouth opening training stick from both sides of the mouth, and fix it safely between the upper and lower molars according to the patient's tolerance. It lasts 10 minutes each time, 5 times a day. After using it, clean it with water or warm water below 60°C, and dry it in a cool and ventilated place, and then properly put it in the storage box. 2) Oral massage. Drawing on the oral motor skills of newborns, patients are advised to perform oral massage once after each meal and after oral cleaning and gargling. The massage includes jaw massage and intraoral massage. Jaw massage involves targeted massage of the left and right cheeks, upper and lower jaws, and lips, lasting 1 - 2 minutes per area. Intraoral massage involves the tongue surface, tongue base, palate, upper and lower gums, and left and right cheeks. Before the massage, patients should wash their hands and wear medical toothbrush finger covers for the massage. Each area is massaged for 1 - 2 minutes. The responsible nurse will guide the patient through the massage, and once the patient has fully mastered the technique, they can perform self-massage, while the nurse remains in charge of supervision.

2.2.3. Observation Index

1) Degree of mouth opening [7]: Use a special incisor pitch measurement rule to measure, open the mouth to the greatest extent, the distance between the upper and lower incisor margins is the standard, and check the degree of mouth opening. The average mouth opening of normal people in a natural state is 3.7 - 4.5 cm.

2) Degree of difficulty in opening the mouth: evaluate with reference to the mandibular LENT SOMA grading standard [8], and grade the degree of difficulty in opening the mouth according to the upper and lower incisor pitch, grade I: incisor pitch between 20 - 30 mm; Grade II: Difficult to eat dry food, incisor pitch between 11 - 20 mm; Grade III: Difficult to eat soft food, incisor pitch between 0.5 - 10 mm; Grade IV: The incisor pitch is < 0.5 cm, and it is not allowed to eat by mouth at all, and nasal feeding is required.

3) Oral comfort: Evaluated according to the linear visual analog scale method [9], the two ends of this scale are marked with numbers from 0 - 10, and 0 points for asymptomatic; 1 - 4 points for mild discomfort; 5 - 7 is moderately uncomfortable; 8 - 10 points to severe discomfort (intolerable).

4) Compliance [10]: The compliance of patients is divided into three levels: complete compliance, indicating high cooperation from the patient, who uses assistive devices and performs exercises according to the instructions, with the frequency and amplitude meeting the specifications; partial compliance, indicating that the patient partially follows the instructed exercises, such as using assistive devices only some of the time, incomplete content of functional exercises, reduced frequency, and amplitude not meeting the requirements; and non-compliance, indicating that the patient only occasionally uses assistive devices combined with functional exercises for training or does not use them at all and does not perform any training. Total compliance = (number of patients with complete compliance + number of patients with partial compliance)/total num-

ber of patients \times 100%.

5) Quality of Life: The Chinese Quality of Life Instruments for Cancer Patients with Head and Neck Cancer (QLICP-HN) [11] was used to evaluate the quality of life of patients in five dimensions: physiological function, social function, psychological function, common symptoms and side effects, and specific modules. There are 46 items in total, and each item is scored using the Likert five-level scoring method. The higher the score, the better the patient's quality of life.

2.2.4. Statistical methods

The statistical methods were analyzed with SPSS 19.0 statistic data, the normal data were expressed by $x \pm s$, and the comparison between groups was analyzed by variance analysis and t-test; The count data were expressed by the number of cases and percentages, and the comparison between groups was performed by χ^2 test, and the difference was statistically significant by $P < 0.05$.

3. Result

1) There was no significant difference between the two groups before the intervention ($P > 0.05$). After the intervention, the mouth opening of the observation group was higher than that of the control group ($P < 0.01$). (Table 1)

2) Before the intervention, there was no significant difference between the two groups in the degree of difficulty in opening the mouth ($P > 0.05$); after intervention, the degree of difficulty of mouth opening in the observation group was better than that in the control group, the difference was statistically significant ($P < 0.05$). (Table 2)

Table 1. Comparison of mouth opening between two groups [$(x \pm s, \text{cm})$].

Group	Number of cases	Pre-intervention	Post-intervention
Control group	30	1.45 \pm 0.85	3.62 \pm 0.92
Observation group	30	1.51 \pm 0.78	3.04 \pm 0.68
t value		0.042	3.285
P value		0.588	0.001

Table 2. Comparison of the degree of mouth opening difficulty between the two groups [n (%)].

Group	Number of cases	Pre-intervention				Post-intervention			
		Class I	Class II	Class III	Grade IV	Class I	Class II	Class III	Grade IV
Control group	30	4 (13)	14 (47)	8 (27)	4 (13)	11 (37)	12 (40)	5 (17)	2 (6)
Observation group	30	3 (10)	15 (50)	9 (30)	3 (10)	17 (57)	13 (43)	0 (0)	0 (0)
Z value			0.382				2.218		
P value			0.612				0.028		

3) Before intervention, there was no significant difference between the two groups in oral comfort score ($P > 0.05$); after intervention, the oral comfort score of the control group was significantly higher than that of the observation group ($P < 0.001$). (**Table 3**)

4) The observing group was superior to the control group in training compliance; the difference was statistically significant ($P < 0.05$). (**Table 4**)

5) The quality of life of the two groups was compared between the two groups. The QLICP-HN scales were filled in before discharge. The results showed that the physiological function, social function, psychological function, common symptom and side effect, specific module and total score of the observation group were higher than those of the control group; the difference was statistically significant ($P < 0.05$). (**Table 5**)

Table 3. Comparison of oral comfort scores between the two groups of patients [$x \pm s$ (points)].

Group	Number of cases	Pre-intervention	Post-intervention
Control group		7.12 ± 1.68	5.98 ± 1.59
30 Observation group	30	6.84 ± 1.72	2.56 ± 1.42
t value		0.987	11.285
P value		0.429	0.000

Table 4. Comparison of compliance with oral opening exercise between two groups [n (%)].

Group	Number of cases	Complete compliance	Partial compliance	Non-compliance	Total compliance rate
Control group	30	5 (17)	13 (43)	12 (40)	60
Observation group	30	21 (70)	5 (17)	4 (13)	87
Z value					22.854
P value					0

Table 5. Comparison of quality of life scale scores between two groups of patients [$x \pm s$] (Points)].

Group	Number of cases	Physiological mental state 1 function	Social function common symptoms and side effects	Specific module
Control group	30	19.98 ± 1.58 29.98 ± 2.43	19.57 ± 2.56 24.05 ± 1.56	40.86 ± 3.65
Observation group	30	21.24 ± 2.12 31.82 ± 2.63	23.56 ± 2.03 28.12 ± 2.13	45.89 ± 3.82
t value		4.586 4.652	8.862 10.897	6.198
P value		0.000 0.000	0.000 0.000	0

4. Discussion

Difficulty in opening the mouth is a common complication after the treatment of head and neck cancer, and its incidence is affected by multiple factors such as the clinical stage of the tumor, the location of the disease, and the treatment plan [2]. According to statistics, as many as 65% of patients face the problem of limited mouth opening after treatment, among which the incidence of limited mouth opening after radiotherapy alone is 25% to 42%, and the incidence of patients undergoing surgery and postoperative radiotherapy is even more significant increase [12] [13]; For this complication, there is no standardized treatment plan yet. At present, mouth-opening exercise is the main intervention method, and it needs long-term persistence.

Our department adopts the strategy of active mouth-opening exercise combined with passive mouth-opening exercise with auxiliary equipment, supplemented by oral massage intervention. The results of this study showed that compared with the control group, the patients in the observation group performed better in terms of functional exercise compliance and oral comfort ($P < 0.05$), and their mouth opening and mouth opening difficulties were improved. The QLICP-HN scale score was also significantly higher than that of the control group. The reason is that, on the one hand, the mouth-opening training stick is made of food-grade silicone, which is not only flexible and bite-resistant, but also has a wide occlusal surface, which can effectively avoid tooth and muscle soreness, enabling quantitative exercise to be carried out for a long time, and ensure the “degree” of “exercise.”, thereby significantly improving the patient’s incisor pitch. Its ultra-long anti-slip handle design is not only easy to operate and easy to fix, but also can choose the appropriate size according to the mouth opening degree, making the comfort and compliance of the mouth-opening training stick superior to traditional corks. On the other hand, this study used the concept of neonatal oral massage for reference, maxillofacial and oral massage. According to the “Acupoint Theory of Traditional Chinese Medicine”, massage covers the three major salivary glands of the parotid gland, submandibular gland, and sublingual gland, as well as the three major Tianjin-promoting acupoints of Chengjiang point, Yuye point, and Jinjin point. Stimulation of specific acupoints can not only increase saliva secretion and improve oral self-cleaning ability, but also improve the oral environment, relieve symptoms such as dry mouth and sore throat, prevent oral infection, and then improve oral comfort and compliance with mouth-opening exercises. In addition, oral massage can also promote passive movement of the parotid gland, stimulate the temporomandibular joint and masticatory muscles, help reduce muscle atrophy, joint sclerosis, reduce salivary gland fibrosis, and enhance the motor capacity of perioral muscles and tongue muscle tension. The combined application of oral massage and mouth opening function exercise has played a synergistic role, effectively improved the difficulty of mouth opening, and improved the quality of life of patients.

To sum up, for the difficulty of opening the mouth after the treatment of head and neck cancer, the early introduction of mouth opening training sticks combined with autonomous mouth opening functional exercise, combined with oral massage intervention, can significantly improve the patient's comfort and exercise compliance behavior, and effectively improve mouth opening. The degree and difficulty of opening the mouth, thereby improving the quality of life of patients. This strategy is worthy of extensive promotion and application in clinical practice. At the same time, rehabilitation exercise for head and neck cancer patients after treatment is a long-lasting process. In the future, we will further increase the study sample size, extend the intervention time, and strengthen the follow-up of patients after discharge, so as to provide patients with more comprehensive and in-depth rehabilitation support.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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