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Study on the Intervention of Collaborative Nursing Mode in Oral Health and Self-Care of Patients with Colorectal Cancer After Chemotherapy

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Abstract: *Objective:* To analyze the effects of a coordinated intervention plan combining oral health and self-care on the oral health, self-care ability, and hospitalization satisfaction of colorectal cancer patients post-chemotherapy. *Methods:* A total of 106 patients undergoing postoperative chemotherapy for colorectal cancer from October 2022 to August 2023 were randomly divided into two groups. Both groups received routine nursing care, while the intervention group also received a coordinated intervention program. The effectiveness of the intervention was evaluated using the oral odor score, Beck oral rating scale, self-care ability scale, and patient hospitalization satisfaction scale. Data was collected before the intervention, and on the 7th and 14th days after the intervention. *Results:* No significant differences were found between the two groups before the intervention ($P > 0.05$). After the intervention, the intervention group showed significant improvements in Beck oral score, dry mouth, and bad breath scores ($P < 0.05$), compared to the control group. There was no significant difference in oral pH between groups ($P > 0.05$). Self-care ability improved significantly in the intervention group ($P < 0.05$). Independent sample *t*-tests revealed that the intervention group had significant improvements in satisfaction with medical care, including doctors' and nurses' professional skills and humanistic care ($P < 0.05$). No significant differences were found in waiting time and hospital environment ($P > 0.05$). *Conclusion:* The coordinated intervention plan combining oral health and self-care for colorectal cancer patients post-chemotherapy significantly improves oral health, self-care ability, and hospitalization satisfaction. This approach, integrating traditional Chinese and Western medicine, has great potential for clinical application.

Keywords: Collaborative nursing model; Colorectal cancer; Postoperative chemotherapy patients; Oral health; Self-care

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1. Introduction

Colorectal cancer is currently one of the most prevalent malignant tumors worldwide, with significant impacts on both life expectancy and overall health. In clinical treatment, surgery and chemotherapy often disrupt the oral health environment of patients, leading to issues such as increased oral odor, dry mouth, and acidic oral pH [1]. These factors can negatively affect the patients' cancer treatment outcomes and significantly reduce their satisfaction with hospital care, ultimately affecting the likelihood of recovery and shortening survival time. In response, collaborative nursing practices have been increasingly implemented in the treatment of colorectal cancer, aiming to improve clinical outcomes. However, most existing studies focus primarily on postoperative care, with limited research on oral health and self-care. Therefore, 106 patients undergoing postoperative chemotherapy for colorectal cancer at the oncology department of a hospital from October 2022 to August 2023 were selected as the subjects for this study. The aim was to explore the clinical effectiveness of a collaborative nursing program targeting oral health care. Specifically, the study analyzes the impact of the coordinated nursing program on patients' oral health, self-care abilities, and hospitalization satisfaction. This research aligns with the "Healthy China Action (2019–2030)" initiative, contributes to public health education, and enhances public awareness of self-care and health management. It is also an important reflection of the implementation of the "Healthy Oral Action Plan (2019–2025)" and "China's Medium- and Long-term Plan for the Prevention and Treatment of Chronic Diseases (2017–2025)." This study is of great significance for improving the satisfaction of colorectal cancer patients post-surgery, enhancing their oral health, and promoting the collaborative nursing model.

2. Materials and methods

2.1. General information

This study received approval from the ethics committee of the hospital. Additionally, all postoperative colorectal cancer patients participating in this study were informed of the experimental procedures, voluntarily agreed to participate, and signed the informed consent forms.

A total of 106 postoperative colorectal cancer patients undergoing chemotherapy were recruited from the oncology department of a hospital between October 2022 and August 2023. Eligible patients were randomly assigned to either the control group or the intervention group, with 53 patients in each group. Both groups underwent different intervention measures simultaneously. Furthermore, there were no statistically significant differences in the baseline data of the two groups before the intervention ($P > 0.05$), ensuring comparability.

The selection criteria for inclusion and exclusion in this study were as follows:

(1) Diagnostic criteria: Patients met the diagnostic criteria outlined in the Chinese Standard for the Diagnosis of Colorectal Cancer (2020 Edition) and had undergone radical surgery.

(2) Inclusion Criteria: (a) Patients with a confirmed diagnosis of colorectal cancer at clinical stages III or IV; (b) Patients aged between 50 and 70 years (inclusive); (c) Patients with an expected postoperative survival of more than three months; (d) Patients with clear consciousness and normal communicative ability; (e) Patients with stable conditions and no major organ dysfunction; (f) Patients with a Beck Oral Score above 6; (g) Patients receiving FOLFOX chemotherapy; (h) Patients who voluntarily agreed to participate in the study and signed the informed consent forms.

(3) Exclusion criteria: (a) Terminal patients with an expected survival of less than three months; (b) Patients experiencing difficulty opening their mouths or with swallowing dysfunction; (c) Patients with mental or intellectual disabilities who were unable to comprehend and respond to the questionnaire; (d) Patients

who declined to sign the informed consent forms or were involved in other clinical trials [3]; (e) Patients requiring a new chemotherapy regimen due to changes in their condition during treatment; (f) Patients experiencing severe adverse reactions to chemotherapy, as assessed by professional physicians, requiring treatment termination or delay; (g) Patients unwilling to continue the study; (h) Patients unable to continue participation due to physical or disease-related reasons [4].

2.2. Methods

Patients in both groups received routine treatment and care according to the FOLFOX chemotherapy regimen.

2.2.1. Treatment and nursing for the control group

(1) Admission education: On the day of admission, patients were introduced to the ward environment, the attending physician, and the responsible nurse. Patients were required to sign the admission notice, physical therapy consent, and other relevant consent forms. The process aimed to build trust with the patients and establish a positive nurse-patient relationship. The attending physician diagnosed and evaluated the patient's condition to determine the treatment plan.

(2) Introduction to chemotherapy: Before the initiation of chemotherapy, the attending physician explained the purpose, duration, and potential side effects of chemotherapy to the patient. Patients were required to sign the chemotherapy consent form [5].

(3) Life guidance: Patients were advised on lifestyle adjustments, including:

(a) Maintaining a light diet with small, frequent meals.

(b) Avoiding spicy and other irritating foods.

(c) Abstaining from smoking and alcohol consumption.

(d) Drinking more than 1,000 ml of water daily.

(4) Oral care: During morning care, nurses cleaned the patients' mouths with iced tea lotion.

2.2.2. Treatment and nursing for the intervention group

For the intervention group, a collaborative intervention nursing plan was implemented, involving the following steps:

(1) Establishment of a collaborative intervention team: A collaborative intervention team was formed prior to the trial. Team members included a nursing graduate student, two graduate supervisors, an oncologist, a stomatologist, a rehabilitation therapist, and a responsible nurse. The team underwent homogenized training sessions and assessments via a WeChat group.

(2) Implementation of the collaborative intervention program:

(a) Health education: Health education was conducted through expert knowledge lectures, distribution of oral care health manuals, and psychological support to help patients alleviate negative emotions and express their thoughts confidently [6];

(b) Oral care: Oral care steps including guiding patients in oral hygiene practices, showing instructional operation videos, followed by supervised patient practice, and assisting with wiping, gargling, and oral function exercises;

(c) Patient self-care:

(i) Dietary guidance: Patients were advised to avoid high-fat, fried, spicy, and irritating foods; consume fresh

fruits, vegetables, grains, vitamin-rich, low-fat, and easily digestible foods; incorporate foods such as yams, carrots, and walnuts post-chemotherapy to boost immunity; quit smoking and alcohol consumption; drink more than 1,500 mL of water daily.

(ii) Knowledge sharing via WeChat group: Patients were organized into a WeChat group where they received information related to postoperative chemotherapy, such as the progression of colorectal cancer, surgical and chemotherapy objectives, precautions, and oral care during postoperative chemotherapy [7].

(iii) Daily engagement: The group conducted "daily question" sessions at fixed times (e.g., 4 p.m. to 6 p.m.), encouraging patient participation. Answers were later shared, and any unresolved questions were addressed in detail the following day [8].

2.3. Observational indicators and criteria

The observational indicators comprised several measures:

(1) Beck oral rating scale: Higher scores indicate poorer oral health.

(2) Halitosis scoring criteria: Higher scores correspond to more severe halitosis.

(3) Dry mouth scoring criteria: Higher scores indicate greater severity of dry mouth.

(4) Oral pH measurement: Normal pH values range from 6.6 to 7.1. Values outside this range suggest abnormal oral pH levels.

(5) Self-care ability scale: Self-care ability was assessed using a total score of 172 points and scores across various dimensions [9]. Levels were classified as follows: (a) Scores below 33% of the total indicate low self-care ability; (b) Scores between 33% and 66% indicate medium self-care ability; (c) Scores above 66% indicate high self-care ability, with higher scores reflecting better self-care abilities.

(6) Cancer patient hospitalization satisfaction scale: Higher scores indicate greater satisfaction with hospitalization.

2.4. Data collection

Data collection was performed at three key time points: before intervention, the 7th day after intervention, and the 14th day after intervention. The data collection schedule is summarized in **Table 1**.

Table 1. Data collection schedule

Time	Two sets of data collection and evaluation time						
	General demographic information	**Beck oral rating scale**	**Halitosis scoring**	**Dry mouth scoring**	**Oral pH measurement**	**Self-care ability scale**	**Cancer patient hospitalization satisfaction scale**
Pre-intervention	√	√	√	√	√	√	-
Intervention day 7	-	-	√	√	√	-	-
Intervention day 14	-	-	√	√	√	-	√

2.5. Statistical analysis

The collected data were entered into a computer and analyzed using SPSS 26.0 statistical software [10]. Statistical

methods included:

(1) Chi-squared test: Applied to categorical data, with results presented as percentages. When the number of cases was less than 10, Fisher's exact probability method was used.

(2) *t*-test: Applied to measurement data conforming to a normal distribution, with results expressed as mean ± standard deviation (SD).

(3) Rank-sum test: Used for measurement data that did not conform to a normal distribution.

(4) Repeated measures analysis of variance (ANOVA): Conducted on repeated measurements [11].

A P-value of < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of basic data between the two groups before intervention

Measurement data, including height, weight, and age of the patients in the two groups, showed no statistically significant differences as determined by the independent sample *t*-test ($P > 0.05$). Categorical data, such as gender, occupation, family accompaniment, marital status, and payment methods for medical expenses, also demonstrated no statistically significant differences according to the χ^2 test ($P > 0.05$) [12]. For ordinal data, such as education level and monthly family income, the Wilcoxon rank-sum test was applied, yielding no statistically significant differences ($P > 0.05$). Details of the data comparison are presented in **Table 2**.

Table 2. Comparison of general data between the two groups before the intervention

Item	Category	Intervention group (n = 51)	Control group (n = 51)	Statistic	P-value
Age (years)		65.33 ± 2.733	64.78 ± 2.540	1.020[a]	0.310
Gender	Male	38 (74.5%)	37 (72.5%)	0.502[c]	0.822
	Female	13 (25.5%)	14 (27.5%)		
Height (cm)		163.71 ± 7.82	165.88 ± 5.13	-1.67[a]	0.664
Weight (kg)		55.24 ± 5.82	57.39 ± 8.11	3.277[a]	0.201
Marital status	Married	42 (82.3%)	46 (90.2%)	3.276[d]	0.338
	Divorced	3 (5.9%)	2 (3.9%)		
	Widowed	6 (11.8%)	2 (3.9%)		
	Unmarried	0 (0.0%)	1 (2.0%)		
Occupation	Retired	22 (43.1%)	23 (45.1%)	0.166[c]	0.983
	Farmer	5 (9.8%)	5 (9.8%)		
	Self-employed	4 (7.8%)	3 (5.9%)		
	None	20 (39.2%)	20 (39.2%)		
Medical expense coverage	Self payment	22 (43.1%)	30 (58.8%)	7.702[d]	0.091
	Provincial insurance	1 (2.0%)	3 (5.9%)		
	Urban medical insurance	13 (25.5%)	11 (21.6%)		
	Rural cooperative	10 (19.6%)	2 (3.9%)		
	Public coverage	5 (9.8%)	5 (9.8%)		

Table 2 (Continued)

Item	Category	Intervention group (n = 51)	Control group (n = 51)	Statistic	P-value
Caretaker	Yes	45 (88.2%)	47 (92.2%)	0.443[c]	0.505
	No	6 (11.8%)	4 (7.8%)		
Education level	Primary school or below	22 (43.1%)	22 (43.1%)	-2.116[b]	0.833
	Junior high school	11 (21.6%)	13 (25.5%)		
	High school/technical secondary school	7 (13.7%)	6 (11.8%)		
	College	6 (11.8%)	6 (11.8%)		
	Bachelor's or above	5 (9.8%)	4 (7.8%)		
Monthly household income (RMB)	Less than 1,000 RMB	19 (37.3%)	22 (43.1%)	-0.536[b]	0.592
	1,000–2,999 RMB	23 (45.1%)	21 (41.2%)		
	3,000–4,999 RMB	8 (15.7%)	6 (11.8%)		
	Over 5,000 RMB	1 (2.0%)	2 (3.9%)		

Note: a: t-value; b: Z-value; c: χ^2 value; d: Fisher's exact value.

3.2. Comparison of disease data between the two groups before intervention

Before the intervention, the disease-related data of the two groups were comparable, with no statistically significant differences ($P > 0.05$). Detailed results are shown in **Table 3**.

Table 3. Comparison of disease data between the two groups before the intervention

Item	Category	Intervention group (n = 51)	Control group (n = 51)	χ^2	P
Disease name	Colon malignant tumor	32 (62.7%)	30 (58.8%)	0.165	0.685
	Rectal malignant tumor	19 (37.3%)	21 (41.2%)		
Disease stage	Stage III	36 (70.6%)	36 (70.6%)	0.000	1.000
	Stage IV	15 (29.4%)	15 (29.4%)		
Surgical method	Laparoscopic radical colectomy for colon cancer under general anesthesia	36 (70.6%)	36 (70.6%)	0.000	1.000
	Laparoscopic radical proctectomy for rectal cancer under general anesthesia	15 (29.4%)	15 (29.4%)		

3.3. Comparison of observation indicators between the two groups before intervention

Prior to the intervention, the observation indicators for the two groups were comparable, and no statistically significant differences were observed ($P > 0.05$). The results are detailed in **Tables 4–7**.

Table 4. Comparison of self-care ability scores and four dimensions between the two groups before intervention

Item	Category	Intervention group (n = 51)	Control group (n = 51)	t	P
Score	Self-care ability	41.180 ± 11.264	45.106 ± 10.211	-1.842	0.068
	Self-care concept	9.592 ± 3.201	10.884 ± 2.389	-2.314	0.230
Dimension	Sense of responsibility	10.848 ± 3.668	11.765 ± 2.511	-1.481	0.142
	Self-care skills	9.496 ± 3.890	10.202 ± 2.350	-1.109	0.271
	Level of health knowledge	11.253 ± 4.367	10.941 ± 2.572	0.442	0.660

Table 5. Comparison of Beck oral health scores and five dimensions between the two groups before intervention

Item	Category	Intervention group (n = 51)	Control group (n = 51)	t	P
Score	Beck oral evaluation score	13.69 ± 1.849	13.47 ± 1.876	0.593	0.555
	Lips	3.137 ± 0.566	3.019 ± 0.509	1.103	0.273
	Gums and oral mucosa	3.156 ± 0.504	3.039 ± 0.564	1.110	0.270
Dimension	Tongue	2.764 ± 0.472	2.745 ± 0.483	0.207	0.836
	Teeth	2.176 ± 0.555	2.333 ± 0.516	-1.477	0.143
	Saliva	2.451 ± 0.502	2.333 ± 0.711	0.964	0.338

Table 6. Comparison of oral dryness scores between the two groups before the intervention

Item	Category	Intervention group(n = 51)	Control group(n = 51)	Z	P	95% CI
Total score	Grade 0	0	0	-1.794	0.073	-0.019–0.030
	Grade 1	0	0			
	Grade 2	13 (25.5%)	5 (9.8%)			
	Grade 3	37 (72.5%)	46 (90.2%)			
	Grade 4	1 (2.0%)	0			

Table 7. Comparison of oral odor scores between the two groups before the intervention

Groups	Oral odor values	t	P	95% CI
Intervention group (n = 51)	3.121 ± 0.588	0.560	0.577	-0.150–0.267
Control group (n = 51)	3.065 ± 0.465			

Table 8. Comparison of oral pH values between the two groups before intervention

Groups	Oral pH values	t	P	95% CI
Intervention group (n = 51)	6.274 ± 0.098	0.196	0.845	-0.035–0.044
Control group (n = 51)	6.270 ± 0.104			

3.4. Comparison of observation indicators between the two groups after intervention

After the intervention, statistically significant differences were observed in all measured indicators between the two groups ($P < 0.05$). The details are provided in **Tables 9–14**.

Table 9. Analysis of self-care ability scores of patients in the two groups after intervention

Groups	Pre-intervention	Intervention day 7	Intervention day 14	Time effect	Group effect	Interaction effect
Intervention group (n = 51)	41.80 ± 11.26	80.29 ± 15.20	114.55 ± 11.56	600.702 (P < 0.001)	265.836 (P < 0.001)	200.969 (P < 0.001)
Control group (n = 51)	43.78 ± 7.09	52.92 ± 8.78	63.45 ± 10.80			
F	1.958	123.934	532.167			
P	0.068	< 0.001	< 0.001			

Table 10. Comparison of total oral health scores between the two groups after intervention

Groups	Pre-intervention	Intervention day 7	Intervention day 14	Time effect	Group effect	Interaction effect
Intervention group (n = 51)	13.69 ± 1.85	8.39 ± 2.61	5.94 ± 1.56	657.569 (P < 0.001)	265.836 (P < 0.001)	128.180 (P < 0.001)
Control group (n = 51)	13.47 ± 1.83	12.22 ± 1.89	9.43 ± 2.14			
F	0.351	71.859	88.920			
P	0.555	< 0.001	< 0.001			

Table 11. Comparison of oral dryness scores between the two groups after intervention

Groups	Pre-intervention	Intervention day 7	Intervention day 14	Time effect	Group effect	Interaction effect
Intervention group (n = 51)	2.76 ± 0.47	1.59 ± 0.64	1.09 ± 0.51	340.918 (P < 0.001)	56.311 (P < 0.001)	94.867 (P < 0.001)
Control group (n = 51)	2.90 ± 0.30	2.43 ± 0.50	1.94 ± 0.79			
F	3.063	55.161	123.222			
P	0.073	< 0.001	< 0.001			

Table 12. Comparison of oral odor scores between the two groups after intervention

Groups	Pre-intervention	Intervention day 7	Intervention day 14	Time effect	Group effect	Interaction effect
Intervention group (n = 51)	3.12 ± 0.59	1.88 ± 0.74	0.67 ± 0.55	460.997 (P < 0.001)	109.821 (P < 0.001)	58.582 (P < 0.001)
Control group (n = 51)	3.06 ± 0.46	2.63 ± 0.60	2.22 ± 0.50			
F	0.314	21.210	61.186			
P	0.577	< 0.001	< 0.001			

Table 13. Comparison of oral pH values between the two groups after intervention

Groups	Pre-intervention	Intervention day 7	Intervention day 14	Time effect	Group effect	Interaction effect
Intervention group (n = 51)	6.67 ± 0.10	6.47 ± 0.14	6.60 ± 0.15	131.817 (P < 0.001)	41.601 (P > 0.05)	19.768 (P > 0.05)
Control group (n = 51)	6.67 ± 0.11	6.41 ± 0.19	6.55 ± 0.26			
F	0.196	1.703	0.950			
P	0.845	0.521	0.666			

Table 14. Comparison of hospitalization satisfaction between the two groups after intervention

Item	Category	Intervention group(n = 51)	Control group(n = 51)	t	P
Score	Cancer patient's hospitalization satisfaction	86.77 ± 5.21	82.41 ± 3.26	2.579	< 0.001
Dimension	Doctor's profession skills	87.83 ± 5.89	82.40 ± 4.71	0.345	0.025
	Doctor's humanistic care	84.25 ± 11.39	81.39 ± 7.67	0.173	0.045
	Doctor's information provision	82.02 ± 3.27	82.10 ± 3.25	1.036	0.048
	Doctor's accessibility	83.98 ± 8.88	81.32 ± 6.08	0.284	< 0.001
	Nurse's profession skills	83.17 ± 7.41	82.25 ± 6.18	0.415	0.024
	Nurse's humanistic care	90.36 ± 9.46	85.29 ± 9.08	0.167	< 0.001
	Nurse's information provision	83.91 ± 9.27	80.18 ± 8.08	0.728	0.016
	Nurse's accessibility	85.17 ± 7.03	80.38 ± 7.68	0.083	0.021
	Team communication	84.76 ± 6.84	84.13 ± 5.96	0.174	0.031
	Services from other staff	72.99 ± 7.29	72.83 ± 7.28	0.337	0.023
	Waiting time	76.30 ± 10.58	78.62 ± 9.93	1.179	0.179
	Hospital convenience	73.25 ± 14.34	73.43 ± 12.18	0.195	0.036
	Hospital environment	84.90 ± 5.26	84.82 ± 4.44	0.136	0.746

4. Discussion

The basic demographic data of the two groups before the intervention showed no statistical significance ($P > 0.05$), confirming their comparability. Results from repeated measures ANOVA indicated the following:

(1) Beck oral score: Statistically significant differences were observed in the effects of time, group, and their interaction ($P < 0.05$). The intervention group demonstrated significantly better scores compared to the control group ($P < 0.05$).

(2) Dry mouth and halitosis scores: Significant differences were observed in the effects of time, group, and their interaction ($P < 0.05$). The intervention group showed superior outcomes relative to the control group ($P < 0.05$).

(3) Oral pH: While the time effect was statistically significant ($P < 0.05$), no significant differences were found for group or interaction effects ($P > 0.05$). This indicates that the intervention group was not markedly superior to the control group in terms of oral pH [13].

(4) Self-care ability: Significant differences were observed in time, group, and interaction effects ($P < 0.05$), with the intervention group performing better than the control group ($P < 0.05$).

An independent sample t-test revealed that the hospitalization satisfaction scores of patients in both groups showed statistically significant improvement after the intervention ($P < 0.05$). Specifically, the intervention group exhibited significant improvement in nine aspects, including the professional skills and humanistic care of doctors and nurses, as well as inter-team communication ($P < 0.05$). However, no statistical significance was observed between the two groups in four areas, including waiting time and hospital environment ($P > 0.05$).

In summary, the implementation of a collaborative nursing intervention program improved the oral health status, halitosis, and dry mouth of colorectal cancer patients undergoing postoperative chemotherapy. Furthermore, it enhanced patients' self-care abilities and overall satisfaction with hospitalization [14].

5. Conclusion

This study concludes that the collaborative intervention program for oral health and self-care among colorectal cancer patients undergoing postoperative chemotherapy effectively integrates multidisciplinary approaches, leveraging the complementary advantages of traditional Chinese and Western medicine. The findings highlight its significant value for clinical application and broader promotion [15].

Disclosure statement

The author declares no conflict of interest.

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