Psycho-Oncologie 2025, 19(3), 3740.
https://doi.org/10.18282/po3740

Article

Clinical practice and research on the psychological cognitive ability under the IKAP model in postoperative flap healing and psychological influencing factors in breast cancer

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CITATION

Zhang L, Huang K, Du H, et al. Clinical practice and research on the psychological cognitive ability under the IKAP model in postoperative flap healing and psychological influencing factors in breast cancer. Psycho-Oncologie. 2025; 19(3): 3740.
https://doi.org/10.18282/po3740

ARTICLE INFO

Received: 27 December 2024
Revised: 9 February 2025
Accepted: 14 February 2025
Available online: 4 July 2025

Abstract: Objective: To investigate the impact of psychological cognitive ability on flap healing and psychological factors in postoperative breast cancer (BC) individuals under the Information-Knowledge-Attitude-Practice (IKAP) model. **Methods:** A total of 123 postoperative BC individuals treated at our hospital between April 2022 and April 2023 were selected for the study. They were randomly assigned into a control group (CG, routine nursing model, n = 61) and an observation group (OG, IKAP model-based psychological cognitive ability intervention, n = 62) using a random number table method. The observation group, on the basis of routine care, combined the IKAP model for psychological and cognitive ability intervention. This included providing personalized health education information, enhancing the patients' knowledge level, changing their attitudes towards the disease, and promoting the implementation of healthy behaviors through psychological counseling and practical training. The healing rates, healing times, and differences in cognitive ability, psychological status, and quality of life scores before and after the intervention were compared involving the two groupings. The impact of cognitive ability on flap healing and psychological factors was also analyzed. **Results:** After 2 weeks of intervention, the healing rate in the OG was higher than that of the CG [72.58% (45/62) vs. 54.10% (33/61)] (χ^2 = 4.527, P = 0.033). The healing time in the OG was shorter than in the CG, but the difference was not considerable (P > 0.05). After 2 weeks of intervention, the two groups showed differences in their Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) scores [(7.73 ± 1.61) vs. (6.08 ± 1.53)], and Functional Assessment of Cancer Therapy-Breast (FACT-B) scores [(92.38 ± 6.43)], with the OG showing more significant improvements (P < 0.05). Compared to the unhealed group, the healed group had higher FACT-Cog and FACT-B scores, and lower HADS scores (P < 0.05). Cognitive ability directly predicted flap healing (β = 0.521, P < 0.001) and also influenced it indirectly through psychological factors (β = 0.537, P < 0.001). The mediating effect of psychological factors accounted for 69.17%, and the direct effect of cognitive ability accounted for 30.65%. This shows that cognitive ability affects flap healing both directly and indirectly through psychological changes. **Conclusion:** The IKAP model can significantly enhance patients' cognitive ability and quality of life, shorten healing time, and, through the mediation of psychological factors, further promote flap healing. This provides a new perspective and method for comprehensive rehabilitation in postoperative BC patients.

Keywords: IKAP model; cognitive ability; breast cancer; flap healing; psychological factors

1. Introduction

Breast cancer (BC), a common malignant tumor among women, has shown a rising incidence globally, presenting a major risk to the health and lives of women [1]. With the continuous development of medical technology, treatment strategies

(Precision Medicine, Targeted Therapy, Immunotherapy and other methods) for BC have become increasingly sophisticated. Among these, surgical treatment, as one of the primary approaches, effectively removes the lesions and improves patient survival rates [2]. However, BC surgery not only causes physical trauma to patients but also exerts a significant psychological impact on them [3]. Many patients experience psychological issues such as anxiety and depression after surgery. These problems not only affect their emotional well-being but may also have a negative effect on their quality of life [4,5]. Postoperative BC patients face multiple stressors, including changes in body image, fear of cancer recurrence, and the pain and discomfort associated with treatment. These pressures often lead to varying degrees of psychological distress. Therefore, in addition to focusing on physical recovery, it is essential to address the psychological well-being of individuals after BC surgery. Timely psychological interventions (cognitive behavioral therapy) should be implemented to alleviate the mental burden and improve the individual's quality of life.

After BC surgery, the healing of the flap is one of the key indicators used to assess the success of the operation [6]. Poor flap healing may lead to complications such as wound infection, dehiscence, and seroma formation. These not only intensify the patient's suffering but can also negatively affect the treatment outcomes, potentially requiring a secondary surgery [7]. Therefore, during the postoperative care phase of BC surgery, it is crucial to implement scientific and effective nursing measures to promote optimal flap healing. The Information-Knowledge-Attitude-Practice (IKAP) model, as a comprehensive care approach, focuses on strategies such as providing informational support, knowledge education, shifting attitudes, and encouraging behavioral changes. These strategies aim to enhance patients' self-management abilities, thereby promoting both their physical and mental well-being. The IKAP model differs from other behavioral change models in its unique four-stage process, which includes Information, Knowledge, Attitude, and Practice. Unlike models such as the Health Belief Model or Theory of Planned Behavior, which focus primarily on individual cognitive factors or intentions, the IKAP model emphasizes a comprehensive approach by integrating psychological and cognitive aspects at each stage, from understanding to actual behavior change [8]. The IKAP model emphasizes a patient-centered approach.

The personalized care plan can be developed through this model by collecting the patient's medical history and basic information and gaining a deeper understanding of the patient's inner world and disease cognition in order to meet the individual needs of each patient [9]. In addition, the IKAP model also places great importance on providing psychological support to patients. Through methods such as psychological counseling and positive psychological suggestion, it helps reduce patients' psychological stress and enhance their mental health [10]. Given the importance of flap healing after BC surgery and the psychological challenges faced by patients, this research attempts to investigate the clinical effectiveness of psychological cognitive ability in promoting flap healing and influencing psychological factors in postoperative BC patients under the IKAP model. By comparing and analyzing the differences in flap healing, psychological status, and quality of life between patients who received the IKAP model intervention and those who only received conventional

nursing care, this study aims to provide more effective nursing interventions for postoperative BC patients to promote their comprehensive recovery.

2. Materials and methods

2.1. Study flowchart

Figure 1 shows the flow chart of this study.

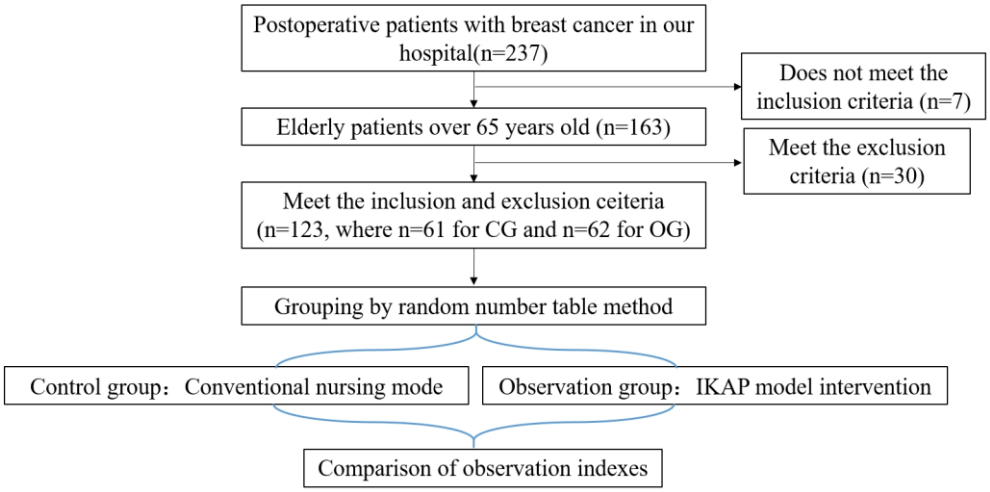

Figure 1. Study flowchart.

2.2. Clinical data

2.2.1. Study subjects

A total of 123 postoperative BC individuals treated at our hospital between April 2022 and April 2023 were selected for this study. The patients were randomly assigned into two groups using a random number table: the control group (CG, received conventional nursing care, n = 61) and the observation group (OG, received psychological cognitive ability intervention under the IKAP model, n = 62). The hospital's medical ethics committee authorized the trial, and informed consent forms were signed by each patient. Inclusion Criteria: (1) Clinically diagnosed based on the diagnostic criteria in Breast Cancer—Major Changes in the 8th Edition of the American Joint Committee on Cancer Staging Manual [11], with a confirmed pathological diagnosis. (2) Age ≥ 18 years. (3) Postoperative BC patients receiving radiotherapy and chemotherapy at our hospital. (4) Voluntarily taking part in the research while providing informed permission. Exclusion Criteria: (1) Cognitive impairment, language or auditory disorders, history of psychiatric illness, or severe mental disorders. (2) Coexisting severe cardiovascular or cerebrovascular diseases or other malignancies with unstable conditions. (3) Completion of clinical treatment (surgery, radiotherapy, chemotherapy, targeted therapy).

2.2.2. Ethical approval

The trial was registered with the Chinese Clinical Trial Registry and authorized by the Ethics Committee of The Second Affiliated Hospital of Guizhou Medical University.

2.3. Research methods

The CG received conventional intervention. Conventional intervention refers to the basic treatments and care measures provided to patients based on clinical norms and standard treatment protocols. These interventions typically do not involve specialized or personalized treatment plans. Patients were informed of possible adverse reactions during the postoperative recovery period, along with preventive and management measures. Continuous psychological support was provided, such as guiding patients to adapt to environmental changes and alleviating the physical stress caused by the disease. Psychological assessments were conducted, and different psychological counseling was provided to patients with various negative emotional states, helping them view the disease correctly and minimizing the psychological impact of the disease. The assessment includes self-report scales, interviews, and behavioral observations to understand emotions, psychological state, and life environment. The counseling methods involve cognitive-behavioral therapy, relaxation training, and psychological support to help individuals cope with anxiety, depression, and other issues. Successful treatment cases were shared to correct patients' misconceptions about the treatment. Adequate care and support were given to help patients maintain a positive mindset, using direct or indirect psychological suggestions to alleviate their negative emotions. Nursing staff were encouraged to involve family members in the patients' daily rehabilitation care, ensuring support from family members, and offering social and familial support to maintain an optimistic attitude and cooperation with clinical interventions, ultimately facilitating gradual recovery with a stable mindset.

The OG received the IKAP model intervention based on the above. The intervention content included the following: (1) Formation of the IKAP Nursing Team: The team included oncologists, psychologists, nutritionists, and specialized BC nurses. All team members underwent IKAP nursing training, becoming familiar with the IKAP philosophy, health education, cognitive training, and methods for guiding beliefs. (2) Information Gathering: Medical records and basic information of BC patients were collected after admission, and their postoperative recovery was assessed. Nurses actively built a good relationship and communicated with patients to understand what information they needed, such as pain management, effective sleep, individual psychological, physiological, and social conditions. Nurses also assessed patients' thoughts and disease perceptions, encouraging patients to express their feelings and expectations. Based on these assessments, appropriate health education content was developed. (3) Knowledge Teaching and Cognitive Enhancement: Cognitive education was provided using simple and understandable language. Patients were informed of potential complications during treatment, how to manage and prevent them, and the importance of postoperative upper limb exercises and nutrition. Postoperative functional exercise guidance was provided to individuals and their families. The individuals were also instructed in intravenous line care to improve self-management behaviors. Important information was communicated to patients based on their personality traits, either directly or indirectly. (4) Changing Beliefs and Providing Support: Misconceptions and negative psychological states were corrected, fostering positive treatment behaviors. Patients in the recovery phase who showed

good results were invited to share their experiences, creating a platform for family members to exchange insights. This increased family members' awareness and ability to engage in healthy behaviors, thereby helping patients change their health behaviors. Patients were encouraged by recognizing their progress. Recognizing a patient's progress can be achieved by acknowledging their small achievements and efforts. Non-verbal support, such as smiling or nodding, can also convey encouragement. Setting small goals and celebrating each progress made is another effective way to recognize their advancement. (5) Behavioral Modification: Pain relief medications were administered according to the level of pain, combined with psychological counseling to maintain a good mental state and sleep quality. Close monitoring of the flap's color, temperature, humidity, and blood circulation was conducted to detect and address issues like ischemia and necrosis. The flap was properly bandaged and fixed to avoid pressure, friction, or other harmful stimuli. Correct positioning and daily activity guidelines were provided to reduce strain and damage to the flap. Regular flap dressing changes and cleaning were carried out once a day to prevent infection and other complications.

In health interventions, participants develop personalized health education information based on the model and promote the implementation of healthy behaviors through psychological counseling and practical training. They follow the plan for implementation over the course of two weeks. During these two weeks, participants track and record behaviors such as exercise, diet, or sleep daily and regularly reflect and adjust their action plans to ensure the achievement of their goals. The implementation of the IKAP model is usually supervised and guided by health education experts to ensure the effectiveness of the intervention. The Cronbach Alpha value of this study is 0.81.

2.4. Observational indicators

(1) Healing rate and healing time criteria: Granulation tissue fills the wound, and epithelial cells move towards the center to completely cover the wound, with no exudate. Healing time: the duration from the first debridement to complete flap healing. The healing rate and healing time of flaps were contrasted involving the two groupings of patients after 2 weeks of intervention. (2) Cognitive function: The Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) [12] is utilized to evaluate the cognitive function of individuals. Better cognitive function is indicated by higher scores on the FACT-Cog scale, which runs from 1 to 10. (3) Quality of life in BC patients: The Functional Assessment of Cancer Therapy-Breast (FACT-B) [13] (FACT-B v4) is a scale that includes 37 items across 5 domains. Not at all, a little, somewhat, quite a bit, and very much are the five Likert scales that are used. Higher scores indicate a higher quality of life for the patient; the total score goes from 0 to 144. (4) Psychological status: The two subscales, Anxiety (HADS-A) and Depression (HADS-D), each with seven items, comprised the Hospital Anxiety and Depression Scale (HADS) [14]. The HADS-A subscale uses a 4-point scoring system: not at all, occasionally, often, and always.

2.5. Statistical analysis

Statistical analysis was performed using SPSS 21.0 software. Prior to the analysis, normality and homogeneity of variance tests were conducted on continuous data. Data that met the normal distribution or approximately normal distribution were expressed as $\bar{x} \pm s$, and repeated measures data were analyzed using repeated measures ANOVA. For comparison between two groups, *t*-tests were used, and categorical data were expressed as *n* (%), with χ^2 tests applied. The effect of cognitive function on flap healing and psychological factors in postoperative BC patients was analyzed using Model 4 from the SPSS macro program Processv 4.1. The Bootstrap approach was used to test the mediation effect. *P*-values less than 0.05 were regarded as statistically significant.

3. Results

3.1. Baseline data

A comparison of baseline data between the two groups revealed no considerable variations in age, marital status, education level, menstrual status, BMI, fertility history, tumor stage, tumor location, tumor size, history of abdominal surgery, surgical methods, or underlying diseases ($P > 0.05$). See **Table 1**. The CG had ages ranging from 33 to 65 years, while the OG had ages ranging from 34 to 69 years. There were no considerable differences in the general data of the two groups ($P > 0.05$), as seen in **Table 1**.

Table 1. Baseline characteristics comparison ($\bar{x} \pm s$).

Characteristic	Observation Group (*n* = 62)	Control Group (*n* = 61)	χ^2/*t*-value	*P*-value
Age (years,$\bar{x} \pm s$)	56.47±1.58	55.98 ± 1.72	1.646	0.102
Marital status (*n*/%)			0.105	0.746
Married	56 (90.32)	54 (88.52)		
Divorced/Widowed/Unmarried	6 (9.68)	7 (11.48)		
Education level (*n*/%)			0.205	0.903
Primary school or below	23 (37.10)	21 (34.43)		
Middle school/High school	20 (32.26)	22 (36.07)		
College or above	19 (30.65)	18 (29.51)		
Menstrual status (*n*/%)			0.435	0.509
Menopause	35 (56.45)	38 (62.30)		
Non-menopause	27 (43.55)	23 (37.70)		
BMI (kg/m^2)	21.54 ± 2.71	21.47 ± 2.85	0.140	0.889
Fertility history (*n*/%)			0.367	0.545
Yes	47 (75.81)	49 (80.33)		
No	15 (24.19)	12 (19.67)		
Tumor location (*n*/%)			0.065	0.798
Left	40 (64.52)	38 (62.30)		
Right	22 (35.48)	23 (37.70)		

Table 1. (*Continued*).

Characteristic	Observation Group (n = 62)	Control Group (n = 61)	χ^2/t-value	P-value
Tumor stage (n/%)			0.867	0.648
Stage I	22 (35.48)	20 (32.79)		
Stage II	30 (48.39)	34 (55.774)		
Stage III	10 (16.13)	7 (11.48)		
Tumor size (cm, n/%)			0.251	0.616
≤ 3	39 (62.90)	41 (67.21)		
> 3	23 (37.10)	20 (32.79)		
History of abdominal surgery (n/%)			0.390	0.532
Yes	25 (40.32)	28 (45.90)		
No	37 (59.68)	33 (54.10)		
Surgical method (n/%)			0.069	0.793
Radical mastectomy	48 (77.42)	46 (75.41)		
Breast-conserving surgery	14 (22.58)	15 (24.59)		
Underlying diseases (n/%)			0.104	0.747
Yes	21 (33.87)	19 (31.15)		
No	41 (66.13)	42 (68.85)		

3.2. Comparison of flap healing rates and healing time between the two groups

After 2 weeks of intervention, the healing rate in the OG was higher than that in the CG [72.58% (45/62) vs. 54.10% (33/61)] (χ^2 = 4.527, P = 0.033). The healing time in the OG was shorter than that in the CG; however, the difference was not considerable (P > 0.05). See **Figure 2**.

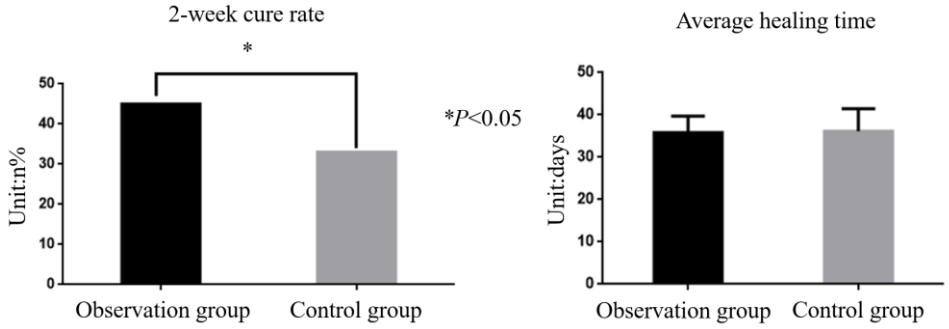

Figure 2. Comparison of flap healing rates and healing time between the two groups.
Note: P < 0.05.

3.3. Comparison of cognitive function, psychological status, and quality of life scores before and after intervention involving the two groupings

Before the intervention, there were no notable variations involving the two groupings in FACT-Cog scores, FACT-B scores, and HADS scores (P > 0.05). After 2 weeks of intervention, the FACT-Cog scores [(7.73 ± 1.61) points vs. (6.08 ± 1.53) points], FACT-B scores [(92.38 ± 6.43) points vs. (85.47 ± 6.01) points], and HADS scores [(12.28 ± 2.47) points vs. (15.67 ± 2.83) points] indicated that the OG

experienced more significant improvements ($P < 0.05$). See **Figure 3**.

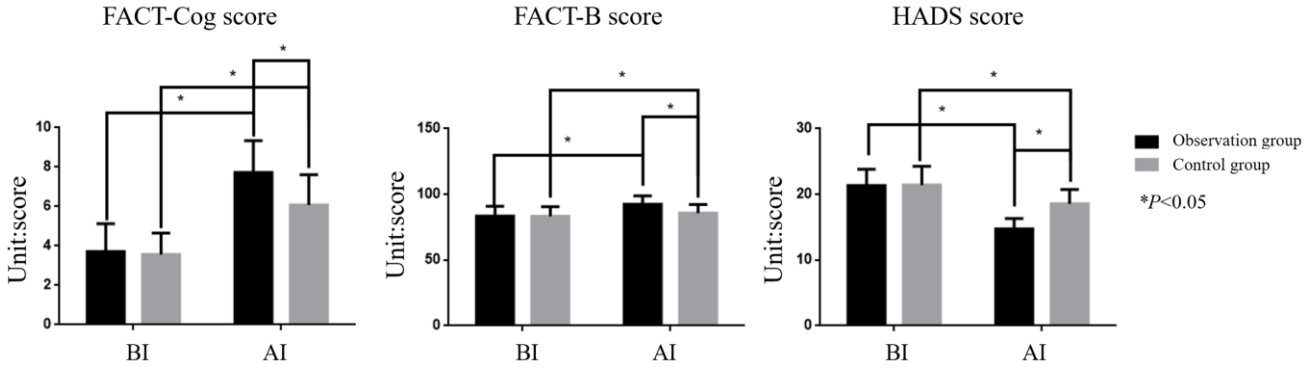

Figure 3. Comparison of cognitive function, psychological status, and quality of life scores before and after intervention involving the two groupings.

Note: Comparison between groups, *$P < 0.05$; Before intervention: BI; After intervention: AI.

3.4. Comparison of cognitive function, psychological status, and quality of life scores between the healed group and the unhealed group

Compared with the unhealed group, the healed group had higher FACT-Cog scores [(8.27 ± 1.03) vs. (7.49 ± 1.22)] and FACT-B scores [(94.35 ± 6.48) vs. (90.41 ± 6.42)], and lower HADS-A scores [(13.24 ± 1.69) vs. (16.26 ± 1.72)] ($P < 0.05$). See **Figure 4**.

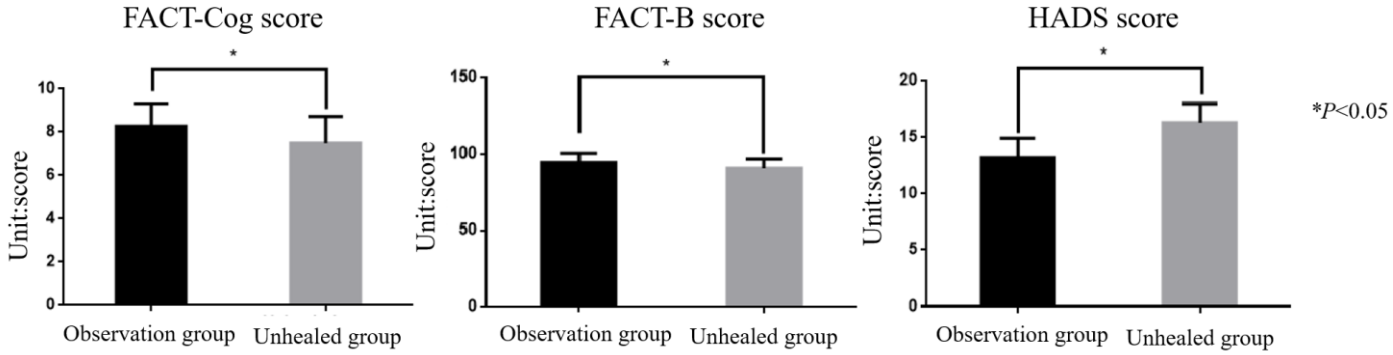

Figure 4. Comparison of cognitive function, psychological status, and quality of life scores between the healed group and the unhealed group.

Note: $P < 0.05$.

3.5. The impact of cognitive function on postoperative flap healing and psychological factors in BC patients

A mediation model was constructed with flap healing as the dependent variable, cognitive function as the independent variable, and psychological factors as the mediating variable (see **Figure 5**). After standardizing the scores of these three variables, the mediation effect was tested using Model 4 in SPSS Process v4.1.

The findings indicated that cognitive function positively predicted flap healing ($\beta = 0.521$, $P < 0.001$). When the mediating variable, psychological factors, was included,

cognitive function still directly predicted flap healing ($\beta = 0.157$, $P < 0.001$). Cognitive function also positively predicted psychological factors ($\beta = 0.537$, $P < 0.001$), and psychological factors positively predicted flap healing ($\beta = 0.616$, $P < 0.001$) (see **Table 2**).

The Bootstrap method was used to test the mediation effect, with 5000 random samples to calculate the 95% confidence interval (CI). The findings are shown in **Table 3**. The mediation effect of psychological factors was 0.344, with a 95% CI of 0.291–0.408. The direct effect of cognitive function was 0.162, with a 95% CI of 0.106–0.227. These results indicate that cognitive function not only directly and positively predicts postoperative psychological changes in BC patients but also indirectly predicts flap healing through psychological changes. The mediation effect value was 0.344, with the direct effect and mediation effect accounting for 30.65% and 69.17% of the total effect, respectively (see **Table 3**).

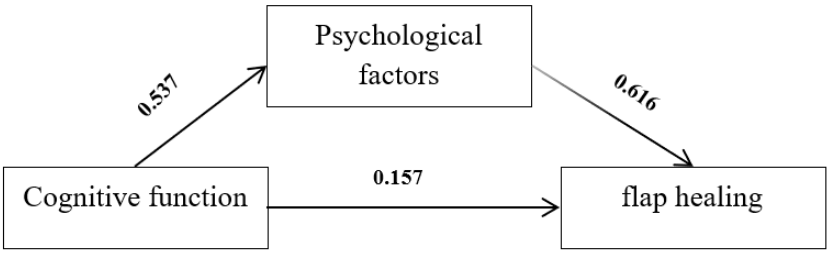

Figure 5. The impact of cognitive function on postoperative flap healing and psychological factors in BC patients.

Table 2. Mediation model index for postoperative BC patients.

Dependent Variable	Independent Variable	*β*	95%CI	*t*	*P*
Flap healing	Cognitive function	0.521	0.436~0.574	12.654	< 0.001
Psychological factors	Cognitive function	0.537	0.514~0.617	15.643	< 0.001
Flap healing	Cognitive function	0.157	0.112~0.235	4.028	< 0.001
Flap healing	Psychological factors	0.616	0.561~0.682	18.365	< 0.001

Table 3. The impact of cognitive function on postoperative flap healing and psychological factors in BC patients.

Effect	Pathway	*β*	95%CI	*P*	Proportion of Total Effect (%)
Total effect	Cognitive function → Flap healing	0.508	0.418~0.571	< 0.001	-
Direct effect	Cognitive function → Flap healing	0.162	0.106~0.227	< 0.001	30.65
Indirect effect	Cognitive function → Psychological factors → Flap healing	0.344	0.291~0.408	< 0.001	69.17

4. Discussion

BC, as one of the most common malignant tumors in women worldwide, involves not only the physiological aspect of flap healing during postoperative recovery but is also profoundly influenced by patients' psychological and cognitive abilities. According to a report by the World Health Organization [15], the incidence of BC is one of the biggest risks to women's health, and it has been rising rapidly over the last few decades. In postoperative care for BC, interventions targeting psychological and cognitive abilities are particularly important, as patients' psychological states are

directly related to their treatment adherence, recovery speed, and quality of life improvement.

The results of this study show that after 2 weeks of intervention, the healing rate in the OG was significantly higher than that in the CG, and there was also a trend toward shorter healing time, although the difference did not considerably. This suggests that the IKAP model effectively promotes flap healing in postoperative BC patients through strategies such as providing informational support, knowledge education, mindset transformation, and behavioral changes. The IKAP model promotes flap healing by providing information support, psychological counseling, and personalized care. It helps patients properly care for the flap, reducing complications. By reducing anxiety, guiding patients to avoid improper behaviors, and optimizing care plans, it facilitates flap healing. Additionally, the model emphasizes regular follow-ups to identify issues early and intervene promptly, ensuring a smooth healing process. The IKAP model emphasizes comprehensive collection of patients' medical records and basic information, as well as an in-depth understanding of their inner thoughts and disease perceptions, enabling the development of personalized care plans tailored to patients' actual needs. Additionally, the IKAP model focuses on proper dressing and fixation of the flap to avoid pressure, friction, and other adverse stimuli, along with regular flap dressing changes and cleaning to prevent complications such as infections. These measures collectively contribute to high-quality flap healing [16]. Previous studies have shown that a patient's mental health plays a crucial role in the recovery process after surgery. The mental health status of breast cancer patients significantly affects their recovery speed and quality of life, while anxiety and depression may hinder their rehabilitation. Therefore, adopting comprehensive interventions to improve patients' mental state and cognitive function is critical [17].

Secondly, from the perspective of psychological status, this study found that the IKAP model can significantly improve the psychological well-being of postoperative BC individuals. After the intervention, the FACT-Cog and FACT-B scores in the OG were higher than those in the CG, while the HADS scores were lower, indicating that the IKAP model not only improved patients' cognitive function and quality of life but also alleviated their anxiety and depression. The IKAP model achieves this by establishing a professional care team that includes oncologists, psychological counselors, nutritionists, and BC specialist nurses, providing comprehensive psychological support to patients. Psychological counselors use techniques such as psychological counseling and suggestion therapy to help patients reduce psychological stress and enhance their mental health [18]. At the same time, the IKAP model emphasizes the importance of social and family support by encouraging family members to actively participate in the patient's daily rehabilitation care. This approach helps create a warm and harmonious recovery environment, enabling patients to maintain an optimistic mindset and actively cooperate with clinical interventions, thereby promoting comprehensive physical and psychological recovery [19].

In addition, this study found that cognitive function has a positive predictive effect on flap healing, with psychological factors playing a mediating role in the process. This indicates that cognitive function not only directly and positively predicts psychological changes in postoperative BC patients but also indirectly predicts their

flap healing through psychological changes. This finding provides new perspectives and approaches for the comprehensive rehabilitation of postoperative BC patients. Enhancing patients' cognitive function can help them better understand and accept their disease, develop a positive attitude toward treatment, and adopt behaviors that promote flap healing and overall physical and psychological recovery. Similar to this study, the research by [20] also found a significant positive correlation between the level of social support and postoperative recovery in breast cancer patients.

The IKAP model is highly meaningful for implementation in different hospitals and cultures, as it can be flexibly adjusted according to patient needs and the differences in healthcare environments. In resource-rich large hospitals, it can be combined with electronic health record systems and personalized care plans; in smaller hospitals with limited resources, it can be implemented through face-to-face education and regular follow-ups. Regardless of the setting, the core of IKAP is to improve patient engagement, reduce complications, and promote healing through care plans and psychological support.

From a cultural perspective, the IKAP model can be adjusted based on the specific needs of different cultures, ensuring that patients are better able to accept care. For example, in some cultures, patients rely more on family support, and the model can provide customized care based on these needs.

In terms of long-term impact, IKAP not only promotes flap healing but also improves patients' psychological and caregiving abilities, enhancing their quality of life. Family members of patients also benefit by learning caregiving skills, creating a better home care environment. Additionally, IKAP helps patients establish a healthy lifestyle, reduce complications, and lower healthcare resource consumption, offering significant economic and social value.

5. Conclusion

In conclusion, the IKAP model significantly improves the cognitive function and quality of life of postoperative BC individuals, promotes flap healing, and, through the mediating role of psychological factors, further facilitates comprehensive recovery. This provides new perspectives and approaches for the holistic rehabilitation of postoperative BC patients. This study does have several drawbacks, though. First, the results' external validity can be impacted by the sample size's relative smallness. Second, the intervention period in this study was relatively short, and the long-term effects could not be fully evaluated. Additionally, factors such as patient adherence and psychological status may play important roles in the effectiveness of care, but these were not explored in depth in this study.

In conclusion, the IKAP model significantly improves the cognitive function and quality of life of postoperative breast cancer (BC) patients, promotes flap healing, and, through the mediating role of psychological factors, further facilitates comprehensive recovery. This provides new perspectives and approaches for the holistic rehabilitation of postoperative BC patients. Furthermore, it is recommended that future studies consider incorporating personalized interventions to better cater to the individual needs of BC patients, enhancing the overall rehabilitation process.

This study does have several drawbacks. First, the results' external validity can

be impacted by the sample size's relative smallness. Future research could think about increasing the sample size to further validate the effectiveness of the IKAP model in the rehabilitation of postoperative BC patients. Second, the intervention period in this study was relatively short, and the long-term effects could not be fully evaluated. Future research could extend the follow-up period to assess the long-term impact of the IKAP model on patient recovery. Additionally, factors such as patient adherence and psychological status may play important roles in the effectiveness of care, but these were not explored in depth in this study. Future research should further investigate these factors to optimize care strategies and enhance patient recovery outcomes.

Author contributions: Conceptualization, KH and HD; methodology, CW; formal analysis, LZ and XY; investigation, CW; resources, BL; data curation, KH; writing—original draft preparation, LZ; writing—review and editing, LZ and KH; visualization, HD; supervision, CW; project administration, BL; funding acquisition, XY. All authors have read and agreed to the published version of the manuscript.

Consent to publish: The manuscript has neither been previously published nor is under consideration by any other journal. The authors have all approved the content of the paper.

Data availability statement: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Ethical approval: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of The Second Affiliated Hospital of Guizhou Medical University (Approval No.:2023-212 22 December 2023).

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Conflict of interest: The authors declare no conflict of interest.

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