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Effect of family positive behavior support nursing on CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+} and quality of life of children with malignant tumor

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ABSTRACT

This study was to observe the effect of family-positive behavior support (PBS) nursing on the level of CD3+, CD4+, CD4+/CD8+ and quality of life (QL) of children with malignant tumor (MT). For this purpose, 96 children with MT who visited the First People's Hospital of Chenzhou City from February 2021 to November 2022 were selected. The hospital carried out family PBS nursing in January 2022. According to the differences in the nursing methods of children, they were divided into a control group (Group C) and an observation group (Group O) with 48 cases each. Group C took routine nursing. The observation group carried out family PBS nursing based on Group C. The CD^{3+}, CD^{4+}, and CD^{4+}/CD^{8+} levels and QL scores were compared. Results showed that after the intervention, the levels of CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+}, pain and injury, nausea, anxiety during operation, treatment anxiety, anxiety, self-perception of appearance, communication problems and total scores of both groups of children were better than those before the intervention (P<0.05). After the intervention, the levels of CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+}, anxiety, anxiety, cognitive problems and total scores in the observation group were significantly higher than those in Group C (P<0.05). It was concluded that family PBS nursing applied to children with MT can improve the level of CD^{3+}, CD^{4+}, and CD^{4+}/CD^{8+}. The immune system function of children was improved. It improved the anxiety, anxiety and cognitive problems of children in the operation process. At the same time, this practice can help children increase their appetite and weight, and thus promote their quality of life of children.

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Introduction

According to the report on the global assessment of childhood cancer burden (1), childhood MT has become a serious disease burden worldwide. As a child at the stage of growth and development, once MT occurs, it will have adverse effects on the child's physiology and psychology (2). Cancer children affected by self-control defects will have problems such as decreased diet compliance and insufficient nutrition intake, and long-term malnutrition will lead to low immune function. It leads to the decline of children's social adaptability and ultimately leads to the decline of QL (3). At the same time, children's emotional disorders, self-control defects and other problems will have adverse effects on their negative psychological stability and family stress management (4). The immune function and QL of children with MT should be the key indicators of clinical attention. The analysis of the causes of children's self-control defects is related to the fact that parents always focus on the disease care of children and lack correct guidance on intelligence, behavior and psychological quality (5). Some scholars believe that there is a certain correlation between psycho-emotional and immune factors in adolescent cancer patients. A cognitive behavioral intervention can promote the improvement of NK cell content in peripheral blood (6). PBS is a comprehensive support model developed on the basis of system theory and aimed at creating a more effective family environment (7). Researchers have constructed a family PBS program, which has optimized the family cohesion and adaptability of MT children (8). This study is to further explore the effect of family PBS program on the cellular immune function and MT children's QL.

Materials and Methods

General information

96 children with MT who visited Chenzhou First People's Hospital from February 2021 to November 2022 were selected. The hospital carried out FPBSN in January 2022. According to the differences in child care methods, it was divided into Group C and Group O, with 48 cases each. This study was reviewed by the Medical Ethics Committee of Chenzhou First People's Hospital, which was in line with the Helsinki Declaration. The included children and their families have informed consent to the study and signed the informed consent form. Inclusion criteria for children: ① Through clinical symptoms, imaging and pathological examination, it meets the MT evaluation criteria in the diagnosis and treatment of children's tumors (9); ② Age: 5-8 years old; ③ The expected survival period is more than 6 months, and the expected duration of hospital treatment is more than 3 months. Exclusion criteria: ① The main caregiver is a nanny or grandparent; ② Give up treatment halfway through the study; ③ Children with mental retardation or immune deficiency. Inclusion

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criteria for parents: ① age 22-45 years old; ② Can use smartphones; ③ Education level at junior high school or above. Exclusion criteria for parents: ① patients with serious mental, psychological or organic diseases; ② Those who leave the group halfway.

Nursing methods

Group C

The time limit for inclusion is from February 2021 to December 2021. Routine nursing was adopted. During the period of hospitalization, the children were given overall responsibility for nursing. Health education was carried out on the ward environment, ward care diet, medication, rest and range of activities. The corresponding nursing intervention was carried out under the guidance of doctors for the bleeding, fever, cancer-related fatigue and infection-related symptoms during the treatment. And parents of children are encouraged to participate in the treatment and management process of children, help children to dredge bad emotions and correct their bad behaviors. When discharged, the family members of the child should be informed of the time of reexamination and outpatient follow-up.

Group O

The time limit for inclusion is from January 2022 to November 2022. FPBSN was carried out on the basis of Group C. It is divided into three stages: the baseline survey period, the implementation of intervention expectations, and the tracking and maintenance period. (I) An FPBSN team was established, and a training team was established by a head nurse, a nutritionist and a psychological consultant. The head nurse was the coordinator of the behavior support team, the nutritionist was responsible for formulating the diet plan for MT children, and the psychological consultant was responsible for sorting out the feasible strategies for family psychological behavior intervention for MT children. Five responsible nurses were selected as the person in charge of the implementation, and the psychologist explained the PBS theory to the responsible nurses. The intervention level of the parent subsystem, the husband and wife subsystem, the parent-child subsystem, and the sibling subsystem are described respectively. Family cognitive intervention, parent-child activity intervention, prior control, behavior training, and after-effect treatment are also the focus of the change. Five responsible nurses shall be assessed at the end of the training and can take up their posts only after passing the assessment. The training period is 3 days. (II) In the baseline survey period, the responsible nurse completed one-to-one interviews within 7 days of the admission of the child in the first week of intervention. The purpose is to clarify the children's dietary behavior mode, parental rearing mode, family member composition and parent-child interaction mode. It is used for the adjustment process of abnormal behaviors such as diet behavior intervention and aggressive behavior. (III) Implement intervention expectation, ① Family cognitive intervention, with a time limit of 2~8 weeks, using scene simulation and slide show in group intervention mode. The conference room with an independent ward was selected as the venue for the presentation. It explained in detail the definition of eating behavior, children's choice of food and the process of eating is self-conscious and automatic behaviors through continuous accumulation and learning, and there is behavioral inertia. Children should try to avoid feeding by others and eating independently. According to the characteristics of children with MT, five themes were formulated, including cognitive reconstruction, problem-solving, family emotional relationship, behavior management, and childcare skills, which were explained from 13:00 to 14:00 every Monday. In the experiment, one theme was completed every week, and 1-2 families of children with obvious effects were organized to share successful experiences in the sixth week. The content is synchronously recorded and sent to the family members of the children in the form of files. It can ensure that the children's families can fully grasp the specific content of family positive behavior intervention before the next intervention cycle. ② Parent-child activity intervention, with a time limit of 4 to 8 weeks, was conducted by 5 responsible nurses in turn as family parent-child activity guides. The time is set at 16:00~20:00 every Wednesday. Food production, parent-child reading, handicraft production, color graffiti, picture album reading, simple jigsaw puzzle and other methods were used. During the activity, family members of the same age were invited to participate. It can strengthen children's acceptance of their peers and increase children's yearning for multiple foods and life after discharge. ③ Precedent control, with a time limit of 2 to 10 weeks of intervention, is carried out through the formulation of procedure cards and the formulation of behavior contracts. During the experiment, it needs to communicate with the doctor in charge of the children and collect the children's meal time, food type, food quality, chemotherapy time, treatment measures implementation time, etc. One program card is issued every week, and small toys or small red flowers are used as incentives to urge children to make marks on the program card on time, so that they can cooperate with the treatment. At the same time, the children should be informed if they can actively cooperate with the treatment, and the treatment process should not be loud, noisy, or anorexia. In this way, one wish can be satisfied, such as a long-awaited toy or gift. Parents also need to maintain principles and pay attention to parent-child communication during this period. ④ Behavior training is conducted every 2 weeks from 19:00 to 20:00 in the evening in the 3rd to 8th week of intervention. It is divided into substitution skill training, waiting ability training, and reward support interactive training. Among them, substitution skill training uses positive words to guide children to express their emotions positively. When the child shows a refusal to cooperate, refuses to eat, and is about to..., the parents need to carry out visual neglect and give oral praise in time when the child has positive self-care behaviors such as independent dressing and eating. The nursing staff should supervise the parents to practice repeatedly, avoid using criticism, command, punishment and questioning sentences, and avoid using threatening or giving up words. The interactive practice of reward support is aimed at improving the way children's families deal with consequences. When the child has negative behaviors such as irrational refusal to eat, aggressive tendencies, etc., it is necessary to use distraction techniques to bring the child into the treatment room. The original treatment plan will be implemented after stabilizing the children's emotions without intervention. At the same time, some short-term discharged children during the study period were interve-

ned by video feedback. Parents regularly took pictures of parent-child play, eating and other scenes in daily life for 10 to 30 minutes every day. During parent-child activities, parents responded normally to their children's needs. After the shooting, the nursing staff observed the interaction behavior signals between parents and children and strengthened the childcare knowledge again. When the children showed positive behaviors such as an active diet, resistance to drugs, and courage to accept treatment, they gave positive responses to establish the children's self-motivation awareness. (IV) During the follow-up maintenance period, from the 9th to 12th week of intervention, exchange media such as program cards, toys and gifts were weakened, and parents' positive emotional guidance for children was used as the primary response strategy.

Observation indicators

Baseline data

The gender, age, tumor type, education level of guardians and the proportion of children with emotional and behavioral problems in the two groups were investigated by using the self-made baseline data questionnaire of the hospital.

Immune function index

Before and 3 months after the intervention, 5ml of children's fasting elbow vein blood was collected for immune function indicators. After anticoagulation with heparin, lymphocytes were suspended with lymphocyte separation solution, and T cell subsets were examined by indirect fluorescence staining and automatic flow cytometry. Monoclonal and secondary antibodies were added in strict accordance with the instructions during the operation. 10000 cells were examined for each sample, and data were processed and recorded according to the established procedures. The standard value of CD^{3+} was 73.5%+9.23% (immunolabeling method). The standard value of CD^{4+} is 55%~65% (immunolabeling method). The standard value of CD^{4+}/CD^{8+}ratio is 1.4~2.5.

QL

The Pediatric Quality of Life Inventory Measurement Models (PedsQLTM) was evaluated before and 3 months after the intervention, and the evaluation was carried out by the psychiatrist of our hospital. The scale was developed by the Vani leading group in the United States (10). There are 8 dimensions of pain and injury, nausea, anxiety in the process of operation, anxiety in treatment, anxiety, cognitive problems, self-perception of appearance and communication problems, and 27 items. Each item is divided into five grades, namely, never, rarely, occasionally, often, and always, with the values of 100, 75, 50, 25, and 0 respectively, the score of each dimension is the quotient of the total score of the items contained and the division of the number of items. The total score is the ratio of the sum of the scores of each item to the total scale items. The Cmnhach's α coefficient of the scale is 0.76, and the structural validity is 0.71. In combination with the purpose of this study, the respondents were set as the main guardians of the children and explained to the guardians the meaning and method of filling in item by item, which was collected by the investigators in the later stage. A total of 196 questionnaires were distributed in this study. 100 questionnaires were distributed before intervention and 96 questionnaires were recovered. 96 questionnaires were distributed and 96 questionnaires were recovered after 3 months of intervention. The recovery rates of the two questionnaires were 96% and 100% respectively.

Statistical methods

SPSS 26.0 statistical software is used for Data analysis. The counting data is expressed by examples, and the measurement data was expressed by ($\bar{x}\pm s$). χ^2 test and independent-sample t-test are used in inter-group. The paired sample *t*-test is used at different time points within the group. The correction level was $\alpha= 0.05$.

Results

Reliability and validity analysis of the scale

The coefficients were all higher than 0.70, which is close to the reliability and validity test results of the source scale. This shows that the internal reliability and validity of the scale are good and have a good consistency. At the same time, the overall ICC value of the scale is higher than

Table 1. Reliability and validity analysis results of the scale.

Score	Overall satisfaction	Pain and injury	Feel like vomiting	Operation Anxiety	Treatment anxiety
M	75	75	75	75	75
P_{25}	75	69.3	68.06	69.3	74.25
P_{75}	90.75	79.82	89.72	84.15	86.63
$P_{75\text{-}P25}$	16.50	10.52	21.66	14.85	12.38
α	0.86	0.94	0.92	0.92	0.94
α*	0.81	0.88	0.87	0.88	0.88
ICC (95%CI)	0.73 (0.46,0.86)	0.85 (0.70,0.92)	0.86 (0.72,0.92)	0.88 (0.77,0.94)	0.87 (0.75,0.93)
Score	**Worry**	**Cognitive problems**	**Self-perception of appearance**	**Communication issues**	**Total**
M	75	75	75	75	75
P_{25}	67.54	69.64	68.4	69.64	68.52
P_{75}	74.25	80.22	90.17	84.57	83.66
$P_{75\text{-}P25}$	6.70	10.58	21.77	14.92	15.14
α	0.94	0.95	0.93	0.93	0.97
α*	0.90	0.89	0.88	0.89	0.95
ICC (95%CI)	0.92 (0.83,0.96)	0.86 (0.71,0.93)	0.85 (0.70,0.91)	0.88 (0.76,0.93)	0.91 (0.83,0.95)

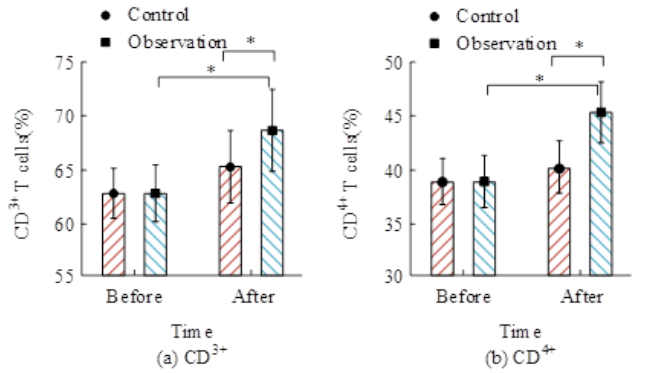

Figure 1. Change trend of CD^{3+} and CD^{4+}.

0.70, so it can be considered that the overall scale can be used for the retest of reliability. In the results of the reliability retest, the ICC values of all dimensions of the scale and the overall scale are higher than 0.75. The scale proved that the scale used in the experiment could be used to evaluate the status of MT children aged 5 to 8 years (Table 1).

Comparison of baseline data

In Table 2, the two groups' baseline data has no statistically significant difference in gender, age, tumor type, education level of guardians and emotional and behavioral problems (P>0.05).

Comparison of CD^{3+} and CD^{4+} and CD^{4+}/CD^{8+}

After the intervention, the levels of CD^{3+} and CD^{4+} in both groups are higher than those before the intervention (P<0.05). The levels of CD^{3+} and CD^{4+} in group O are higher than those in group C (P<0.05). See Table 3. The difference between $CD^{3+}$and CD^{4+}between the two groups is shown in Figure 1.

The level of CD^{3+}/CD^{8+} in children with Group C did not change significantly after intervention (P>0.05), while the level of CD4+/CD8+ in children with Group O increased after intervention (P<0.05). The levels of $CD^{3+}/CD^{8+}$and CD^{4+}/CD^{8+}in Group O were higher than C(P<0.05). See Table 4. The difference between CD^{3+}/CD^{8+} and CD^{4+}/CD^{8+} between the two groups is shown in Figure 2.

The levels of hemoglobin (Hb) and albumin (Alb) in children with Group C did not change significantly after intervention (P>0.05), while the levels of Hb and Alb in children with Group O increased after interven-

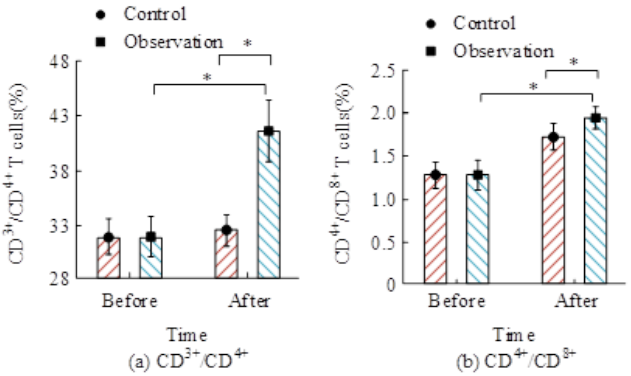

Figure 2. Change trend. The difference between CD^{3+}/CD^{8+} and CD^{4+}/CD^{8+} between the two groups.

Table 2. Comparison of baseline data (n=48).

Group	Sexual distinction		Age		Tumor type			Education level of the guardian			Emotional and behavioral problems
	Male	Female	<6	≥6	Leukemia	Lymphadenoma	Other	Junior high school	Senior middle school	University	
Group C	28	20	25	23	23	14	11	16	19	13	18
Group O	25	23	23	25	15	13	20	18	14	16	25
χ^2	0.379		0.167		4.334			1.186			2.064
P	0.538		0.683		0.115			0.553			0.151

Table 3. Comparison of CD^{3+} and CD^{4+} (n=48, $\bar{x}\pm s$).

Group	CD^{3+} (%)		CD^{4+} (%)	
	Before	After	Before	After
C	63.80±4.46	65.91±4.96*	38.24±3.63	40.21±3.51*
O	63.85±4.22	68.64±4.55*	37.84±2.48	45.78±3.45*
t	-0.064	-2.818	0.633	-7.836
P	0.949	0.006	0.528	0.000

Note: Compared with the group before the intervention, *P<0.05. The following are the same.

Table 4. Comparison of CD^{3+}/CD^{8+}, CD^{4+}/CD^{8+} (n=48, $\bar{x}\pm s$).

Group	CD^{3+}/CD^{8+}		CD^{4+}/CD^{8+}	
	Before	After	Before	After
C	32.67±1.24	32.98±1.14	1.47±0.23	1.56±0.26
O	31.98±1.02	42.67±2.98*	1.43±0.18	1.99±0.38*
t	-0.195	-5.031	1.007	-6.538
P	0.827	0.000	0.316	0.000

Note: *P<0.05.

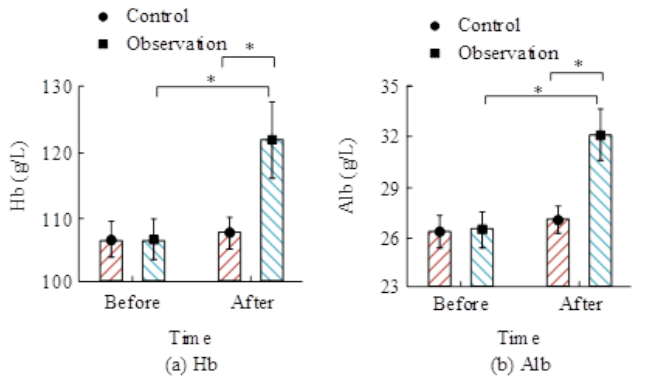

Figure 3. Change trend of Hband Alb.

tion (P<0.05). The levels of Hb and Alb in group O were higher than those in group C (P<0.05). See Table 4. The difference between Hb and Alb changes is in Figure 3.

Comparison of QL

After the intervention, the pain and injury, nausea, anxiety during operation, treatment anxiety, anxiety, self-perception of appearance, communication problems and total score of the two groups were higher than those before the intervention, with statistically significant difference (P<0.05). After the intervention of Group O, the anxiety, anxiety, cognitive problems and total scores of the operation process were higher than those of Group C in the same period. See Table 5.

BMI and QOL scores of Group O children after intervention were higher than those before intervention (P<0.05). BMI and QOL scores of Group O children after intervention were higher than those of Group C children in the same period (P<0.05). Table 6 shows the results.

The dizziness and fatigue of group O children after intervention were better than those of group C (P<0.05), and the appetite and weight of group O children were significantly higher than those of group C (P<0.05). The results are shown in Table 7.

Discussion

The necessity of FPBSN application in children with MT

MT children often need a variety of clinical operations, such as chemotherapy, puncture, etc. Although the survi-

Table 5. Comparison of the scores of PedsQL™[n=48, M (Interquartile distance), points].

Group	Pain and injury		Feel like vomiting		Operation Anxiety	
	Before	**After**	**Before**	**After**	**Before**	**After**
C	50 (38,63)	63 (50,63)*	50 (50,60)	65 (60,75)*	67 (58,83)	79 (75,83)*
O	50 (38,75)	63 (50,63)*	60 (50,70)	70 (65,75)*	67 (58,75)	83 (79,92)*
t	-0.584	-1.295	-1.636	1.263	0.178	-2.408
P	0.559	0.195	0.102	0.208	0.859	0.016
Group	**Treatment anxiety**		**Worry**		**Cognitive problems**	
	Before	**After**	**Before**	**After**	**Before**	**After**
C	67 (58,83)	67 (62,75)*	42 (42,50)	50 (50,50)*	60 (50,60)	60 (52.5,70)
O	58 (50,83)	71 (67,83)*	42 (42,50)	50 (50,58)*	55 (50,60)	65 (60,70)*
t	0.900	-1.107	-0.172	-2.871	0.810	-2.021
P	0.368	0.268	0.864	0.004	0.418	0.043
Group	**Self-perception of appearance**		**Communication issues**		**Total**	
	Before	**After**	**Before**	**After**	**Before**	**After**
C	60 (50,60)	79 (67,83)*	58 (58,75)	75 (67,83)*	59.5 (56,62)	67 (65.5,69)*
O	55 (50,60)	75 (67,83)*	67 (58,75)	83 (75,83)*	60.5 (58,63)	70 (67.5,73)*
t	0.810	0.774	-0.598	-1.492	-1.268	-3.268
P	0.418	0.439	0.550	0.136	0.205	0.001

Table 6. Comparison of BMI and QOL scores.

Group	BMI (kg/m²)		QOL scores (points)	
	Before	**After**	**Before**	**After**
C	17.39±1.01	17.63±0.76	27.36±3.48	27.82±4.52
O	17.46±0.78	18.67±1.29*	27.25±2.95	35.99±5.26*
t	0.268	2.391	-0.892	4.563
P	0.569	0.003	0.325	0

Table 7. Comparison of different living conditions.

Group	Dizziness and fatigue reduced	Improvement of appetite	Weight gaining
C	28/48(58.33%)	22/48(45.83%)	18/48(37.75%)
O	43/48(89.58%)	37/48(77.08%)	33/48(68.75%)
χ^2	7.314	5.275	2.354
P	0	0.002	0.007

val rate of children has increased in recent years (11), because children are at the stage of growth and development, it is easy to have a variety of behavioral problems. Researchers found that children with blood tumors had obvious behavioral problems, especially poor social interaction, increased physical demands, aggressive behavior, depression, social withdrawal, etc. (12). According to the survey, some scholars found that children aged 4 to 7 usually have problems such as eating less, refusing to try new foods, chewing slowly, preferring certain foods, and eating at an irregular time. The prevalence rate is 30% (13). During the hospitalization of MT children, their families usually accommodate the children's eating behaviors, even some aggressive behaviors, which aggravates the risk of abnormal behavior of children. It is necessary to intervene in the dietary behavior and behavioral abnormalities of children with MT.

FPBSN is a nursing program based on family system theory and centered on the relationship between husband and wife and parent-child. Children's emotions are plastic, and their emotional behaviors are formed under the joint influence of family functions, parenting styles, parents' emotions, parents' eating behaviors, etc. (14). FPBSN takes the family as the axis and applies multi-disciplinary technologies such as psychology and nutrition to the family system of children with cancer. This method combines behavior guidance with daily family situations to provide help for children's family function improvement (15). MT is accompanied by decreased immune function. According to the theory of nutritional immunity, natural, balanced, pure and diversified nutrition is the basic condition for the immune system to obtain nourishment. A good immune system is the main channel to inhibit the development or recurrence of disease (16). At the same time, a good diet also needs family support. It can help MT children establish good dietary behavior, promote immune function, and improve their QL is the main direction of MT children's nursing at this stage.

Effect of FPBSN on CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+}in children with MT

CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+} are surface markers of T lymphocytes with cellular immune effects, representing helper T lymphocytes and suppressive T lymphocytes respectively. In the healthy state of the body, most of the helper and suppressive T cells are in dynamic balance, especially CD^{4+}/CD^{8+}can reflect the cellular immune function of the body. FPBSN can improve the levels of CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+} in children with MT, and improve the immune function of children. As the unit that has the most important influence on children's dietary behavior, the family is evaluated by the family characteristics of different dietary behavior patterns. Timely positive behavior support intervention is helpful to weaken children's risky eating behaviors. MT children are affected by disease and their preferences for food, accompanied by problems such as refusal to eat, crying, and resistance to nutrient supplements. FPBSN guides parents of children to gradually and positively guide children to cooperate with treatment and effectively improve children's eating behavior (17). From the observation results of cellular immune function indicators, the levels of CD^{3+} and CD^{4+}cells are still insufficient, but the ratio of CD^{4+}/CD^{8+} is within the normal range. With the help of family-positive support nursing, the stable state of auxiliary and inhibitory T cells in the treated MT children recovered faster. Considering that the diet behavior of the children was related to improvement and emotional stability. At the same time, it can effectively improve the level of Hb and Alb in children.

Effect of FPBSN on QL of children with MT

PedsQLTM children's QL scale can reflect the QL of MT children in hospitals (18). Through the observation of the QL scores of the two groups, this study found that the application of FPBSN had a significant impact on anxiety, cognitive problems and total scores compared with routine nursing. FPBSN can supervise the children's families to accept the fact of illness and help them face up to their psychological burden. It can effectively improve the self-efficacy of family members and increase the control of parenting behavior. In turn, the children received higher emotional input from their relatives, and their anxiety and anxiety were reduced (19). Some studies (20) believe that the preparation level of adolescent patients and caregivers during the transition period of growth is closely related to QL. In this study, positive behavior intervention was used to effectively improve the family coping style of patients with MT and lay a foundation for reducing the root causes of the emotional behavior of children. Pre-control was used to effectively implement the contents of the program card and to provide help for the improvement of parents' authority and democratic parenting style (21). It can also imperceptibly improve the children's diet and sleep patterns, and enhance emotional communication in combination with parent-child interaction activities. It can promote children's anger, anxiety and impulsive behavior to be gradually replaced under the guidance of PBS nursing, and effectively improve the children's QL (22). However, due to the short investigation time of this study, the included samples belong to a single center, which inevitably has some data bias. In the future, we will use the form of multi-center research to further explore the mechanism of PBS nursing on the immune function of MT children.

The results of the reliability and validity test of the scale showed that the scale used in the experiment could be used to evaluate the status of MT children aged 5 to 8 years. The application of FPBSN in MT children can improve the levels of CD^{3+}, CD^{4+}, CD^{4+}/CD^{8+} and improve the immune system function of children. And it can improve children's anxiety, anxiety and cognitive problems in the operation process. At the same time, this method can help children increase appetite and weight, so as to promote the improvement of children's QL.

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