

Effect of Kangaroo Mother Care Combined with Music Therapy on Neurodevelopment in Very Preterm Infants and the Psychological Well-being of Their Parents

Jia Nan¹, Yun Li², He Yujuan³

¹College of Nursing, Henan Medical College, Xinzheng, 451100, P. R. China

²Neonatal Intensive Care Unit, Xinxiang Central Hospital, Xinxiang, 453003, P. R. China

³School of Medical Humanities, Henan Medical University, Xinxiang, 453003, P. R. China

ABSTRACT:

Objective: To investigate the effects of Kangaroo Mother Care combined with music therapy on neurodevelopment in very preterm infants, as well as on parental anxiety and self-efficacy.

Methods: Very preterm infants with a gestational age of 28 to 31+6 weeks, admitted to the Neonatal Intensive Care Unit (NICU) of Xinxiang Central Hospital from December 2023 to December 2024, were selected as study participants. The grouping method used a random number table, and infants were randomly assigned to either a control group or an intervention group based on the order of hospitalization, with 34 cases in each group. The control group received routine NICU care plus music therapy, while the intervention group received routine NICU care combined with music therapy and Kangaroo Mother Care. The following outcomes were compared between the two groups on days 1, 14, and 28 after intervention: NBNA scores (including behavior ability, passive muscle tone, active muscle tone, primitive reflexes, general reactions, and total NBNA score), aEEG scores (including continuity, sleep-wake cycles, lower boundary amplitude, bandwidth, and total aEEG score), parental anxiety scores, and general self-efficacy scores.

Results: 1. Compared with the control group, the intervention group showed significantly higher NBNA scores (passive muscle tone, active muscle tone, primitive reflexes, general reactions, and total NBNA score) and aEEG scores (lower boundary amplitude, bandwidth, and total aEEG score) at 14 days of intervention, along with significantly lower parental anxiety and significantly higher parental self-efficacy. 2. Compared with the control group, the intervention group showed significantly higher NBNA scores (behavior ability, passive muscle tone, active muscle tone, primitive reflexes, general reactions, and total NBNA score) and aEEG scores (sleep-wake cycles, lower boundary amplitude, bandwidth, and total aEEG score) at 28 days of intervention, as well as significantly lower parental anxiety and significantly higher parental self-efficacy.

Conclusion: As postnatal age increases, the brain function of preterm infants gradually matures, parental anxiety improves, and self-efficacy gradually increases. However, compared with music therapy alone, Kangaroo Mother Care combined with music therapy more effectively promotes neurological development in very preterm infants, reduces parental anxiety, and improves parental self-efficacy.

KEYWORDS: Very preterm infants; Kangaroo Mother Care; Music therapy; Neurodevelopment; Anxiety

I. INTRODUCTION

Very preterm infants require hospitalization in the Neonatal Intensive Care Unit (NICU) after birth. Currently, most NICU's in China adopt a closed management model. Although this model reduces the risk of infection in preterm infants, it may adversely affect their brain development and language development [1-2]. The first year after birth is a critical period for rapid brain development in infants, during which the brain exhibits strong plasticity. Timely targeted interventions during this stage can improve the neurological functional status of preterm infants [3]. The ability to perceive sensory stimuli present at birth, together with the plasticity of brain development in preterm infants, lays the neurobiological foundation for the clinical application of early sensory interventions [4]. As important components of neurodevelopmental care [5], Kangaroo Mother Care and music therapy

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can theoretically have calming and comforting effects on preterm infants, enhance their sense of security, and thereby promote nervous system development [6]. However, the specific effects of their combined use on anatomical brain development and infant neurodevelopment remain unclear [7-8]. The closed management model of the NICU limits parent-infant contact, and together with parents' lack of knowledge about their infant's health status and excessive concerns about prognosis, significantly increases negative emotions among parents[9]. Although Kangaroo Mother Care and music therapy have been extensively studied for their roles in reducing parental negative emotions and promoting parent-infant attachment, the heterogeneity of findings across studies remains high, necessitating more prospective clinical research to validate these effects [10-11].

Kangaroo Mother Care provides tactile and olfactory stimulation to very preterm infants, whereas music therapy offers auditory stimulation while simultaneously alleviating parental anxiety during participation in Kangaroo Mother Care. Theoretically, the combined use of these two interventions may yield better outcomes than either intervention alone. Therefore, this study aims to investigate the effects of Kangaroo Mother Care combined with music therapy on the neurodevelopment of very preterm infants and the psychological well-being of their parents.

II. SUBJECTS AND METHODS

A. Research Subjects

A total of 68 preterm infants with a gestational age of 28 to 31+6weeks, admitted to the NICU of Xinxiang Central Hospital from December 2023 to December 2024, were selected as study subjects. Using a random number table method, the infants were randomly assigned to either a control group or an intervention group based on the order of hospitalization, with 34 cases in each group.

Inclusion criteria

Preterm infants: ①Gestational age of 28~31+6weeks; ②Apgar score of 7~10 at 10 minutes after birth; ③Bilateral pass on postnatal brainstem auditory evoked potential testing; ④Tolerance to Kangaroo Mother Care; ⑤Parental informed consent.
Parents: ①Agreement to participate in this study; ②Ability to understand the questionnaire content.

Exclusion criteria

Preterm infants: ①Congenital hereditary metabolic diseases; ②Complex congenital heart disease; ③Incomplete medical records; ④Severe congenital malformations. **Parents:** ①Refusal to participate in this study; ②Inability to understand the corresponding content of the questionnaire; ③Presence of infectious or psychiatric disorders; ④Inability to complete the 4-week intervention. This study was approved by the Ethics Committee of our hospital (Approval No.: 2023-803). Informed consent was obtained from the parents of the infants.

Sample Size Calculation:

The sample size was estimated using the formula for comparison of means between two groups.

$$N1=N2= [(t\alpha/2+t\beta) S/\delta]^2$$

N represents the required sample size per group, S represents the population standard deviation, δ represents the difference between the two group means. In this study, a two-sided $\alpha=0.05$ and $\beta=0.2$ were set. According to statistical tables, $t\alpha/2=t0.05/2=1.96$, $t\beta=t0.2=0.84$. Based on preliminary experimental data, the total NBNA score in the control group was (33.87 ± 0.64) and that in the intervention group was (35.12 ± 2.96) , yielding $S=2.32$ and $\delta=1.25$. Substituting these values into the formula, the required sample size per group was 27 cases. Considering a 20% dropout rate, the final sample size per group was determined to be 34 cases.

B. Research Methods

Preterm infants in the control group received routine care and music therapy once daily for 2 hours per session, lasting 4 weeks. Preterm infants in the intervention group received Kangaroo Mother Care in addition to the interventions provided to the control group, once daily for 2 hours per session, lasting 4 weeks.

1) Music Therapy

Music albums specifically designed for preterm infants, such as 《Music for Dreaming》 and 《Sleep Baby Sleep》 (published by Sony Music), were selected. For the control group: A sterilized portable speaker was placed 30 cm from the preterm infant's head, with the playback volume set to 30 dB. During music, invasive nursing procedures were paused, interference was minimized as much as possible, and ambient noise was controlled within 45 dB [12]. For the intervention group: A stereo portable speaker was placed 2 meters away from the parents and infant. According to the recommendations of the Practice Guidelines for Music Interventions with Hospitalized Children in the United States, the volume was controlled between 45 dB and 55 dB to avoid

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excessive loudness that might disturb the preterm infant's rest [13]. During music playback, the infant's condition was closely observed. In case of crying or agitation, the infant was soothed, or the music therapy was temporarily interrupted.

2) Kangaroo Mother Care

Pre-implementation preparation: Family members strictly adhered to the procedures and regulations for entering the NICU. They wore masks, caps, and shoe covers, and performed hand hygiene before contacting the infant. They wore front-opening, comfortable clothing, refrained from using skincare products or perfume, and did not wear necklaces, watches, or other accessories. Upon entering the department, they signed in with the nurse on duty, presented their identification, and truthfully reported their own health status. The room temperature was maintained at 22-24°C, with humidity at 55%-65%. The infant was kept away from air vents to prevent fluctuations in body temperature. Ambient light was dimmed, and noise interference was reduced.

Implementation procedure: Parents first reclined on a sofa or lounge chair, adjusting to a comfortable semi-recumbent position (approximately 60° inclination), with their upper clothing opened. With the assistance of a professional nurse, the preterm infant was placed upright or in a 60° prone position on the parent's chest, with the legs bent and flexed, ensuring full skin-to-skin contact with the parent. One hand of the parent supported the infant's buttocks, while the other supported the head and neck, ensuring that the head was turned to one side to maintain an open airway. The infant's face, chest, abdomen, arms, and legs were kept in close contact with the parent's chest and abdominal skin.

Precautions: During the procedure, the infant's vital signs were closely monitored to prevent any adverse events. If the infant's condition deteriorated during this period, Kangaroo Mother Care was suspended.

3) Outcome Measures

NBNA scores (including behavior ability, passive muscle tone, active muscle tone, primitive reflexes, and general reactions), aEEG scores (including continuity of background activity, sleep-wake cycles, lower boundary amplitude, and bandwidth), parental anxiety scores, and general self-efficacy scores were assessed on day 1, day 14, and day 28 after intervention.

C. Research Tools

1) NBNA score

The NBNA is an assessment tool for evaluating neonatal neurodevelopment with good reliability and validity [14]. The total score is 40 points, encompassing five dimensions: behavior ability, active muscle tone, passive muscle tone, primitive reflexes, and general condition. A higher score indicates better neurodevelopment.

2) aEEG score

Burdjalov et al.[15] developed a comprehensive aEEG scoring system for preterm infants, which evaluates the continuity of background activity, sleep-wake cycles, lower boundary amplitude, and bandwidth. The total score ranges from 0 to 13, with higher scores indicating more mature neurodevelopment. In this study, electroencephalographic activity was monitored using the OLYMPIC BRAINZ MONITOR (OBM) from Natus, USA. Each monitoring session lasted 6 hours.

3) SAS score

The scale used in this study is the Chinese version adapted and revised by the National Scale Collaboration Group in 1986[16]. The scoring criteria are as follows: <50 points indicates no anxiety; 50-59 points indicates mild anxiety; 60-69 points indicates moderate anxiety; and ≥70 points indicates severe anxiety. The Cronbach's α coefficient of this scale is 0.93.

4) General Self-Efficacy Scale (GSES)

The GSES consists of 10 items, each rated on a four-point scale based on the degree of agreement, with scores ranging from 1 to 4. Higher scores indicate greater self-efficacy. The Cronbach's α coefficient of this scale is 0.87[17].

D. Statistical Methods

All data were analyzed using SPSS version 27.0. Categorical data were expressed as frequencies, and intergroup differences were analyzed using the chi-square (χ^2) test. For continuous data, variables following a normal distribution were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), and intergroup differences were analyzed using the independent samples t-test. Repeated measures data between the two groups were compared using repeated measures analysis of variance. For continuous data not following a normal distribution, median and interquartile range [M (P25, P75)] were used, intergroup comparisons were performed using the Mann-Whitney U test, and repeated measures data between the two groups were compared using generalized estimating equations. A two-sided $P < 0.05$ was considered statistically significant.

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III. RESULTS

A. Comparison of general data between the two groups at admission

During the study period, in the control group, one infant withdrew due to discharge against medical advice, and two infants were transferred to a higher-level hospital due to worsening of their condition. Ultimately, a total of 31 preterm infants completed the study in the control group. In the intervention group, one infant was transferred to a higher-level hospital due to worsening of their condition, two infants' families withdrew from the study prematurely, and one infant was cured and discharged before completing the 4-week intervention. Ultimately, a total of 30 preterm infants completed the study in the intervention group.

There were no statistically significant differences between the two groups at admission in terms of gestational age, birth weight, sex, mode of delivery, 1-minute Apgar score, 5-minute Apgar score, 10-minute Apgar score, maternal age, mode of conception, whether regular prenatal examinations were performed, whether antenatal dexamethasone was administered, and pregnancy complications ($P > 0.05$), indicating comparability of general data between the two groups (Table 1).

Table 1. Comparison of General Data Between the Two Groups at Admission

Group	Control group (N=31)	Intervention group (N=30)	$\chi^2/t/Z$	P
Preterm infants				
Gestational age at birth (weeks)	29.67±0.94	29.70±0.82	-0.114	0.910b
Birth weight (kg)	1400±190	1440±210	-0.820	0.415b
Sex (male/female)	16/15	16/14	0.018	0.893a
Mode of delivery (vaginal/cesarean)	14/17	17/13	0.807	0.369a
1-minute Apgar score	7 (6, 7)	6 (5.75, 7.25)	-0.578	0.563c
5-minute Apgar score	8 (7, 9)	8 (7, 8)	-1.041	0.298c
10-minute Apgar score	9 (8, 10)	9 (8, 9.25)	-0.340	0.734c
Mother				
Maternal age (years)	29.0 (26.0, 32.0)	26.5 (24.0, 29.0)	-1.869	0.062b
Mode of conception (natural/artificial)	10/25	8/27	0.299	0.584a
Regular prenatal examinations (yes/no)	12/23	11/24	0.065	0.799a
Antenatal dexamethasone use (yes/no)	27/8	30/5	1.429	0.232a
Pregnancy complications (yes/no)	29/6	33/2	0.357	0.550a

Note: a: χ^2 test; b: independent samples t-test; c: Mann-Whitney U test

B. Comparison of outcome measures between the two groups at the start of intervention

At the start of intervention, there were no statistically significant differences between the two groups in any domain scores or total scores of the NBNA ($P > 0.05$). Similarly, no statistically significant differences were found between the two groups in any domain scores or total scores of the aEEG ($P > 0.05$). Furthermore, there were no statistically significant differences in SAS scores or GSES scores of the parents between the two groups ($P > 0.05$). These results indicate that all outcome measures were comparable between the two groups at the start of intervention (Table 2).

Table 2. Comparison of outcome measures between the two groups at the start of intervention

Item	Category	Control group (N=31)	Intervention group (N=30)	$t/\chi^2/Z$	P
NBNA score	Behavior ability	7(6, 8)	8(7, 9)	-1.640	0.101c
	Passive muscle tone	5(5, 6)	5.50(5, 6)	-0.965	0.335c
	Active muscle tone	4(4, 5)	4(3.75, 5)	0.251	0.802c
	Primitive reflexes	4(3,4)	4(3,4)	-0.048	0.962c
	General condition	4(4,5)	4(4,5)	-0.573	0.567c
	Total score	25(24,26)	25.5(23.75,28)	-0.997	0.319c
aEEG score	Continuity	2 (1, 2)	2 (1, 2)	-0.654	0.513c
	Sleep-wake cycles	2 (1, 3)	2.50 (2, 3)	-1.659	0.097c
	Lower boundary amplitude	1 (1, 2)	1 (1, 2)	-0.692	0.489c
	Bandwidth	1 (1, 2)	2 (1, 2)	-0.790	0.430c
	Total score	6 (4, 8)	7 (6, 9)	-1.403	0.161c

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SAS score	68.48±5.77	69.07±3.26	-0.484	0.630b
GSES score	20.84±1.64	21.00±1.58	-0.932	0.696b

Note: b: independent samples t-test; c: Mann-Whitney U test.

C. Comparison of NBNA scores between the two groups before and after intervention

On day 14 of intervention, there were statistically significant differences between the two groups in passive muscle tone, active muscle tone, primitive reflexes, general reactions, and total NBNA score ($P < 0.05$), with the intervention group showing significantly higher scores than the control group. On day 28 of intervention, statistically significant differences were observed between the two groups in all domain scores and total NBNA score ($P < 0.05$), and the intervention group continued to show significantly higher scores than the control group.

Repeated measures analysis of variance was performed on NBNA scores measured at three time points (day 1, day 14, and day 28 of intervention). The results showed that NBNA scores in both groups were significantly affected by time effect, group effect, and the interaction between time and group ($P < 0.001$), (Table 3).

Table 3. Comparison of NBNA scores between the two groups of very preterm infants before and after intervention with Kangaroo Mother Care combined with music therapy

Domain	Time		Control (N=31)	group Intervention group(N=30)	Z	P	W(P)
			M(P25,P75)	M(P25,P75)			
Behavior ability	Day 1 of intervention		7 (6,8)	8 (7,9)	-1.640	0.101	Group 8.573(0.003)
	Day 14 of intervention		9 (8, 9)	10 (9, 10)	-0.652	0.514	Time 683.885(<0.001)
	Day 28 of intervention		10(9,10)	11(11,12)	-4.938	<0.001	G*T 31.057(<0.001)
Passive muscle tone	Day 1 of intervention		5 (5, 6)	5.50 (5,6)	-0.965	0.335	Group 19.715(<0.001)
	Day 14 of intervention		6 (5, 6)	7 (6, 7)	-3.403	<0.001	Time 79.457(<0.001)
	Day 28 of intervention		6(6,7)	7(7,8)	-5.270	<0.001	G*T 7.931 (0.019)
Active muscle tone	Day 1 of intervention		4 (4,5)	4 (3.75,5)	-0.251	0.802	Group 20.675(<0.001)
	Day 14 of intervention		5 (4, 5)	6 (5, 7)	-3.865	<0.001	Time 151.224(<0.001)
	Day 28 of intervention		5(5,6)	7(6,7)	-5.133	<0.001	G*T 27.395(<0.001)
Primitive reflexes	Day 1 of intervention		4 (3,4)	4 (3,4)	-0.048	0.962	Group 15.422(<0.001)
	Day 14 of intervention		4 (4, 5)	5 (4, 6)	-3.122	0.002	Time 181.034(<0.001)
	Day 28 of intervention		5(5,5)	6(5,6)	-3.943	<0.001	G*T 14.133(<0.001)
General condition	Day 1 of intervention		4 (4,5)	4 (4,5)	-0.573	0.567	Group 16.275(<0.001)

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Total score	Day 14 of intervention	5 (5, 5)	6 (5, 6)	-4.295	<0.001	Time
	Day 28 of intervention	5(5,6)	6(6,6)	-3.206	0.001	200.344(<0.001)
	Day 1 of intervention	25 (24,26)	25.5 (23.75,28)	-0.997	0.319	G*T
	Day 14 of intervention	29 (27,31)	33 (31,34.25)	-5.143	<0.001	11.536(<0.001)
	Day 28 of intervention	31(30,33)	37(36,38)	-6.497	<0.001	Group
						52.731(<0.001)
						Time
						641.632(<0.001)
						G*T
						34.588(<0.001)

Note: Z: Mann-Whitney U test; W: generalized estimating equations.

D. Comparison of aEEG scores between the two groups before and after intervention

On day 14 of intervention, there were statistically significant differences between the two groups in lower boundary amplitude, bandwidth, and total aEEG score ($P < 0.05$), with the intervention group showing significantly higher scores than the control group. On day 28 of intervention, there were statistically significant differences between the two groups in sleep-wake cycles, lower boundary amplitude, bandwidth, and total aEEG score ($P < 0.05$), and the intervention group continued to show significantly higher scores than the control group.

Comparison of aEEG scores measured at three time points (day 1, day 14, and day 28 of intervention) revealed that the bandwidth dimension and total score of aEEG were significantly affected by time effect, group effect, and the interaction between time and group ($P < 0.05$). (Table 4).

Table 4. Comparison of aEEG scores between the two groups of very preterm infants before and after intervention with Kangaroo Mother Care combined with music therapy

Domain	Time		Control group (N=31)	Intervention group(N=30)	Z	P	W(P)
			M(P25,P75)	M(P25,P75)			
Continuity	Day 1 of intervention		2(1,2)	2(1,2)	-0.654	0.513	Group
	Day 14 of intervention		2 (1,2)	2 (1.75,2)	-1.535	0.125	2.881(0.090)
	Day 28 of intervention		2(1,2)	2(2,2)	-1.657	0.098	Time
Sleep-wake cycles	Day 1 of intervention		2(1,3)	2.5(2,3)	-1.659	0.097	G*T
	Day 14 of intervention		3 (2,4)	3(3,4.25)	-1.657	0.097	0.758(0.685)
	Day 28 of intervention		3(3,5)	5(3.75,5)	-2.445	0.014	Group
Lower boundary amplitude	Day 1 of intervention		1(1,2)	1(1,2)	-0.692	0.489	4.356(0.037)
	Day 14 of intervention		2(1,2)	2(2,2)	-2.725	0.006	Time
	Day 28 of intervention		2(1,2)	2(2,2)	-2.454	0.014	49.040(<0.001)
Bandwidth	Day 1 of intervention		1(1,2)	2(1,2)	-0.790	0.430	G*T
	Day 14 of intervention		2(2,3)	3(3,3)	-4.744	<0.001	1.925(<0.382)

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Total score	Day 28 of intervention	3(2,3)	4(3,4)	-4.673	<0.001	174.916(<0.001) G*T
	Day 1 of intervention	6(4,8)	7(6,9)	-1.403	0.161	15.273(<0.001) Group
	Day 14 of intervention	8(7,10)	10.5(9.75,11.25)	-3.600	<0.001	15.908(<0.001) Time
	Day 28 of intervention	9(9,10)	12(11,12)	-4.853	<0.001	205.775(<0.001) G*T
						6.808(0.033)

Note: Z: Mann-Whitney U test; W: generalized estimating equations.

E. Comparison of psychological status of parents of very preterm infants between the two groups

On day 14 and day 28 of intervention, there were statistically significant differences between the two groups in parental anxiety scores and general self-efficacy scores ($P < 0.05$). Compared with the control group, the intervention group showed significantly lower parental anxiety scores and significantly higher parental self-efficacy scores.

The results of repeated measures analysis of variance for both groups showed that parental anxiety scores and self-efficacy scores were significantly affected by time effect, group effect, and the interaction between time and group ($P < 0.001$). (Table 5).

Table 5. Comparison of psychological status of parents of very preterm infants between the two groups before and after intervention with Kangaroo Mother Care combined with music therapy

Item	Time		Control group (N=31)	Intervention group (N=30)	t	P	F(P)
			$\bar{x} \pm s$	$\bar{x} \pm s$			
Parental anxiety score	Day 1 of intervention		68.48 $\pm$ 5.77	69.07 $\pm$ 3.26	-0.484	0.630	Group 64.580(<0.001)
	Day 14 of intervention		60.90 $\pm$ 3.59	50.73 $\pm$ 3.31	11.491	<0.001	Time 1339.199(<0.001)
	Day 28 of intervention		50.87 $\pm$ 4.01	39.77 $\pm$ 2.13	13.579	<0.001	G*T 85.273(<0.001)
General self-efficacy score / Self-efficacy score	Day 1 of intervention		20.84 $\pm$ 1.64	21.00 $\pm$ 1.58	-0.392	0.696	Group 292.937(<0.001)
	Day 14 of intervention		24.23 $\pm$ 2.10	3.10 $\pm$ 1.69	-12.040	<0.001	Time 793.371(<0.001)
	Day 28 of intervention		28.10 $\pm$ 2.04	36.93 $\pm$ 1.74	-18.177	<0.001	G*T 123.874(<0.001)

Note: t: independent samples t-test; F: repeated measures analysis of variance.

IV. DISCUSSION

The absence of normal sensory stimuli and the persistent presence of abnormal sensory stimuli (such as invasive procedures and noisy ward environments) adversely affect the neurodevelopment of preterm infants[18]. The sudden occurrence of preterm birth makes it difficult for parents to smoothly transition into their parental roles, leading to increased negative emotions. Kangaroo Mother Care and music therapy have been gradually promoted and applied in NICUs, playing important roles in reducing mortality and complication rates, promoting growth and development, improving preterm infant outcomes, and alleviating parental anxiety and depression [19-21]. Whether the combined use of these two interventions is more beneficial than music therapy alone in improving neurological outcomes in preterm infants and parental psychological status remains controversial. Therefore, this study combined Kangaroo Mother Care with music therapy to evaluate their specific effects, and the following results were obtained.

A. Effect of Kangaroo Mother Care combined with music therapy on neurodevelopment in very preterm infants

The results of this study showed that NBNA scores and aEEG scores in both groups gradually increased with increasing postnatal age, indicating that brain function gradually matures as preterm infants grow older. On day 14 of intervention, neurodevelopmental indicators in the intervention group were significantly higher than those in the control group, suggesting that

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the combined use of Kangaroo Mother Care and music therapy has a synergistic effect and yields better outcomes than music therapy alone. At 28 days of intervention, the behavior ability domain of the NBNA score, as well as the sleep-wake cycles and lower boundary amplitude domains of the aEEG score, were also significantly higher in the intervention group than in the control group, indicating that the positive impact on neurodevelopment becomes more pronounced with longer intervention duration.

Kaffashi et al.[22] found that compared with non-Kangaroo Mother Care preterm infants at the same corrected gestational age, preterm infants in the Kangaroo Mother Care group showed increased EEG complexity, and those who reached term-equivalent age had EEG results similar to those of full-term infants, indicating that Kangaroo Mother Care intervention can accelerate neurophysiological maturation in preterm infants. Clemencic-Jones et al.[23] suggested that music therapy helps provide a supportive physical environment for preterm infants and their families, assists parents in stabilizing their emotions, and promotes the growth and development of preterm infants. Continuing music therapy after discharge may improve learning, social, and motor abilities in preterm infants. Haslbeck et al.[24] found that providing music therapy during Kangaroo Mother Care promotes brain development, improves long-term neurological function, and enhances long-term cognitive, learning, and social abilities in preterm infants. Teng et al.[25] reported that preterm infants receiving multisensory (tactile, auditory, visual, and vestibular) intervention nursing showed significantly higher lower boundary voltage during quiet sleep, lower boundary voltage during active sleep, aEEG scores, and NBNA scores compared with those receiving routine nursing. Their Gesell scale scores at one month of corrected gestational age were also significantly higher than those in the routine nursing group. The present study is consistent with the above findings. Providing two hours of Kangaroo Mother Care and music therapy daily improved the neurodevelopmental status of preterm infants, and the combined use of the two interventions was more effective than music therapy alone.

B. Effect of Kangaroo Mother Care combined with music therapy on anxiety and self-efficacy in parents of very preterm infants

The results of this study showed that as postnatal age increased, parental anxiety in both groups showed a decreasing trend, with a more pronounced decrease in the intervention group; self-efficacy showed an increasing trend in both groups, with a more pronounced increase in the intervention group. This may be related to the fact that during Kangaroo Mother Care, parents learn parenting knowledge and skills under the guidance of healthcare professionals, witness the growth, development, and treatment process of their infants, thereby enhancing their parenting confidence and alleviating anxiety. Kangaroo Mother Care for preterm or low birth weight infants has been shown to reduce mean depression scores in mothers[26]. Compared with no Kangaroo Mother Care, Kangaroo Mother Care significantly reduces maternal anxiety levels and maternal stress[27]. The ability of Kangaroo Mother Care to alleviate parental anxiety may be associated with parents gaining a better understanding of their very preterm infant's condition during the intervention, as well as improving their skills and confidence in caring for the infant[28]. Studies have found that Kangaroo Mother Care combined with cognitive psychological nursing helps parents acquire knowledge and skills for caring for preterm infants earlier, enhances their parenting competence, and reduces anxiety levels[29]. The present study, which combined Kangaroo Mother Care with music therapy, reduced parental anxiety and improved self-efficacy, consistent with the above findings.

V. CONCLUSION

In summary, compared with music therapy alone, Kangaroo Mother Care combined with music therapy is more beneficial for the neurological development of very preterm infants, as well as for alleviating parental anxiety and improving parental self-efficacy. In the future care of very preterm infants, the combined use of multisensory stimulation may be adopted to support the neurological development of preterm infants and the improvement of parental psychological status.

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