

## Effects of Massage on Duration of Phototherapy in Premature Infants Admitted to a Neonatal Intensive Care Unit

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### ABSTRACT

**BACKGROUND AND OBJECTIVE:** Approximately 80% of premature infants are diagnosed with icterus, most of whom are treated by phototherapy. Given the adverse effects of this treatment on neonates, minimizing the duration of phototherapy seems to be necessary. This study aimed to evaluate the effects of massage on the duration of phototherapy in premature infants admitted to neonatal intensive care units.

**METHODS:** This clinical trial was performed on premature infants admitted to the neonatal intensive care unit of Qaem Hospital of Mashhad, Iran, in 2011. The infants were randomly divided into intervention (n=30) and control (n=30) groups. The infants of both groups were similar in terms of weight, age, and the level of bilirubin. The intervention group received massage therapy (including massage and passive movements of the body parts) on a daily basis for three 15-minute courses at three consecutive hours for five days. The control group received the routine care and phototherapy. After the intervention, the two groups were compared in terms of duration of phototherapy and level of transcutaneous bilirubin.

**FINDINGS:** The mean duration of phototherapy in the intervention and control groups was 80.8±61.58 and 112.8±75.45 hours, respectively. However, this difference was not statistically significant. On the fifth day of the intervention, the level of transcutaneous bilirubin was 9.7 and 8.1 mg/dl in the intervention and control groups, respectively, this difference was not significant as well.

**CONCLUSION:** Massage can be used as an effective method alongside with phototherapy to minimize the duration of phototherapy for premature healthy infants in clinically stable conditions.

**KEY WORDS:** *Premature Infants, Massage, Phototherapy.*

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## Introduction

Premature birth is highly prevalent in Iran, and premature infants comprise 10% of total births (1). Taking care of these infants carries considerable costs (2), and various neurological and physiological problems can be observed in these infants (3). Caring for premature infants has been widely studied in the past few decades, and different methods have been evaluated to improve their living condition and speed up their process of growth (4).

Touching is one of the useful sensory stimulations for premature infants. Touch, silent speech or non-verbal communication are physiological sensations, which eventually lead to receiving the sense of touch by the skin receptors and analyzing it in the brain. Almost all premature infants with body weights between 1000 and 2000 gr are deprived of gentle touch, since these infants are transferred to neonatal intensive care unit (NICU) after birth, and at this time, the efforts of medical and nursing staff would result in painful procedures in order to keep them stable. Two common types of skin-to-skin contact in infants are kangaroo mother care and massage. Several advantages have been spelt out for massage, including improvement of the neurological development and inducing tranquility and confidence.

Infants receiving suitable and ongoing massage therapy in NICUs had better sleep quality and weight gain (5). Slow and gentle massage can cause an increase in the skin blood flow, assuage stress and muscle pain, and create positive feelings (6). Almost 80% of premature infants are diagnosed with icterus, and in 8-11% of cases, the level of bilirubin exceeds 95%; therefore, the need for assessment and treatment arises. In case of failing to treat icterus, dangerous complications such as kernicterus appear that eventually lead to a lifetime of disability. Accurate diagnosis, treatment, and follow-up of icterus have always been some of the most important challenges in neonatology. Currently, the most effective and common method for treating icterus in neonates is phototherapy (7).

However, two categories of complications namely, short-term and long-term, have been described for phototherapy. Short-term complications include hyperthermia, insensible water loss, and loose stool (8-10). The incidence of loose stool in premature infants is significantly higher than term ones (11).

The long-term complications of phototherapy include hypocalcaemia and thrombocytopenia (12,13).

Thus, through reducing the duration of phototherapy the occurrence of complications can be prevented to some extent. According to a study by Diego et al., massage can decrease constipation in infants (13), and lower the duration of meconium evacuation in term neonates (14).

Chen et al. illustrated that massage can have a considerable effect on icterus in term infants (15). In a study performed by Field et al., significant impact of massage on various aspects of growth in premature infants was demonstrated; thus, it can be considered as a safe method in infants older than 30 weeks gestation (16). It is important to reduce the symptoms of icterus in infants through improving the quality and quantity of care. This study, therefore, aimed to evaluate the impact of massage on the duration of phototherapy in preterm infants admitted to NICU of Qaem Hospital, Mashhad, Iran.

## Methods

This clinical trial was done on all the premature infants admitted to the NICU of Qaem Hospital, Mashhad, Iran. The demographic and daily data entry forms were used to obtain data. The content validity of the forms was approved by ten faculty members of School of Nursing and Midwifery, Mashhad University of Medical Sciences, Iran. After applying the necessary modifications, the forms were used in the study. The data included weight, daily calorie intake, breast milk, glucose, intravenous fluid therapy, oxygen therapy, phototherapy, and the level of body temperature.

The questionnaire of demographic characteristics contained plain questions; and its reliability was demonstrated in various studies (1, 17, 18). During the intervention, the level of transcutaneous bilirubin (TCB) was measured on a daily basis, via KJ-8000 Jaundice meter (China), at 12-12:30 before the massage. The functional accuracy of the device was approved by measuring serum bilirubin in previous studies (19).

The device was calibrated based on the factory instructions. Parallel-forms reliability was used to determine the reliability of pulse oximetry, i.e., the accuracy of the device was compared to a similar one before the study, and the device was calibrated at the beginning of the sampling on a daily basis. At first, the reliability of the scale was evaluated using a 100 gr weight. The infants with 30-37 weeks gestation

without any obvious congenital malformations, central nervous system disorders, or gastro-intestinal problems and with the body temperature of 36.2-37.2° C and body weight of 1200-2000 gr were included in the study. The sample size for each group, based on observational studies (18), and after preliminary studies with 95% confidence and power of 80% based on comparison of two independent means, was calculated to be 17; but to be more precise, 30 samples were allocated to each group. Before the end of the intervention, five samples from the massage group and seven samples from the control group were excluded due to personal desire of parents, the need for ventilator, or blood transfusion. Eventually, 25 and 23 infants in the intervention and control groups were entered into the study.

After obtaining the approval of Ethics Committee of Mashhad University of Medical Sciences, informed consent was obtained from the parents. Moreover, a letter of introduction from the School of Nursing and Midwifery of Mashhad was provided and permission of the hospital authorities was obtained. The intervention was initiated after explaining the purpose of the study to the parents. The control group received the routine care, and the intervention group, in addition to the routine care, received massage with Field technique (a safe technique to use for infants older than 30 weeks gestation) in three 15-minute sessions for five consecutive days (16) (based on the fact that each infant admitted to NICUs has to stay in the hospital for at least five days due to sepsis workup and receiving prophylactic antibiotics by injection) at 12:45, 14:45, and 15:45 by the researcher.

The reason for choosing the afternoon shift is that it is quieter than the morning shift. Each 15-minute session included three five-minute phases; during the first and last phases, the infant was put in prone position and was massaged with gentle pressure by the soft parts of the fingers of both hands covered with olive oil to reduce friction. In these two phases, each one minute one of the following areas was touched: 12 moving touches (each five seconds one move) from the head down to both sides of the face and neck and vice versa; 12 moving touches (each five seconds one move) from back of the neck through the shoulders and vice versa; 12 moving touches (each five seconds one move) from the upper-back down to the lower waist and vice versa; 12 moving touches (each five seconds one move) from the thighs down to the ankles and vice versa; and 12 moving touches (each five

seconds one move) from the shoulders to the wrists and vice versa.

In the middle phase, the neonate was put in supine position and six extension-flexion passive movements (each ten seconds one) were respectively applied to the following areas: right arm, left arm, right leg, left leg, and both legs. The first daily TCB measurement was done before the intervention. The duration of phototherapy was also recorded by in a self-regulated checklist, which was put on the vital sign chart of the neonates and it was filled by a nurse every shift.

Based on the researchers' observations and/or the recorded reports of nurses, if the infant was vomiting or had residues of more than 20% of feeding at every session, or had discolored residues (brown and biliary) or flatus, they would be considered positive in terms of feeding intolerance. Moreover, in case of observing apnea for more than 15 seconds or a kind of apnea, which is accompanied with bradycardia and cyanosis, they were considered positive in terms of apnea. Paired t-test, chi-square, Fisher's Exact test, Mann-Whitney U test, and Odds Ratio were performed using SPSS version 16. P-value less than 0.05 was considered significant.

## Results

The results indicated that height, weight, head circumference (centimeter), age at birth, first and fifth minute Apgar scores, and maternal age of the control and intervention groups were not significantly different (Table 1). Although there was not a statistically significant difference between the two groups in terms of the level of TCB, its decreasing trend was faster in the massage group than the control group (Table 2).

In addition, there was not a statistically significant difference between the two groups in terms of the duration of phototherapy, but the mean duration of phototherapy in the intervention group was lower than the control group (80.8±58.61 vs. 112.8±45.75). The chance of apnea in the massage group was 2.8 times less than the control group. In addition, the massage group showed a significantly improved feeding tolerance after the onset oral feeding as compared to the control group, so that 21 cases of food intolerance were reported in the control group, while it was four infants in the intervention group ( $P \leq 0.001$ ). The chance of incidence of feeding intolerance in the intervention group was one tenth of the control group (odds ratio=10.7).

**Table 1. Comparison of mean of demographic variables in the two groups**

Variable group	Intervention mean±SD	Control mean±SD	P-value
Gestational age (week)	32.8±1.78	32.1±1.80	0.103
Height at birth (centimeter)	41.8±2.85	40.1±3.28	0.104
Weight at birth (gr)	1480.5±162.31	1421.2±134.93	0.129
Head circumference at birth (centimeter)	30.6±1.48	30.1±1.72	0.124
Maternal age (year)	29.4±5.53	26.6±5.58	0.147
First minute Apgar score	7.3±0.88	7.3±0.94	0.779
Fifth minute Apgar score	8.2±0.94	8.3±0.76	0.651

**Table.2 Comparison of the level of trans cutaneous bilirubin in infants based on the intervention days in the intervention and control groups**

Group TCB Level	Massage (n=25) middle (25-75)	Control (n=23) middle(25-75)	P-value
First day	6.8(5.6-9.3)	6.5(5.6-7.3)	0.45
Second day	8.3(7.2-10.1)	8.4(5.2-10.4)	0.31
Third day	9.1(6.9-11.2)	9.0(7.2-11.7)	0.94
Fourth day	8.7(6.4-10.7)	8.9(6.9-11.8)	0.63
Fifth day	7.9(6.1-9.8)	8.1(6.7-11.3)	0.56

## Discussion

This study did not find a significant difference between the control and massage groups in terms of duration of phototherapy and the level of TCB in infants, which is consistent with the result of a study done by Seyedrasooli et al. (14). But it was not in accordance with the results a study performed by Huang, which suggested that massage alongside with enema and phototherapy could significantly reduce the level of icterus (as compared to those receiving double phototherapy but no massage and enema) (20). Our results were not in agreement with those of a study conducted by Chen, et al. demonstrating that gentle massage could significantly increase the number of defecations and significantly decrease the level of blood bilirubin on the second-fifth days of the intervention (15). Our results were confirmed by those of Lin'an et al. (21). In their study, the duration of phototherapy in the massage group was less than the intervention group, which may be due to the increase

in intestinal peristalsis, which in turn, causes increased number of defecations and volume of meconium. It seems that massage is more effective in term infants as compared to preterm ones. However, the speed of lowering the level of bilirubin in premature neonates receiving massage was more than those only receiving phototherapy.

The present study exhibited a significant difference between the two groups in terms of apnea; therefore, massage can significantly affect apnea. In a pilot study done by Whitley, it was found that therapeutic touch could not increase the duration of apnea and can be harmless to infants (22). The infants of this study were aged under 29 weeks gestation, which raises some issues in terms of the safety of massage for this group of infants.

Since this study was a pilot, the small sample size (five infants in each group), and being double-blind can lower the reliability of the results. Thus, conducting further studies with larger sample sizes is recommended in order to confirm its results. A study done by Xiuliang et al. showed the reduction of apnea in low birth weight infants receiving massage (23). In this study, it was not mentioned whether the infants were premature or only low birth weight. Since the immaturity of the respiratory center is one the important risk factors for apnea; ignoring this factor can seriously affect the results of the study. The results of the study by Osborn determined that apnea more than 14 seconds and bradycardia below 100 beats/minute were not observed in any of the infants (24).

Even though there have been a few studies on the effects of massage on apnea, we can conclude that touching as a stimulation can have an effective role in the prevention and treatment of apnea periods. It seems that the effect of massage in the present study can be due to frequent and regular stimulation of the skin in neonates. On the other hand, skin stimulation is the first step for reviving neonates; which can somehow justify the reduction in occurrence of apnea. There was a significant difference between the two groups in terms of feeding intolerance, and massage could decrease feeding intolerance to some extent.

In the study by Huang, it was illustrated that massage with enema can significantly decrease constipation and feeding intolerance in premature infants (20). This study considers taking some initial measures such as enema, regular phototherapy, and massage simultaneously in order to effectively reduce

icterus. In a study by Zhiying, it was revealed that massaging the oral cavity during the nasogastric feeding shortens the oral feeding (25). In this study, massage was used as a complementary method for easing and fastening the process of natural sucking, which even lowers the risk of oral infections and increases weight gain.

The effectiveness of oral cavity massage was evaluated in this study, which rendered interesting results in spite of its easiness. In a study done by Diego et al., it was indicated that gastrointestinal motility increases after receiving massage (13,26). In addition, the study by Seyedrasooli et al. showed that the first time of meconium evacuation was significantly less in term infants receiving massage than the control group (14). This difference might be due to the increase of gastrointestinal movements caused by massage, which

in turn led to improvement in feeding intolerance and early evacuation of meconium. Thus, the level of bilirubin would begin its decreasing trend sooner, which results in shorter recovery time and hospital stays and less complications of hospitalization and health costs. The results of this study revealed that massage could be an effective method for decreasing the duration of phototherapy by improving feeding intolerance in healthy premature infants with clinically stable conditions.

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