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Exploring Neonatal Touch

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Abstract
This paper reviews the literature on the positive and negative effects of touch on infants. The positive effects are mainly shown through massage literature while the negative effects are exemplified in studies on 'care touch'. The discrepancies between both sides of the literature are then discussed and the paper concludes that massage touch is safe and beneficial. A discussion follows on how to make massage an effective program in Neonatal Intensive Care Units through parental massage programs, with an emphasis on moderate pressure massage and priority placed on infants with the most problematic histories.

Introduction

In different parts of the world people use various techniques to nurture their young, but a common practice that is often used is touch. The Gujarati in Western India massage their infants because they believe it increases circulation, cultivating beauty and strong bones. Some British parents massage and rub their infants because they believe it strengthens the mother-child connection. In New Zealand, infant touch is centralized around the knees and ankles to help the child's joints, whereas in Russia, touch is thought to help the development of the central nervous system (Barnett, 2005). Whatever the motivation, touch has been a consistent and beneficial technique in infant development in many cultures. In the US however, the effects of touch are just starting to be explored.

One specific way touch is being looked at is in relation to premature infants. The number of premature infants born in the US has increased by 30% over the past 25 years. In America alone, half a million premature infants are born every year (Nordqvist, 2006). With this growing number of premature infants comes a growing concern for their care. Due to the tendency of premature infants to be underweight, a lot of attention has been dedicated to help neonates develop and to minimize the stressors they face. One main topic of dispute is whether unnecessary touch is a stressor that should be avoided or a beneficial technique that helps development.

There are two kinds of touch: care touch and neonatal massage. Care touch includes daily procedures in the Neonatal Intensive Care Unit (NICU) such as feeding, changing diapers, and

examinations. Massage touch is a more methodological touch intended to stimulate the child. There are different methods, but most consist of both tactile and kinesthetic stimulation (i.e. rubbing and a series of limb extensions). Currently, care touch is readily used in NICUs, whereas massage touch is not often used because of safety concerns about touch in general, leading to minimal touch policies. This paper will explore the benefits and detriments of touch through the dichotomy of care touch and massage touch.

Benefits of touch

Many of the medical benefits of touch have been found in massage touch research. The positive effects of massage include: weight gain, improved sleep/wake states, decreased stress, early discharge from the NICU, improved skin integrity, increased development of the sympathetic nervous system, and enhanced parent-infant bonding.

Weight Gain

One of the main concerns in developing neonates is weight gain. Dieter, Field, Hernandez-Reif, Emory, and Redzepi (2007) conducted a study exploring the positive effects of massage on weight gain. Infants in the study met the specific inclusion criteria of weighing between 750-1600g, being between 25-34 weeks old (based on gestational age), not having been breast-fed, and being generally healthy. A commonly used protocol, the Field massage therapy protocol, was used: infants were massaged for 15 minutes, 3 times each day, 1 hour after being fed. Each massage session consisted of 5 minutes of tactile stimulation, 5 minutes of kinesthetic stimulation, and concluded with another 5 minutes of tactile stimulation. During the tactile stimulation the infant was placed in a prone (face down) position and given moderate pressure stroking with the bottom of the fingers on both hands. During the kinesthetic massage, the neonates were placed in a supine (on back) position and led through passive flexion/extension actions. The results showed that the massaged group gained significantly more weight than the control group (on average 26 g more per day). This study also explored the sleep/wake behaviors of massaged neonates. Sleep/wake habits are important to infant development. Being awake more (and, therefore, sleeping less) is a sign of positive growth and development. It was found that the massaged neonates slept less than the control neonates, whereas the control neonates showed normal premature trends in both weight gain and sleep patterns. Both the massaged and control neonates received normal NICU care during the research. This study showed that in just five days, massage can promote weight gain and positively alter the distribution of sleep/wake states in neonatal infants – both beneficial effects for neonates' development.

Oil and Weight Gain

The massage protocols in many studies are done without oil, but research has shown an increase in weight gain when oil is used during massage. Arora and colleagues (2005) tested the effects of weight gain in infants massaged with oil and without oil. Mothers, trained in massage techniques by experts, massaged their premature infant for 10 minutes, 4 times a day, for 28 days. The massage techniques used were similar to the Field protocol. In the oil massage group, 10 milliliters of sunflower oil per kilogram of the neonate's weight was used. The neonates' weights were measured weekly. The results indicated that the oil massage group gained more weight (11.6 g/kg/day) than the regular massage group (8.7 g/kg/day), which in turn gained more weight than the control group (8.3 g/kg/day). The reasons behind the additional weight gain in the oil massage group are unclear, but one hypothesis is that the oil is absorbed into the skin and stored in the fat cells without altering the body's metabolism (Arora, Kumar, & Ramji, 2005). Using oil

for massage also has other beneficial outcomes. Kuhn and colleagues (1991) found that it improves skin quality by removing dead skin cells and encouraging the release of the neonate's natural oils, which improves the skin's resilience. The oils also help hydrate the skin and prevent cracking and drying.

Reasons Behind Weight Gain

In many studies, neonates who were massaged gained more weight than control groups (e.g. Beachy, 2003; Dieter et al., 2007; Vickers, Ohlsson, Lacy, Horsley, 2004). It was noticed that the neonates who gained more weight did not ingest more calories (Dieter et al., 2007), nor did they spend more time sleeping, which might have allowed them more time to digest (Dierter et al., 2005). In response to these findings Diego, Field, and Hernandez-Reif (2005) explored a theory that moderate-pressure massage stimulates vagal activity (the activation of the vagal nerve is an index of parasympathetic nervous system activation), which leads to an increase in the release of digestive hormones and an increase in gastric motility. In their study, 48 neonates were randomly assigned to one of three groups: a control group, a sham massage therapy group where infants received light pressure massage, and a moderate pressure massage therapy group. The Field massage treatment was given three times a day for five days. During the duration of the study, mean weight gained and mean calories consumed per day were recorded for each infant. Electrocardiograms (ECGs) and electrogastrograms (EGGs) were collected 15 minutes before the treatment, for 15 minutes during the treatment, and 15 minutes after the treatment on the first day of the study only. The results indicated that the moderate pressure massage group gained 27% more weight than the control and sham group, but did not consume more calories. The moderate pressure massage group also had a significant increase in vagal activity that peaked during the massage and an increase in gastric motility (measured by the EGG and tachygastria, the rate of electrical pacemaker activity in the stomach). Weight gain in the massaged infants was significantly related to increased vagal activity and gastric motility recorded on the first day of the study during and after the massage.

A primary weakness of the Diego and colleagues (2005) study is that the vagal and gastric motility were only measured on the first day of the study. Lee (2005) did a similar study testing vagal tone, but data on vagal tone was collected 10 minutes pre- and post-massage every day. In this study 26 infants were split into either a massage group or control group. The infants in the control group received normal care while the infants in the massage group received 15-minute massages, 2 times per day for 10 days using the Field protocol. The results indicated an increase in vagal tone post-massage, suggesting that there may be a relationship between the weight gain caused by massage and vagal activity. However, it should be noted that in this study the massage group did not gain significantly more weight than the control group. Thus, further research needs to be done in this area to learn more about the relationship between vagal tone and weight gain, and the cause of vagal tone increase observed in massaged neonates.

Stress

Massage has also been shown to help neonates decrease stress behaviors and activities. A reduction in stress is desirable because stress has been associated with medical and neurodevelopment problems in neonates (Hernandez-Reif, Diego, & Field, 2007). In a study by Hernandez-Reif, Diego, & Field (2007) the effects of massage therapy were studied in terms of changes in stress behavior of the neonates. Once again, the massage therapy group received the Field protocol of three 15-minute massages, three times a day, for five days. Infants' stress behaviors, which included sneezing, crying, grimacing, yawning, jerking of limbs, and finger

flaring, were recorded on the first and last day of the study. The results revealed a reduction in the duration of stressful behavior and movement in the massaged group in comparison to the control group. The pacifying effect that massage has on preterm infants could benefit their health and reduce their length of time in the NICU. It may also desensitize the neonates to the stressful environment of the NICU by prolonging the time of parasympathetic activity (the resting, steady state, or non-stressed state of the autonomic nervous system). This in turn relates to increased vagal activity, which, as discussed earlier, leads to weight gain.

Nervous system

Massage also speeds up the maturation of the autonomic nervous system, which controls homeostasis in the body. In a study done by Kuhn and colleagues (1991), 40 infants were divided into a control group and an experimental group to test the effects of massage on the sympathetic nervous system and the adrenal cortex. The neonates in the experimental group were massaged for 15 minutes, 3 times a day, for 10 days using the standard Field protocol. Urine samples were collected on the first and last day of the study to test levels of norepinephrine and epinephrine (the stress hormones responsible for the "fight or flight" response). The results revealed that during neonatal massage, catecholamine (norepinephrine and epinephrine) was secreted at increased levels. Since catecholamine is associated with stress, one concern might be that massage would increase the levels of stress. But, as shown in the Hernandez (2007) study, massage actually decreases stress levels. The secretion of catecholamine during massage seems to be at the optimal level for development and arousal, but not stress. This improves the infant's level of attention, which in turn helps the development of the infant's sympathetic nervous system (Kuhn et al., 1991).

Negatives of Touch

Some researchers have questioned the beneficial results observed in many of these studies. According to Vickers, Ohlsson, Lacy, & Horsley (2004) many of the neonate massage studies used unsystematic methods, which caused the inclusion of non-randomized and uncontrolled trials as evidence in support of neonatal massage. For example, a founding review article written by Field (1980) included an article by Solkoff (1975) that failed to describe the methodology used. Another article referenced in Field's review, included only prose with no experimental methods or numerical data. When exploring a topic as reliant on methodology as massage, the lack of specific methodology is a serious concern and calls many of the findings into question.

However, other than these few criticisms of neonatal massage, most of the research done on neonatal massage has been overwhelmingly positive. Despite this, only 35% of NICUs in the U.S. use massage therapy (Dieter et al., 2007). This reflects the minimal-touch policy that many neonatologists still favor based on the negative responses that neonates have to the "care touch" that they regularly experience in the NICU (during administrations of tests, feedings, and moving of locations). Some negative responses to the handling of neonates in the NICU include apnoea, decrease in heart rate, and increase in respiratory rate and blood pressure (Cooper Evans, 1991; Danford, Miske, Headley, & Nelson, 1983; Gorski, Hale, & Leonard, 1983; Gorski, Huntington, & Lewkowiez, 1990; Long, Phillip, & Lucey, 1980; Murdach & Darlow, 1984; Norris, Campbell, & Brenkert, 1982; Peters, 1992; Speidel, 1978). The question remains as to whether it is just the care touch used in the NICU that is abrasive or whether premature infants react badly to touch in general, making it unsafe.

The main research supporting the 'minimal touch policy' is done by Long, Alistair, Phillip, and Lucey (1980) in their experiment on the effects of excessive handling on neonates. Their data

led them to conclude that daily procedures such as feeding, examinations, and diaper changes were sometimes associated with hypoxemia (insufficient oxygenation of the blood). In their experiment, 45 neonates were monitored for four hours for the first five days after birth. The infants were split into three groups as follows. Group one was monitored with conventional mechanisms: impedance pneumography (which monitors respiratory condition), electrocardiograms, blood analysis, and nursing observation. Group two was monitored in the same way as group one with the addition of the measurement of transcutaneous oxygen tension (a measurement of the oxygen perfusion of the skin) recorded by an Oxymonitor; the nurses were not allowed to see the recordings. The third group was monitored in the same fashion as group two, but the caretakers were allowed to observe the Oxymonitor recordings to see how handling affected oxygenation of the blood. A log was kept for all infants that recorded the timing of disturbances such as position changes, physical examinations, and feedings. The data revealed an increase in hypoxemia associated with handling. An interesting result of their study is that the infants in group 3 received less handling and thus less hypoxemia than groups one and two. The authors hypothesized that this was because the staff could see the effect each disturbance had on the neonate and acted accordingly by changing or completely stopping their handling. This study demonstrates that it is necessary rethink the customary nursery routines.

This research points to the fragile state of premature infants. From a hospital's point of view, anything that can be done to improve the infants' condition is worth considering. Based on the research that suggests possible harm, nurses are instructed to touch and handle the neonates as little as possible. By implementing a minimal touch policy, hospitals hope to ensure that no risks are taken at this fragile age.

Synthesis: Dichotomy of good and bad touch

It seems that there is a discrepancy between the findings concerning the benefits of touch and those concerning the dangers of touch. Though on the surface there appears to be conflicting literature, upon further scrutiny it becomes clear that the type of touch differentiates the positive and negative effects. Nearly all the evidence suggesting that there are risks related to touch have been found in studies looking at NICU care touch and not massage touch. In fact, studies that explore the safety of massage touch specifically have found that the practice is safe. In a study done by White-Trout and colleagues (1988), the researchers studied neonates' physiological response to massage and concluded that massage is a safe practice. Thirty-three premature infants were randomly assigned to a control group and massage group. In the massage group, the Rice Infant Sensorimotor Stimulation massage technique was administered. This massage technique uses eye-to-eye contact, auditory stimulation, and five minutes of rocking after a 10-minute massage. The neonates were massaged daily for 10 days. Heart rate, respiratory rate, and body temperature were measured 8 minutes into every massage (the midpoint of stimulation) and directly after the massage. The results showed that there was a slight decrease in body temperature in the experimental group, but there was no significant difference between the experimental and control groups for heart rate and respiratory rate (White-Trout & Goldman, 1988). In terms of the safety of massage, the change in body temperature, heart rate, and respiratory rate were all within an acceptable clinical range for premature infants. These minimal physiological changes do not constitute evidence against the administration of massage. Massage has not been integrated into many NICUs because of the 'minimal touch policy,' but with this new understanding that massage touch does not pose the same dangers that care touch does, NICUs should reevaluate their policy of discouraging nonessential touch.

There seems to be a systematic difference between massage touch and care touch that may explain why massage touch has many benefits that care touch does not. Although care touch is practical and necessary, it may not always be done with as much attention to the infant as massage touch. Due to the 'minimal touch policy,' massage touch has always been viewed with skepticism so people practicing massage may be particularly attentive to the infant's response. When comparing the two forms of touch, one must consider that they have different outcomes and procedures because they are done for different reasons. Care touch is given to ensure that the infant remains alive and healthy, whereas massage touch is specifically applied to help the infant grow and develop. Thus, massage touch represents a soothing touch, while care touch is sometimes unavoidably uncomfortable and painful (e.g., administering shots or changing diapers). Many aspects of massage touch are calming, from the use of warm hands to the administration of soothing oils. On the other hand, care touch is experienced so many times throughout the day that as much thought cannot be dedicated to each task as is given to a single 10-minute massage per day. Further, when massage touch is administered, the massager makes eye contact with the infant, while in care touch this personal connection is not always made. These differences help explain why massage touch has benefits that care touch does not. Based on these strong findings in favor of massage touch and on the evidence that massage is safe, it seems clear that massage has significant potential to aid in neonatal development. Since the findings suggest that massage touch does not represent a safety concern (whereas care touch can) it would be interesting to study whether some positive aspects of massage touch can be integrated into care touch to make it a safer and more pleasant experience.

Issues to address

If massage were to be implemented in NICUs because it is a safe and beneficial practice, some issues need to be addressed to make it an effective program.

Degree of pressure

When it comes to perfecting the neonate massage, the exact amount of pressure that needs to be applied is critical. Field and colleagues (2006) investigated the amount of pressure needed, while massaging, for optimal results. Sixty-eight preterm infants were randomly assigned into a light pressure or moderate pressure massage therapy group. The two groups were massaged using the Field technique over a 5-day period. Weight gain was recorded over the duration of the study and behavior state, stress behaviors, and heart rate were recorded on the first day. The results show that the moderate massage group gained more weight than the light pressure massage group (a 6g versus a 2g increase per day). The moderate massage group also showed a decrease in active sleep, fussiness, crying, and stress behavior. The study by Diego et al. (2005), which was discussed previously, exhibited similar results. In this study, the group that received the light pressure massage gained less weight then the group that received the moderate pressure massage. These studies support that massage therapy is a beneficial investment, but emphasize that the massage must be given with at least moderate pressure.

Infants who benefit the most from massage

If massage were to be implemented in NICUs, it is helpful to know if all neonates should be massaged or if there are some who will benefit more than others. Massage, after all, is neither without a cost nor is it always available. A study conducted by Scafidi, Field, and Schanberg (1993) addressed the question of which infants stand to benefit the most from massage. In the study, 93 infants were randomly assigned to a control group or an experimental group. Using the

Field protocol, 15-minute massages were administered to the experimental group 3 times a day for 10 days. Sleep/wake behaviors, stress behaviors, and weight gain were recorded during the massages. Whereas on average the experimental group gained more weight than the control group, some infants in the experimental group gained considerably less weight than would be expected. Further analysis revealed that the massaged infants who gained the most weight were those who previously suffered from more obstetric and perinatal problems than the massaged neonates who did not gain as much weight (Scafidi et al., 1993).

One possible explanation of why this finding occurred is that infants with these problematic obstetric and perinatal histories often experienced high physiological stress. Since massage is connected to stress reduction, it may have been especially beneficial to these infants by helping to stabilize them. Another theory is that infants with these complications are likely to have more severe disturbances of their nervous system (Scafidi et al., 1993). Since massage has been shown to enhance the development of the nervous system (Kuhn et al., 1991), it may have contributed to improving their fragile nervous systems. To develop a massage intervention program that is cost-effective, past research suggests that infants with more problematic histories should have priority for massage.

Parents and massage

Massage would be much more accessible if it did not need to be administered by trained professionals in the NICU. Ferber and colleagues (2001) compared the effects of massages given by mothers to those given by trained professionals. Neonates were randomly assigned to a mother massage group, a professional massage group, or a control group. In the massage groups, the premature infants were massaged 3 times per day for 10 days for 15 minutes. The Field protocol was used, but the kinesthetic portion of the massage was omitted. In the mother massage group, professionals trained the mothers on the techniques of massage. The results indicated that both massaged groups gained weights of 26.4 and 28.3g/day while the control group gained only 20.5 g/day. Analysis of this data showed there was not a significant difference between the amount of weight gained from the two massage treatment groups (Ferber et al., 2001). Thus, one can conclude from this study that human touch is beneficial regardless of the person applying the touch. Further studies should determine whether the effectiveness of massage is influenced by the presence or absence of the kinesthetic portion.

The Ferber et al. (2001) study opens new doors to the accessibility of massage for premature infants. Massage therapy is easy to teach and simple to learn. There are many classes available to new mothers and books like *Baby's First Massage: An Instructor's Manual* make learning massage accessible and easy (Beachy, 2003). So far, there are over 1200 Certified Infant Massage Instructors in the US, and 25 other countries have practicing trainers and instructors (Adamson, 1996).

Massage has also been shown to help parents bond with their children. Often, parents feel helpless when their premature infants are hospitalized. Through massage, parents can begin to connect and communicate with their children (Bond, 2002). Some psychologists believe that loving touch during infancy teaches humans love, recognition, and self-worth. These outcomes lead to a sense of identity and stability later in life for the infant (Adamson, 1996). One hundred percent of the mothers who participated in a massage class felt their infants benefited from the massage and 76.6% felt that the massage had given them confidence in handling their infants (Adamson, 1996).

Massage has also been linked to helping parents and children who have psychological and physical illnesses. In various studies performed by Field and colleagues massage has been shown

to improve conditions of both adults and children with depression and anorexia, and to help lower the stress levels and improve the mood of adults with HIV, breast cancer, and diabetes (see Field, 2002). It is clear that the positive effects of massage are extensive and more research should be done to explore its potential.

Conclusion

Massage seems to be a promising solution to improving the growth and development of premature infants. It is beneficial in many ways: it helps infants reduce stress, increase skin integrity, improve development of the central nervous system, leave the hospital sooner, gain weight, and sleep less. Although some speculate that neonates do not respond well to touch in the NICU, it seems to be the more abrasive – though necessary – care touch used in the NICU to which infants respond poorly, rather than massage touch. In fact, numerous studies suggest that massage is a safe and beneficial practice (e.g. White-Trout et al., 1988). In further research, one might explore if any parts of the massage procedure can be integrated into care touch procedures to further benefit infants. From the evidence presented in this paper, it is clear that neonatal massage would be a safe and beneficial addition to any NICU.

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