

# Systematic Gentle/Light Stroking and Maternal Random Touching of Ventilated Preterms: A Preliminary Study

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**Abstract:** Touching, whether systematic or random, of ventilated preterm infants remains a controversial issue. Consequently, comparison between systematic and random supplemental touching of such infants has hitherto received little systematic attention. Sharp falls in oxygen saturation can be detrimental to the infant's health, and studies continue to be published reporting them during general handling procedures. Stability of physiology, especially during the early days of life, is essential to prevent haemorrhages which can cause brain damage.

The immediate effects of both TAC-TIC (Touching And Caressing, Tender In Caring) therapy and Maternal intuitive touching (19 sessions of each) upon the physiological measure of transcutaneous oxygen tension (Tc PO<sub>2</sub>) in high risk ventilated preterms were examined in this study. Within one South London hospital all the preterm infants (7 female, 4 male) born over a 3 month period, and who have been attached to MARY3 computer monitors were recruited with medical and parental consent. An interrupted time series design was employed to look at Tc PO<sub>2</sub> before, during and after each of the interventions. A pattern of significant decreasing Tc PO<sub>2</sub>, from before to after and during to after maternal intuitive touching was observed. Unlike this, TAC-TIC therapy showed a slightly increase during its procedures albeit not significant. Using percentage increase in Tc PO<sub>2</sub> data, one-way ANOVA demonstrated no significant differences between TAC-TIC and Maternal intuitive touching across the 3 phases. The authors cautiously conclude that TAC-TIC intervention, as used in this study, may be considered as not being harmful as

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measured by Tc PO<sub>2</sub>, and suggest that further research should be carried out to investigate further the immediate effects of Maternal intuitive touching.

**Zusammenfassung:** *Systematisches zartes/leichtes Streicheln und mütterliche Berührungen bei beatmeten Frühgeborenen: Eine vorläufige Untersuchung.* Das Berühren von künstlich beatmeten Frühgeborenen, sei es nun systematisch oder unsystematisch, ist ein kontroverses Thema. Der Vergleich zwischen systematischem und zufälligem Berühren von solchen Kindern hat bis jetzt wenig Aufmerksamkeit gefunden. Ein stärkeres Absinken der Sauerstoffsättigung kann für die Gesundheit des Kindes nachteilig sein, und es wurden und werden regelmäßig Studien mit dem Ergebnis veröffentlicht, daß es während der allgemeinen „Handling-Prozeduren“ zu solchen Senkungen der Sauerstoffsättigung kommt. Eine Stabilität der physiologischen Parameter, insbesondere während der ersten Lebensstage, ist von zentraler Wichtigkeit, um Blutungen vorzubeugen, die Hirnschäden zur Folge haben können.

Die unmittelbaren Auswirkungen von TAC-TIC-Therapie (Touching and Caressing, Tender in Caring) (Therapie durch Berührung, Streicheln und zärtliche Fürsorge) und intuitive Berührungen durch die Mutter (19 Sitzungen von jeder Zuwendungsform) auf die physiologischen Meßwerte der transkutanen Sauerstoffsättigung (Tc PO<sub>2</sub>) bei Hochrisiko-Frühgeburten unter künstlicher Beatmung wurden in dieser Studie untersucht. In einem Krankenhaus im Süden Londons wurden alle frühgeborenen Kinder (7 Mädchen, 4 Jungen), die an die MARY 3-Computer-Monitor-Einheit angeschlossen waren, über drei Monate mit Zustimmung der Ärzte und Eltern untersucht. Es wurde ein Untersuchungsdesign mit bestimmten Zeiteinheiten angewandt, um die Sauerstoffsättigung vor, während und nach den Interventionen zu beobachten. Dabei wurde eine signifikante Abnahme der Sauerstoffsättigung während der mütterlichen Berührungen beobachtet. Im Gegensatz hierzu zeigte sich während der TAC-TIC-Therapie ein leichter Anstieg, der aber nicht signifikant war. Bei einer veränderten Auswertung ergaben sich keine signifikanten Differenzen zwischen TAC-TIC-Therapie und mütterlich intuitiven Berührungen während der drei Phasen. Die Autoren folgern vorsichtig, daß die TAC-TIC-Therapie, wie sie in dieser Untersuchung verwandt wurde, sich nicht nachteilig auf die Sauerstoffsättigung auswirkt. Es wird vorgeschlagen, daß die Wirkungen der mütterlich-intuitiven Berührungen weiter untersucht werden sollten.

## Introduction

Handling preterm neonates who are under assisted ventilation is a delicate and complex area. Stability of physiology, especially during the early days of life, is essential to prevent haemorrhages which can cause brain damage. Physiological distress has been primarily monitored by using the measure of oxygen tension (Tc PO<sub>2</sub>) which correlates significantly ( $r = 0.93-0.97$ ) with arterial oxygen tension (Rooth 1975; Eberhard and Mindt 1976; Huch and Huch 1976). Sharp decreases in Tc PO<sub>2</sub> may indicate nociceptive activities and suggests a physiological imbalance which causes clinical concern.

The aim is to keep arterial PO<sub>2</sub> at 8–12 kPa (60–90 mmHg). Below 6–8 kPa may lead to hypoxia, and hyperoxaemia carries a risk of retinopathy of prematurity (ROP). A stable oxygen concentration thus is essential for optimal biochemical functioning and general bodily functions such as thermoregulation.

The effects of routine medical and care-giving procedures on the arterial oxygen tension (Pa O<sub>2</sub>) of sick neonates have been well investigated. Long et al. (1980) reported that in a twenty hour observation of preterm infants in a Neonatal Unit,

over 41 minutes period of hyperoxemia, 75% occurred during handling procedures such as sheet/nappy change.

In 1978, Speidel reported that sharp falls in Pa O<sub>2</sub> occurred as a consequence of such procedures as: changes of incubator sheet, radiography, and blood sampling. Speidel stated that “. . . handling the baby for any reason often causes a fall in Pa O<sub>2</sub> . . .” (p. 864), and justifiably advocated minimal handling in the Neonatal Intensive Care Unit (NICU). This recommendation was taken *ipsi literae* by most of the Units in the 1970s and mid 1980s, and has continued to be interpreted as “minimal touching”, by many medical and nursing staff in both the U.K. and abroad.

The physiological trends in preterm infant oxygenation in relation to medical and social forms of touch have also been reported by Gorski, Huntington, and Lewkowicz (1990). This report encompasses 37 days of observations of 18 preterms (28–34 weeks gestational age) during their hospital confinement. One of their findings was that “developmental stimulation” or social interaction, if poorly timed, could cause distress to a vulnerable infant as much as medical procedures.

There are many ways of handling and/or touching an infant. Rough handling and/or touching, be it during a routine procedure or a cuddle, may increase nocipetive activities thus destabilizing physiology; furthermore, the careless semantic assumptions that the words ‘massage’, ‘stroking’, ‘rubbing’, ‘patting’, ‘tapping’, ‘holding’ and ‘handling’ have interchangeable meanings is false; they neither involve the same actions, nor produce the same reactions from babies, be they full-term or preterm infants (Adamson-Macedo and Attree 1994). The lack of uniformity of definition involving the various actions of touching, the multiplicity of handling styles experienced by the neonate, and the “many faces of touching” have been highlighted by several authors (Adamson-Macedo 1985 unpublished; Wolke 1987; Korner 1990). Bender (1990) has reflected upon the innumerable caregivers’ styles of handling in suggesting this may delay the baby’s capacity to build up a consistent picture of his or her environment.

Albeit the revival in the late 1980s and 1990s of interest in further investigations of the effects of interventions, and particularly tactile stimulation on infants born preterm (Schanberg and Field 1987; Field 1990, 1991) the issue ‘To Touch or not To Touch’ distressed neonates, whilst on assisted ventilation, remains controversial. However, there is agreement that the experiences of the neonate in intensive care can be extremely distressful and painful, and that the extremely immature infant is super sensitive to pain (McIntosh 1988). Studies have also been reporting on possible impairment of the immune system (Anand 1987), and on developmental outcome (Fox and Porges 1985) if pain is not treated. The alleviation of neonatal pain has been attracting multidisciplinary research.

The studies reported in this paper were preceded by a single-case pilot study carried out with a 26 weeks gestational age and Extremely Low Birthweight (ELBW; 670 grams) ventilated male preterm infant. TAC-TIC was given 30 times and monitored on 16 occasions spread over 9 weeks at approximately two-to four-days intervals. The values given are the mean kilo-pascals reading for all sessions monitored before [Mean = 5.73; Standard Deviation (S.D.) 1.5], during (Mean = 5.74; S.D. = 0.9), and after stimulation (Mean = 6.2; S.D. = 1.3); the mean (%) of oxygen requirement was 40 (S.D. = 8.4).

Tc PO<sub>2</sub> levels were maintained during the intervention, and were higher after TAC-TIC, although this difference did not reach significance.

An interesting observation from the pilot data is that Tc PO<sub>2</sub> levels seemed to vary less during TAC-TIC, than either before or after the TAC-TIC within the 16 sessions (Standard Deviation before 1.5, after = 1.3 and during = 0.9).

Painstaking analyses of behaviour through Video tape recording (Adamson-Macedo, Hayes, and Simcock 1994) have shown that Touching And Caressing Tender In Caring (TAC-TIC) therapy elicits a significantly greater number of self-regulatory behaviours than stress-related behaviours, indicating that TAC-TIC may be alleviating the distress of the infant, and facilitating the course of development which has been interrupted due to prematurity. Taken together, an increase in Tc PO<sub>2</sub> and greater number of self-regulatory behaviours during TAC-TIC, these results were encouraging and suggest that gentle and systematic stroking may well be not only be beneficial but, an essential care for the infant under artificial ventilation.

Touching may be a basic maternal and paternal (in many cultures) behaviour. A very ill baby is at a disadvantage due to medical restrictions and/or fear of the parents doing harm to their babies. Parents of very small and sick preterms often feel very inadequate and afraid of compromising further the health of the infant if they intervene inappropriately. Touching may well be a basic maternal/paternal behaviour but touching may be also a demonstration of 'warmth' and affection; the assumption that all parents feel at ease displaying such behaviour, particularly whilst their infants are in incubators, is false. Some caregivers report that they would like to learn systematically, others would rather to be left to their own 'intuitiveness'.

Studies comparing systematic rhythmic gentle stroking as in TAC-TIC therapy with random touching, as in Maternal intuitive touching, are hitherto unknown; this study was designed to (i) test further the hypothesis that TAC-TIC does not cause a significant sharp fall in Tc PO<sub>2</sub>, and (ii) compare TAC-TIC with Maternal intuitive touching.

## Method

### *Sample*

The study comprised two independent but related experiments. Main criteria for inclusion were:

- less than 37 weeks gestational age;
- receiving oxygen therapy and being attached to the computerised monitoring system
- absence of congenital malformation.

At the time of recruitment there were 36 infants, 25 of which were not receiving oxygen therapy. All eleven ventilated preterms (7 females; 4 males), attached to Mary3 (Bass, Badger and McIntosh 1991) during the one month period available for this study to be carried out, were recruited from a London Hospital Neonatal Intensive Care Unit (NICU) with medical and parental consent to participate of this investigation. Same participants were recruited for both experiments but

only seven mothers agreed to carry out instructions of experiment 2 (4 females; 3 males).

### *Design*

A pre-test/post-test time series interrupted design, in three phases, was employed in order to record and analyse the relative effects of the TAC-TIC therapy and Maternal intuitive touching upon Tc PO<sub>2</sub>; the baseline of 3 mins. was chosen to attend Ethics committee requirement.

- (1) For 3 mins, before commencing therapy, with the experimenter recording on the computer the identification label “before”
- (2) Therapy conducted during 3–4 mins, with the label “during”,
- (3) For 3 mins, after the cessation of therapy, with the label “after”.

The Mary3 system set-up was used for 24-hour monitoring, and was similar to that used by Gorski and colleagues (1990); Tc PO<sub>2</sub> data could be recorded within the range of 0–20 kPa. The data sampling rate was 1 value per second, averaged over successive 60-second intervals; Tc PO<sub>2</sub> levels were printed as ordinates, with markers demarcating ‘before’, ‘during’ and ‘after’ intervention phases at 1-minute intervals on the abscissa. One of the investigators and an independent examiner both analysed these data. The initial analysis was done using a Repeated Measure One-way ANOVA and Related t-tests.

### *Interventions*

The experimenter used a modified (shortened) version of the TAC-TIC therapy, (see de Roiste 1993) consisting of a systematic sequence of stroking movements, which lasted 3–4 minutes instead of 15 minutes, covering the whole of the head, face, and body. There are four principles underlying TAC-TIC: gentleness, rhythm, equilibrium and continuity (which collectively are given the acronym GREC) (Adamson-Macedo and Attree 1994, p. 266).

- Gentleness and lightness cannot be overemphasised when working with tiny babies, especially those on ventilators. ‘Gentle as a butterfly’ should be both the intention and the message conveyed by stroking.
- Rhythm in a properly executed TAC-TIC session each movement is carried out at the same speed, there is repetition and the spacing between movements is constant, thereby conveying rhythm.
- Equilibrium occurs because some movements are soothing and others are more alerting; a balanced structure should be neither overstimulating nor disturbing.
- Continuity exists because one hand is always gently touching the baby’s skin (though is not heavily placed on the skin); the principle and the message transmitted is continuity of the same gentle experience.

The infant was not ‘handled’, i.e., no change in infant position occurred. Maternal intuitive touching refers to mother’s spontaneous touching; mothers were given the instruction to touch or stroke the baby in whatever way they pleased for 3–4 minutes. There were no control of between mothers’ intra-modal variation. Two independent but related experiments with two interventions, namely TAC-TIC

therapy given by the investigator, and Maternal intuitive touching, comprised this study, as follows:

*Experiment 1:* TAC-TIC: daily TAC-TIC therapy from day-3 of life until detachment from the MARY3 computer monitor (81 sessions).

*Experiment 2:* Another session of TAC-TIC therapy performed either immediately before or after Maternal intuitive touching (19 sessions)

Interventions were carried out on late morning or early afternoon in order not to interrupt hospital routines. Behavioural states, as possible a confounding variable was not controlled.

All participants were receiving artificial ventilation, and received a maximum of 2 sessions daily, from the day defined by medical permission with parental informed consent; the start point was when each infant averaged 3-days old (mean = 3, SD = 1.6) to the day on which s/he was detached from computerised monitoring.

## Results

### *Experiment One: TAC-TIC only*

Characteristics of the population (7 female, 4 male) include variables at birth (gestational age, birthweight and apgar scores), and maternal age. Because of the skewed distribution of this data, the results are presented in terms of Medians firstly, followed by the Mean, and their Standard Deviations (S.D.); infants gestational age 28 weeks, Mean = 29.8 (4.6); birthweight 1.1 kg, Mean = 1.4 kg (0.69), Apgar scores at 1 minute was 4.5, Mean = 5.2 (2.8), and at 5 minutes was 8.0, Mean = 7.9 (1.8) Maternal age was 25 years, Mean = 25.7 (7.4).

The incidence of post-natal complications for the participants was taken from the case notes. Eight babies suffered from respiratory distress syndrome (RDS), two from hypotension, three of Necrotizing Enterocolitis (NEC) and 4 from Patent duct arteriosus (PDA).

One Factor ANOVA-Repeated Measures with the levels of the 'before' (median = 8.5), 'during' (median = 8.2), and 'after' (median = 8.4) phases showed no significant difference ( $F = 1.197$ ;  $df = 2$ ;  $p < 0.32$ ) in TcPO<sub>2</sub>.

### *Experiment Two: TAC-TIC and Maternal intuitive touching*

Seven infants (4 females; 3 males) completed this experiment. Mean birthweight was 1.53 kg, and gestation age was 33 weeks. Apgar scores ranged from 1 to 9 at 1 minute (mean = 4) and from 4 to 9 at 5 minutes (mean = 7). Table 1 shows that all infants suffered from jaundice, five from Respiratory Distress Syndrome (RDS), three from Patent Ductus Arteriosus (PDA), and Necrotising Enterocolitis (NEC). Rhesus disease (RD), intraventricular haemorrhage (IVH), hypoglycaemia (HG), and hypotension (HT) were diagnosed in four different infants.

A pattern of decreasing Tc PO<sub>2</sub>, from 'before' to 'after' intervention is observed, with 'before' to 'after' ( $t = 2.77$ ;  $df = 6$ ;  $p < 0.01$ ) and 'during' to 'after' ( $t = 2.95$ ;  $df = 6$ ;  $p < 0.01$ ) intervention being significant, and 'before' to 'during' ( $t = 1.72$ ;  $df = 6$ ;  $p < .06$ ) not significant. Unlike this, TAC-TIC therapy data shows an increase in Tc PO<sub>2</sub> during intervention ( $t = 0.18$ ;  $df = 6$ ;  $p < 0.43$ ) followed

**Table 1.** Postnatal complications

Variable	Incidence of occurrence Experiment 2
RDS*	05
PDA*	03
NEC*	03
Jaundice	07
Sepsis	00
IVH*	01
Hypotension	01
Hypoglycaemia	01
Rhesus disease	01

\* Respiratory distress syndrome; Patent ductus arteriosus; Necrotizing enterocolitis; intraventricular haemorrhage

by a fall afterwards ( $t = 0.18$ ;  $df = 6$ ;  $p < 0.32$ ). None of these changes reached significance.

Comparing Mother's touching and TAC-TIC therapy with related t-tests, no significant differences were found between them across the 3 phases. Before intervention  $t = 0.18$ ;  $df = 6$ ;  $p < 0.43$ , during intervention.  $t = 0.87$ ;  $df = 6$ ;  $p < 0.26$ , and after intervention  $t = 0.98$ ;  $df = 6$ ;  $p < 0.18$ . Using percentage increase in Tc PO<sub>2</sub> data, one-way ANOVA demonstrated no significant differences between TAC-TIC therapy and Maternal intuitive touching across the 3 phases ('before' to 'during' intervention,  $F = 0.30$ ; 'during' to 'after' intervention  $F = 0.67$ , and 'before' to 'after' intervention,  $F = 0.20$ ).

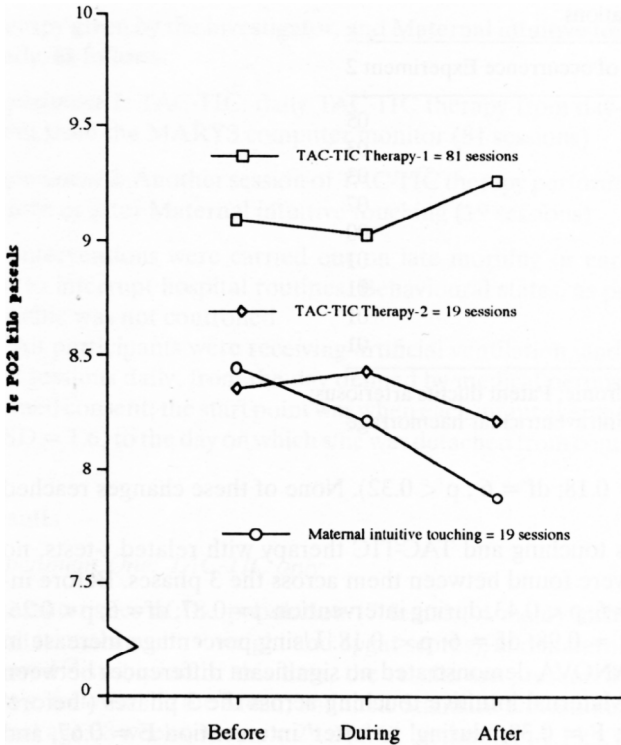
Figure 1 gives a summary of the results which clearly demonstrate the difference in the pattern of the infants' responses to both interventions.

## Discussion

This study was designed to (1) test further the hypothesis that TAC-TIC therapy does not cause sharp fall in Tc PO<sub>2</sub>, and (2) compare TAC-TIC with Maternal intuitive touching. Results have shown that there was no significant sharp fall in oxygen saturation during TAC-TIC and Maternal intuitive touching.

The finding of no significant decrease in Tc PO<sub>2</sub> either 'during' or 'after' application of the TAC-TIC therapy regime supports the hypothesis that no oxygenation deterioration of high-risk ventilated infants had occurred. Taken together, the results of the single case study and these 11 infants, lend support to the idea that there is a place for appropriate interventions with ventilated preterm infants. It may be noted that although the interventions used in both studies were the same, the investigators were different; the precaution was thus taken to ensure that, throughout this study, the investigators used the same technique of light stroking, and followed the same principles which has been specified as underlying this therapy.

The issue of light versus deep touch is a complex one, and it has been attracting attention of several investigators for sometime. Suggestions that 'deep pressure stroking' is more effective than light stroking, and that light stroking is aversive



**Fig. 1.** Mean Tc PO<sub>2</sub> for before, during and after intervention for all three experimental conditions.

to babies (Field 1993) are not supported by scientific evidence. The report on the effectiveness of Tactile Stimulation which examined 19 studies (Ottenbacher et al. 1987) acknowledges that “an accurate interpretation of tactile stimulation cannot be made . . .” (p. 68); it is not surprising since the authors included in their quantitative evaluation studies e.g. which used not only tactile but, also kinaesthetic (White and Labarba 1976), tactile, kinaesthetic, visual and auditory (Rice 1977).

Hooker in 1969 found that between 7 to 8 weeks, light stroking of the skin in the immediate perioral region (upper and lower lips and the ale of the nose) elicited contralateral flexion of the neck and uppermost trunk. Since tactile sensitivity is the first to develop, and it is the modality that infants are most deprived of after preterm delivery, caution should be taken for not exposing the infant to sensory experience earlier in development than when it would ordinarily be available (see Lickliter 1993). New research is showing that functional reorganisation of the somatosensory area occurs as a result of light touch (Owens 1992; Diamond 1993). This may explain the improved learning performance of preterm infants who were recipients of TAC-TIC, as described by de Roiste and Bushnell (1993).

Recently Gorski et al., (op cit.) examined the effects of touch on preterm PO<sub>2</sub>; they found that touch, compared with non-touch, did not significantly lower PO<sub>2</sub>. They did however find that touching the infant when the infant was already physiologically compromised, i.e. with low PO<sub>2</sub>, did further lower PO<sub>2</sub> significantly.



This result apparently reinforces policies of not providing tactile stimulation to preterm infants when they are in a particularly poor state; this however is at variance with the pattern encountered by Adamson-Macedo (1990) who found that an increase in oxygenation occurred more often when Tc PO<sub>2</sub> was lower and decreased when it was higher, thus suggesting a stabilisation. Such conflicting results clearly require further investigation with larger samples, and better controlled studies. This also raises the question of the law of initial values and regression to the mean.

Since there was no significant difference between the initial values of Tc PO<sub>2</sub> for TAC-TIC and Maternal touching, the argument that initial high values of Tc PO<sub>2</sub> being higher to begin with could be more likely to fall, does not apply; nor could the data be biased due to the fact that the infants were laying in different positions, i.e. prone, supine or on-side, for each experimental time. This was not the case in this study. The prone position has been recognised as aiding respiration and increasing oxygenation more than the supine or on-side position (e.g. Martin et al. 1979). However, there is some evidence that the prone position increases the risk of Sudden Infant Death Syndrome (SIDS) hence parents have been advised to nurse their infants on supine or on side position.

On data analysis of changes during Maternal intuitive touching it was found that Tc PO<sub>2</sub> decreased when the three phases are compared, i.e. before, during, and during-to-after, thus suggesting that intervention might have been distressing to the infant. Harrison, Leeper and Yoon (1990) also reported on O<sub>2</sub> saturation levels being significantly lower during parent touch as compared with baseline periods. Gandy and Robertson (1987) pointed out that significant decrease in Tc PO<sub>2</sub> indicates distress. This may be lending support to the views of Macedo (1984) and Rice (1977) that patterned sequences of stroking movements may be more beneficial than random touching, since they encompass more of the body and are contended to be more therapeutic.

Further arguments may be advanced to explain the decrease of Tc PO<sub>2</sub> during Maternal touching; these refer to:

- (1) the occurrence of extraneous events when the mother was touching her infant, e.g. loud noises (Long et al. 1980) thus accounting for the drop in Tc PO<sub>2</sub>. This argument would however apply to any kind of intervention and, being unpredicable, not susceptible to experimental control;
- (2) the consequence of having all babies experiencing the same gentle pressure of touch by the investigator; it may be possible that either the different type of pressure exercised by each mother or the variation of the types of touching (e.g. stroking, rubbing, patting or holding), or a combination of these variations account for the decrease in Tc PO<sub>2</sub>;
- (3) some mothers were trying to copy the investigator but they may have felt inappropriate or embarrassed thereby affecting the steadiness of their hands. Previous conversation with mothers (1984) who were invited to watch TAC-TIC original film (1984) collected the information that the mothers wanted to be "properly" taught how to use the intervention. They felt that just by watching the film they did not feel confident that they could use the procedure adequately.

On the other hand no significant differences were found between Maternal touching and TAC-TIC in percentage increase in Tc PO<sub>2</sub>. In this study, this could be due to the employment of a shortened version of TAC-TIC being administered to the high risk infants; thus it may have been “inadequate”, either in terms of quantity, i.e. insufficient number of strokes or quality, i.e. strokes which have the greatest beneficial effect, being missed out.

There is also the likelihood that a rhythmic (with repetition and periodicity) cephalocaudal sequence of Systematic Gentle/Light Stroking, as in this tactile stimulation programme, should not have the same effects on PO<sub>2</sub> as asystematic touch. However, a tactile stimulation programme performed by Terres (1979), found that 15 minutes of holding and cuddling three times daily resulted in increased oxygen levels over a week, and greater ability to maintain oxygen levels during the holding periods, by comparison with the non-handled controls.

Similarly, Jay's (1982) tactile stimulation programme with high risk ventilated preterm infants, where the experimenter placed her hands on the heads and abdomens of the experimental infants for 12 minutes, four times a day for 10 days, whilst controls received routine care, found oxygenation benefits in the experimental infants. Experimental, as compared to control infants in Jay's study were found to:

- (a) require significantly less mechanical ventilation (oxygen) from day 4–10; this result suggests that 48 minutes per day of such intervention did not ‘overload’ the infant, on the contrary it was beneficial;
- (b) show significantly higher haematocrit levels, suggesting potentially increased oxygen carrying capacity.

More recently, worked carried out by Harrison and associates (1996) reported that gentle human touch (GHT) provided for 15 minutes daily had no adverse effects on the oxygen saturation of small preterm infants. Morrow et al. (1991) reported on differential effects of massage and heelstick procedures on transcutaneous oxygen of preterm neonates; they concluded that Tc PO<sub>2</sub> were significantly lower after heelstick than after tactile-kinesthetic massage, and that levels remained clinically safe during the massage sessions.

It now seems that results in favour of touching of the high risk infant can be seen as accumulative. It could be argued that rhythmic stimulation has a general influence on homeostasis by enhancing the functioning of the respiratory and the circulatory systems thereby promoting general development and growth. Sander (1962) contended that the task of the newborn was to synchronize the three systems (physiological, motor and state); the caretaking environment no doubt plays an important role in bringing about this synchrony. Timing of appropriate inputs maintain and enhance functional integration, and support growth and development (Turkewitz and Devenny 1993; Lickliter 1993).

Although the generally beneficial effects of TAC-TIC have been reported (Macedo and Adamson-Macedo; de Roiste and de Roiste and Bushnell, op cit.), research has yet to determine the optimal quantity and quality, of strokes, and for that matter in any of the reported programmes which use ‘stroking’ only. Current research continues to monitor the effects of light stroking on ventilated preterms; the new Version-3 of TAC-TIC has taken into account the reactions of previous

infants to the programme (Adamson-Macedo, Hayes, and Simcock 1994), and is especially designed for very premature infants during their first week of life.

It seems that the practice of “hands-off” high risk preterms in the neonate unit as prescribed by Speidel (1978), might have to be restricted to “any kind of invasive procedures”, be they ‘routine’, ‘extra’ or ‘social,’ and might apply not only to staff but to any caregiver in the NICU. The caregiver should observe the responses of the preterm infant very carefully, and without prejudices. Babies are not what we thought, as Chamberlain pointed out; babies, “of whatever age, are aware, expressive, and affected by their interactions with others.” (1992, p. 161).

During the past decade, developmental psychology has witnessed a renaissance of interest in the relation between genes and behaviour. The Systems view includes developmental approaches such as the Probabilistic epigenetic proposed by Gottlieb in 1970. The term probabilistic epigenesis “. . . constitutes an accurate description of the developmental process” (see Turkewitz and Devenny 1993, p. 7). Gottlieb’s (1991) principal claim is that genetic activity does not mediate behaviour by itself but rather is part of a larger genes-behaviour-environment manifold that interacts in complex ways to produce finished traits. Grenough and Juraska (1979) defend the idea that the sensory input to the cortex influences not only the amount of neural differentiation but also the direction of such differentiation.

If the therapy reported here is in fact assisting the infant to cope with his or her distress by stabilising physiology, its role may be speculated as being that of facilitator of development. Based upon developmental comparative research, it seems that TAC-TIC therapy could be argued to be one of the mediators of Maintenance, Facilitative and Induction functions (within Gottlieb’s notion of Experiential Canalization). However, based upon a sociocultural approach to mediated action it can be argued (Werner 1994) that Vygotsky’s claim that human action on both, individual and social planes, is mediated by tools and signs and Bakhtin’s approach to meaning may be appropriate to explain the role of TAC-TIC therapy on preterm infant development. TAC-TIC therapy is both technical and psychological tool. As a sign it may be seen as “the finger alphabet” with the meaning of for example alleviation of pain, discomfort or distress. Both arguments have yet to be investigated in further studies.

Preterms with, in contrast to those without, serious medical problems such as BPD, tend to show delays in their development (Creasey, Jarvis, Myers, Markowitz and Kerkring 1993). Preterms with few and less severe medical problems generally tend to perform as well as their fullterm counterparts on measures of mental and motor functioning (Lukeman and Melvin, 1993). Preterms who are most “at risk” may thus have more to gain from such interventions than healthier preterms.

As Marlow (1989, 1991) pointed out, the literature shows that 90% of children born with less than 1.25 kg enter mainstream education, but a significant proportion require special attention.

Recent report by Adamson-Macedo, Wilson and De Carvalho (1993) has shown that preterm children who had received systematically-applied tactile stimulation, scored significantly higher in intelligence and achievement at 7 years old than comparable Appropriate for Gestation Age (AGA) who had not been recipients.

## Conclusion

### *Summary of Results*

These studies were designed to investigate immediate changes in Tc PO<sub>2</sub> during TAC-TIC therapy and Maternal intuitive touching applied to high risk ventilated preterm neonates. Results of experiments 1 and 2 have shown that there was no significant change in Tc PO<sub>2</sub> during the procedures; an increase can be seen to follow after therapy which raises Tc PO<sub>2</sub> above its original ('before') value, and above its value during.

A pattern of a significant decrease in Tc PO<sub>2</sub>, from 'before' to 'after' intervention is observed in the Mother's sessions, with 'before' to 'after' and 'during' to 'after' intervention changes being significant, and 'before' to 'during' not significant.

Contrary to this, TAC-TIC therapy data of experiment 2 showed a trend towards an increase in Tc PO<sub>2</sub> during intervention followed by a fall afterwards. Although there was a significant drop in Tc PO<sub>2</sub> during Maternal intuitive touching it was not a sharp fall, and this result should not be interpreted as if the touch was distressful for the reasons discussed earlier.

Scientific investigators should define the stimulus within the "touch spectrum" very carefully. The 'quality' of touch may have many different 'meanings' for both the caregiver and the receiver, such as diagnostic, therapeutic, social or affectionate. As Montagu (1978, p. 207) pointed out "Tactile failure in infancy results only too often in estrangement, uninvolvedness, lack of identity, detachment, emotional shallowness, and indifference."

The authors recommend that their suggestions should be taken into account, and cautiously conclude that TAC-TIC therapy is not harmful to high risk ventilated preterms if conducted as in this study; moreover, may well encourage regularity of states and systems thereby providing the preterm infant with the opportunity to organise themselves and integrate the inputs in accordance to their needs and conditions. Harrison, Leeper and Yoon (1990) also found that O<sub>2</sub> saturation levels were significantly lower during parent touch than during baseline period. However, they suggested that "blanket policies that limit parent touch during the early weeks of life may not be appropriate. It may be more appropriate to teach parents to modify the types and amounts of touch they provide based on the infants' physiologic and behavioural cues" (p. 877). Clearly far from being a simple issue, touch of ventilated preterms is a controversial area of studies which needs further investigation well controlled investigations.

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