Providing Comforting Touch to Very Preterm Infants Using the M-Technique

Joan R. Smith, PhD, RN, NNP-BC
Sandy Conner, PT.
St. Louis Children's Hospital/Spalding School of Nursing at Barnes-Jewish College; University of Missouri, Kansas City, School of Nursing; Washington University, St. Louis, School of Medicine, Department of Pediatrics and Newborn Medicine

Disclosure
We have nothing to disclose.

Current Practice
– Do you routinely offer comforting touch (massage, gentle human touch, acupressure, etc)?
– If yes, who provides this comforting touch?
– Do you routinely offer this touch to infants born less than 30 weeks gestation?
– At what PMA do you begin integrating comforting touch routinely into your practice?
– Do you have restrictions?
– Do you have a specific protocol?

Background & Significance
More than 80,000 very preterm infants (< 30 weeks' gestation) are born annually
Very Preterm Infants
– At increased risk for significant cognitive impairments
– Behavioral problems
– Social and emotional adaptation
– Poor executive function
– Wide variety of learning disabilities
– Increased need for specialized school services
Mathews & MacDorman, 2011; Aarnoudse-Moens et al., 2009, 2011a, 2011b; Anderson & Doyle, 2008; Deibel-Ayoub et al., 2009

Synactive Theory of Development
• Discipline of psychology, deductively derived from the systems, adaptation, and stress theory models
• Dynamic, continuous interplay of hierarchically organized subsystems within the organism.
• Infant behaviors are a continuous expression of brain function available for observation.
• Modifying the extra-uterine environment (developmental care) can lead to alterations in brain structure/function (Als et al., 2004)

Preterm Brain Growth
Hill et al., 2010
Stress
• Maternal separation, pain, isolation, sleep deprivation and other environmental events activate the HPA (hypothalamic-pituitary-adrenal axis)
• Constant stress becomes toxic which disrupts brain architecture, stress related disease and cognitive impairment
• Stress increases caloric expenditure
• Prolonged stress increases risk of
  – Cognitive function
  – Cardiovascular disease
  – Diabetes
  – Mental health challenges

Trauma Informed Care
• Developmental trauma is traumatic event occurs during sensitive and critical growth period
• Caregiver regulates infants stress response - if safe, secure, loving it cultivates resilience® (Wu et al., 2013)
• Simple care precipitates major fluctuations in cerebral hemodynamics (Limperopoulos et al., 2008)
  – Associated with parenchymal brain injury
  – Long term developmental outcomes
• HPA axis dysfunction (chronic stress)
  – Insulin resistance, autoimmune d/o gut, reg alterations in brain structure and function and growth failure
  – GER represents one of most important manifestations of stress exposure to GI tract (Konturek, 2011)

Impact of the Environment

Autonomic Nervous System
• Controls visceral function
  – (HR, RR, digestion, breathing, swallowing)
• Sympathetic Nervous system
  – Fight or Flight
  – Blood flow to skeletal muscles and lungs
  – Dilates alveolar O2 exchange
  – Increased HR
  – Vasodilatation of coronary vessels
  – Blood flow away from GI/Inhibit peristalsis

Parasympathetic Nervous System
• Calming of nerves
• Return to regular function and enhance digestion
• Dilate blood vessels to GI
• Accelerates peristalsis
• Cardiac branches of the Vagus and spinal accessory nerves impart parasympathetic control of the heart

Infant Signals
• Approach
  – Smile
  – Cooing
  – Quiet and alert
  – Relaxed limbs
  – Smooth movements
  – Soft, relaxed facial expressions
Infant Signals

• Coping signals
  – Sucking
  – Hand clasp
  – Foot clasp
  – Fisting
  – Grasping
  – Bracing body part against crib
  – Hand to mouth/face
  – Going into drowsy or light sleep
  – Tremor/twitch

Infant Signals

• Avoidant Signals
  – Change in HR, RR, or color
  – Whimper like sounds
  – Finger Splay
  – Saluting
  – Thrusting legs out straight
  – Sitting on air
  – Grimace
  – Eye floating/looking away
  – Arching
  – Gasping
  – Yawn, hiccup, spit up/gag

GOALS

• To promote autonomic and behavioral stability in all interactions
• Modify handling in response to baby’s cues
• Provide containment and boundaries in all interactions (cares, position changes, transfers)
• Slow down, stop or provide containment during interventions

Infant Massage: ROL

• Used as developmental care therapeutic intervention to help restore and improve the body’s function and health (Agarwal et al., 2000)

  Benefits
  – Weight gain (Chen et al., 2008; Diego et al., 2007; Dietz et al., 2003; Ferber et al., 2002; Field, et al., 2006; Field, Stafoll, & Schenberg, 1987; Gonzlez et al., 2009; Massaro et al., 2009; Mahaal et al., 2002)
  – Decreased pain (Chen, Kumar & McMillan, 2006)
  – Improved digestion (Diego et al., 2007)
  – Decreased hospitalization lengths of stay (Mendes & Procianoy, 2008; Vaivre-Douret et al., 2008)
  – Decreased stress (Ardiet et al., 1993; Hernandez-Reif, Diego, & Field, 2007)
  – Improved neurological, motor and behavioral development (Guzzetta et al., 2009, 2011; Procianoy, Mendes, & Schenke, 2010; Ho et al., 2009)

Gaps in the Literature

– Conceptual Ambiguity—no clear operational definition
– Varying protocols
– Healthy preterm infants ≥ 32 weeks PMA
– Position changes/Kinesthetic component
– Not our population of interest—hospitalized VPI

What about Hospitalized Very Preterm Infants?
Developmental Care

Comforting Touch in the Very Preterm Hospitalized Infant
An Integrative Review
Joan Renaud Smith, Ph(Dc), RN, NNP-BC

Types of Touch

- **Procedural**—most of the touch that very preterm infants receive in the NICU is associated with medical/nursing procedures...resulting in adverse effects—hypoxia, bradycardia, sleep disturbance & increased intracranial pressure. **Resulting in minimal stimulation policies**

- **Comforting**—stress-reducing supplemental touch to promote relaxation

- **Few Studies**—2 infant massage, Gentle Human Touch, TAC-TIC Therapy (touch & caressing-tender in caring), Therapeutic Touch (11 total <30 wk PCA/<31 wk PMA)


Comforting Touch Techniques
<30 weeks EGA/<31 weeks PMA

- **Massage**
  - With/without kinesthetic activity
  - Unimodal/multimodal (additional stimulation)
- **Therapeutic touch**
  - Non-touch, energy-balancing therapy
- **Acupressure and Meridian massage**
  - Eastern vital energy therapy
- **Gentle Human touch (GHT)**
  - Still touch without stroke or massage (containment)
- **Yakson**
  - Korean touch with some caressing
- **TAC-TIC (touch and caressing-tender in caring)**
  - Gentle light stroking and caressing

M Technique

- A relaxation technique
- Systematic—same pressure, strokes, sequence—**important for research purposes**
- Ideal for patients too fragile to tolerate a traditional massage
- Easy to learn, reproducible, and can be used for a lifetime

M Technique Evidence

Multiple Settings/Populations

- **Dementia**: Reduced stress & increased wellbeing
- **Hospice**: Reduced terminal agitation, anxiety, stress & increased relaxation
- **PICU**: Mixed results in decreasing pain symptoms & improving oxygenation in infants post craniofacial surgery
- **LPI**: Decreased pain & improved oxygenation post circumcisions
- **Healthy Preterm**: Decreased pain & improved physiologic parameters

Buehn et al., 2004; Richards, 2000; Katz, 1999; Anderson, 2004; de Jong, 2012; Raquepo, 2004

M Technique

- **Structure**
  - Each movement is done in a distinctive pattern that is never modified (based on cues)
- **Repetition of strokes (3)**
  - Pay attention, recognize, relax
- **Pressure and speed** (slow, constant, rhythmical)
  - 0 No pressure
  - 1-2 Tickle
  - 3 M technique
  - 6-7 Massage
  - 10 Crushing pressure

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Buehn et al., 2004; Richards, 2000; Katz, 1999; Anderson, 2004; de Jong, 2012; Raquepo, 2004
Video M Technique

M Technique Training

Feasibility Study

Purpose: To explore the application of M Technique in hospitalized VPI in a level IV NICU

Aim: To determine the impact of the M Technique on physiologic, behavioral, and state responses in very preterm infants.

Subjects: 10 very preterm infants at 30 wks’ PMA--the M Technique once

Design: Feasibility, observational intervention study

Criteria

Inclusion:
– Born < 30 weeks' gestation (determined by Ballard exam),
– 30 weeks' PMA, AGA, at time of delivery
– No evidence of major brain injury, e.g. Grade IV intraventricular hemorrhage.

Exclusion:
– Non-intact skin
– Septic shock
– Respiratory failure (FiO2 >75%),
– Severe brain injury
– Persistent tachycardia, persistent bradycardia, or those deemed unstable as determined clinically by the attending physician.

Methods

Physiologic Parameters
– HR, RR, Oxygen Saturations

Behavioral Variables
– Stress and Relaxation Cues

Behavioral State
– Anderson Behavioral State Scale
Results

• Improved Physiologic Parameters & Behavioral State Scores (ABSS)
  – During (HR p = .006; RR p = .0005; Sats p = .04)
  – End (HR p = .02; RR p = .14; Sats p = .16)
  – Up to 10 minutes Post Intervention (HR p = .02; RR p = .11; Sats p = .02)
  – ABSS - Baseline M = 5.1 - End M = 2.0; up to 10 mins post M = 2.6

• Improved Behavioral Responses
  – Stress and Relaxation Cues

Research Design

• Ten very preterm infants (>26 and < 30 weeks estimated gestational age [GA]) who received the M Technique were matched with 10 control infants for gestational age, race, and gender.

• Purpose
  – To systematically test the cumulative effect of the M Technique on infant neurodevelopment in hospitalized very preterm infants over a 5 week period.

Specific Aims

• Specific Aim 1: Investigate the neurobehavioral and growth velocity impact of the M Technique for hospitalized very preterm infants.
  – Working hypothesis: Very preterm infants (<30 weeks gestation) who receive the M Technique intervention will have improved (1) neurobehavioral development (NICU Network Neurobehavioral Scale (NNNS)); (2) growth velocity (birth weight and infant weight at the beginning and end of protocol), compared to the control group.

• Specific Aim 2: Investigate the physiological and behavioral state impact of the M Technique for hospitalized very preterm infants.
  – Working hypothesis: Very preterm who receive the M Technique intervention (experimental group only) will have improved physiologic stability (HR, RR, oxygen saturations) and behavioral state (e.g., ABSS) changes from baseline at 3 different time points over the course of the 5-week intervention.
**Conceptual Model**

- **Input**
  - Deleterious Effects of the Environment
- **Intervention**
  - M Technique®
  - 5-week Intervention
- **Outcomes**
  - Specific Aim 1: Neurobehavioral (NNNS) & Growth Velocity Impact
  - Modify Environment
  - Specific Aim 2: Physiological (HR, RR, O2 Sats) & Behavioral State Impact (ABSS)

**Setting and Study Population**

- Level IV NICU at a Midwestern academic center
- Very preterm infants >26 and < 30 weeks’ gestational age (GA) will be randomly assigned to experimental or control groups
- 30 weeks’ post menstrual age (PMA) at time of commencing the intervention

**Criteria**

- **Inclusion:**
  - Born >26 and < 30 weeks’ GA (by Ballard exam)
  - 30 weeks PMA at time of delivery
- **Exclusion:**
  - Non-intact skin
  - Septic shock
  - Respiratory failure (FiO2 >75%),
  - Moderate to severe brain injury, e.g. Grade II-IV intraventricular hemorrhage
  - Persistent tachycardia, persistent bradycardia, or those deemed unstable as determined clinically by the attending physician.

**Intervention**

- Detailed protocol followed (as outlined by our feasibility study) once the infant reaches 30 weeks’ PMA
- Infants receive the M Technique 6 times/week, no closer than 6 hour intervals, for 5 weeks (a total of 30 M Technique applications) by trained personnel

**Methods**

- NICU Network Neurobehavioral Scale (NNNS):
  - End of the 5-week intervention
  - A comprehensive neonatal neurobehavioral assessment consisting of 115 items, 13 summary scores
- Physiological & Behavioral State: (3 time points, beginning, middle, end of intervention on the intervention group only)
  - HR, RR, Oxygen Saturations
  - Anderson Behavioral State Scale (ABSS)
TABLE 1. Infant Characteristics at Birth

<table>
<thead>
<tr>
<th>Infant Characteristics</th>
<th>Mean</th>
<th>SE</th>
<th>Range</th>
<th>Control Group</th>
<th>Mean</th>
<th>SE</th>
<th>Range</th>
<th>Significance</th>
<th>2-Tailed P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight, g</td>
<td>379</td>
<td>71</td>
<td>630-1050</td>
<td>322</td>
<td>58</td>
<td>630-1260</td>
<td>.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age, wk</td>
<td>26.7</td>
<td>.44</td>
<td>26-29</td>
<td>26.0</td>
<td>.35</td>
<td>26-29</td>
<td>.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar score 1 min</td>
<td>5.7</td>
<td>.70</td>
<td>1-10</td>
<td>5.7</td>
<td>.66</td>
<td>4-9</td>
<td>.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar score 5 min</td>
<td>9.1</td>
<td>1.4</td>
<td>1-13</td>
<td>8.9</td>
<td>1.3</td>
<td>1-12</td>
<td>.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRIB II score</td>
<td>4.4</td>
<td>.48</td>
<td>4-6</td>
<td>4.4</td>
<td>.48</td>
<td>4-6</td>
<td>.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gender: Male / Female

Abbreviation: CRIB, clinical risk index for babies; SE, standard error of mean.

*Infant characteristics between the M Technique and control groups were comparable.*


Descriptive statistics of infant gender and race between the M Technique and control groups.

TABLE 2. Descriptive-Categorical Variables of Participants at 30 Weeks’ Postmenstrual Age (PMA), Day 1 of Study

<table>
<thead>
<tr>
<th>Infant Characteristic</th>
<th>Group Frequency (%)</th>
<th>Control Group Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assisted ventilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6 (28)</td>
<td>1 (17)</td>
</tr>
<tr>
<td>Yes</td>
<td>5 (24)</td>
<td>17 (83)</td>
</tr>
<tr>
<td>NIC</td>
<td>4 (44)</td>
<td>3 (33)</td>
</tr>
<tr>
<td>OEF</td>
<td>3 (33)</td>
<td>8 (88)</td>
</tr>
<tr>
<td>CPAP</td>
<td>2 (22)</td>
<td>2 (22)</td>
</tr>
<tr>
<td>Oxygen</td>
<td>8 (88)</td>
<td>2 (22)</td>
</tr>
<tr>
<td>Supplemental oxygen</td>
<td>8 (88)</td>
<td>1 (11)</td>
</tr>
<tr>
<td>Yes</td>
<td>8 (88)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>No</td>
<td>0 (0)</td>
<td>1 (11)</td>
</tr>
<tr>
<td>Room temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>6 (66)</td>
<td>4 (44)</td>
</tr>
<tr>
<td>Open bay</td>
<td>6 (66)</td>
<td>4 (44)</td>
</tr>
<tr>
<td>Ventilation</td>
<td>2 (22)</td>
<td>8 (88)</td>
</tr>
<tr>
<td>Yes</td>
<td>1 (11)</td>
<td>17 (83)</td>
</tr>
<tr>
<td>No</td>
<td>17 (83)</td>
<td>1 (11)</td>
</tr>
</tbody>
</table>
| Abbreviations: NIC: nasal continuous positive airway pressure; OEF: oral endotracheal feeding; CPAP: continuous positive airway pressure; CPAP: for trials; Amb: assistance; Vap: ventilation; Vent: ventilator.

*Fisher’s* difference were not calculated because of categorical data.

TABLE 3. Comparison of the Study Cohort Neonatal Intensive Care Unit Neurobehavioral and Scale Summary Scores at Term Equivalents

<table>
<thead>
<tr>
<th>Summary Score</th>
<th>M Technique Group, Mean (SE)</th>
<th>Control Group, Mean (SE)</th>
<th>Significance 2-Tailed P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>3.32 (0.25)</td>
<td>3.60 (0.40)</td>
<td>.83</td>
</tr>
<tr>
<td>Handling</td>
<td>0.61 (0.33)</td>
<td>0.70 (0.06)</td>
<td>.25</td>
</tr>
<tr>
<td>Quality of movement</td>
<td>3.14 (0.22)</td>
<td>3.06 (0.37)</td>
<td>.06</td>
</tr>
<tr>
<td>Regulation</td>
<td>4.32 (0.24)</td>
<td>4.05 (0.54)</td>
<td>.96</td>
</tr>
<tr>
<td>Nonoptimal reflux</td>
<td>7.64 (0.64)</td>
<td>7.33 (0.41)</td>
<td>.89</td>
</tr>
<tr>
<td>Ataxic reflexes</td>
<td>2.89 (0.46)</td>
<td>2.20 (0.53)</td>
<td>.36</td>
</tr>
<tr>
<td>Stress intolerance</td>
<td>0.37 (0.02)</td>
<td>0.31 (0.03)</td>
<td>.17</td>
</tr>
<tr>
<td>Anxious</td>
<td>3.78 (0.32)</td>
<td>3.06 (0.26)</td>
<td>.11</td>
</tr>
<tr>
<td>Hypertonicity</td>
<td>1.00 (0.29)</td>
<td>0.56 (0.24)</td>
<td>.26</td>
</tr>
<tr>
<td>Hypotonicity</td>
<td>1.00 (0.29)</td>
<td>0.56 (0.24)</td>
<td>.26</td>
</tr>
<tr>
<td>Extroversion</td>
<td>4.89 (0.82)</td>
<td>3.78 (0.81)</td>
<td>.57</td>
</tr>
<tr>
<td>Intolerance</td>
<td>5.78 (1.99)</td>
<td>4.78 (0.98)</td>
<td>.15</td>
</tr>
</tbody>
</table>

Descriptive statistics.


FIGURE 2.

**Effects of the M technique on the heart rate of each premature infant at 30 weeks**

Line graph showing experimental subjects’ heart rate (HR) from baseline to 10 minutes postintervention at 20 weeks’ postmenstrual age. The black line indicates the group mean heart rate and standard error (SE) over time and clearly depicts the reduction of HR over time.

FIGURE 3.

**Effects of the M technique on the mean heart rate of very premature infants**

Line graph shows the mean heart rate (HR = SE) for experimental subjects from baseline to 10 minutes postintervention at 30, 32, and 34 weeks’ postmenstrual age (PMA) making evident the decrease in mean HR over time at each PMA studied.
Conclusion

– 1st study to support the cumulative effect of an infant-driven M Technique intervention that incorporates a series of stroking movements performed using a set pressure, sequence, and repetition in hospitalized very preterm infants over a five-week period starting at 30 weeks’ PMA.

– This study demonstrates the utility and feasibility of multiple M Technique applications in high-risk infants in a level IV NICU starting at 30 weeks' PMA with notable evidence of positive physiological and behavioral state impact.

Limitations

• Small sample size, one unit, findings not generalizable
• Did not take into account alterations in brain function (MRI findings)
• No long-term outcomes
• Did not take into account perinatal factors that could possibly affect neurobehavioral outcomes (eg., antenatal steroids)
• NNNS is only one point in time
• Examiner not blinded to observing and recording behavioral state data, could have resulted in bias

Future Research

• Larger, randomized, systematically designed studies to determine short- and long-term effects as it relates to:
  – Brain growth,
  – Long-term neurobehavioral development
  – Decreased stress
  – Parent-delivered M Technique sessions that potentially effect parent mental and emotional health and parent-infant synchrony
• A modifiable infant-driven M Technique protocol starting prior to 30 weeks' PMA to determine timing, duration, and frequency
Implications for Practice

- Findings from this study build upon the science of touch for very preterm infants and are important because much of the care delivered to this high-risk population includes minimal stimulation, resulting in limited comforting touch stimulation.

- This study demonstrates that positive physiological and behavioral state changes occurred after only 7 minutes of the M Technique intervention, resulting in a lesser need of time commitment and effort by caregivers.

Implications for Practice

- Neonatal health care professionals can apply a potentially cost-effective, infant-driven comforting touch strategy, the M Technique, aimed at reducing stress and optimizing the sensory experience of very preterm infants.

- More importantly, neonatal health care professionals can teach parents to deliver the M Technique, which could ultimately have infant, parent, and infant-parent dyad implications with beneficial outcomes for the infants, their families, the healthcare system, and society in general.

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- Jane Buckle, PhD, RN

Project Contributors

- Tricia Coffelt, MOT/L, Neonatal Occupational Therapist
- Mary Raney, MSN, RN, NNP-BC
- Sandy Conner, BS, Neonatal Physical Therapist
- Marco Brotto, PhD, MS, BSN
- Terrie Inder, MBBS, MD
- Jackie McGrath, PhD, RN, FNAP, FAAN
- Maithe Enriquez, PhD, RN, APN-BC, FAAN
- An-Lin Cheng, PhD

QUESTIONS?