Which Breast Pump for Which Mother?
Individualizing Breast Pump Technology

Paula P. Meier, RN, PhD
Director for Clinical Research and Lactation
Neonatal Intensive Care
And
Professor of Women, Children and Family Nursing
And
Professor of Pediatrics
Rush University Medical Center

www.rushmothersmilkclub.com

J Perinatology, 2016

Initiation
Maintenance

Meier PP et al., Which Breast Pump for Which Mother: An Evidence-Based Approach to Individualizing Breast Pump Technology, J Perinatology 2016
Defining Breast Pump Dependency

- Minimally Breast Pump Dependent
  - Infant regulates lactation processes
  - Pump replaces infant < 50% of day

- Partially Breast Pump Dependent
  - Infant consumes some milk at breast
  - Pump is primary regulator of lactation processes

- Completely Breast Pump Dependent
  - Infant does not feed at breast
  - Pump is complete regulator of lactation processes


Throughout the world, the continued provision of mothers’ own milk for premature infants remains a problem, despite very high rates of initiation

- Mothers do not meet their own self-stated goals for MOM provision
- The primary reason is insufficient MOM
- Mothers have a profound dislike for pumping
- The physiology of short- and long-term MOM production and removal in the absence of a breastfeeding infant is poorly understood
- Most interventions have targeted motivation and behavioral approaches, despite this evidence

Meier PP et al., J Perinatology 2016; Meier PP et al., Clinics in Perinatology, in press

Multiple studies indicate that the early post-birth period (5-14 days) is a critical period for establishing an adequate MOM volume that predicts the continued provision of MOM through to NICU discharge

In current research conducted with 430 mothers of VLBW infants (Rush Human Milk Team), mothers who produced ≥ 500 mL of MOM by day 14 post-birth were 3.3 times more likely to continue to provide their MOM through to NICU discharge.

- Meier PP et al., *Which pump for which mother?* J Perinatology, 2016 (review)
**Initiation**

- Changes in hormonal and anatomical control of lactation processes
- Interventions during this time have long-lasting impact


**Initiation of Lactation: Mechanisms and Best Practices**

- Profound hormonal, anatomical and milk composition changes
- Mammary gland transitions from "preparing to make milk" (secretory differentiation) to "synthesizing and secreting milk (secretory activation, lactogenesis II)"
- "One-time event that is either achieved or not achieved"
- Interference impacts the "initiation of lactation", not "the milk supply"

Progesterone declines with the birth of the placenta with uptick in lactose beginning the following day


Milk sodium declines and lactose increases, reflecting closure of paracellular pathways, which coincides with perceptions of the milk “coming in”


Coming to Volume: Mechanisms and Best Practices

- Period between the onset of lactogenesis II and achieving a threshold milk volume that is sufficient to maintain lactation
- Autocrine control of lactation begins
- Two mechanisms control lactation:
  - Suckling-induced prolactin release
  - Feedback inhibitor of lactation (FIL)
- Problems that interfere with milk removal can have a long-lasting impact on lactation performance

1st Mechanism: Suckling-Induced Prolactin Surge

Pumping Begins
Prolactin concentration increases 2-3 times over Baseline (more rapid milk synthesis)


• The FIL is a milk protein that (when not removed by the infant during breastfeeding) makes the mammary gland less sensitive to prolactin.

• It is the mechanism for weaning


2nd Mechanism: Feedback Inhibitor of Lactation

The Suckling Induced Prolactin Surge Controls Continued Lactation

Battin DA et al. Obstetrics and Gynecology 64: 785-788, 1985
Mothers of Healthy Term Infants Produce 
500-600 mLs of Milk by Day 4-7


Partially and Completely Breast Pump Dependent Mothers are Disserved by non-Evidence Based Practices During these Critical Phases

- Hand expression should be used instead of pumping for the first days after birth
- The "type" of pump does not matter.
- Single (versus double) pumping should be used because it is "easier" for mothers
- Hearing about milk volume targets and risks for delayed onset of lactation will make mothers feel nervous

Interventions During the Initiation of Lactation Appear to Have a Long-Lasting Impact on Maternal Milk Volume: Randomized Studies

Breastfeeding Medicine, 2015

Breast pump suction patterns that mimic the human infant during breastfeeding: greater milk output in less time spent on pumping for breast-pump-dependent mothers with premature infants

H Trivers, H Trivers, 
Breastfeeding Medicine, 2015

Effect of early breast milk expression on milk volume and timing of lactogenesis stage II among mothers of very low birth weight infants: a pilot study

Lu Parkes; S Ostlund; C Kegler, R Bebel; and J Hovda

J Perinatology, 2012
• Random assignment of mothers with VLBW infants to exclusive electric pump (n = 14) or hand expression (n = 12) for first 7 days post-birth. No differences between groups

• Hand mothers changed to pump after 7 days, but never caught up with early pump mothers through 28 days

• Electric breast pump use was associated with an additional 119 mLs/day of milk for the first 28 days post-birth, when compared with hand expression mothers


Comparison of Serum Prolactin with Pumping and Hand Expression

Comparison of Milk Output with Electric Pump, Pedal Pump and Hand Expression


- Hands-On Pumping is not the same as hand expression in the absence of electric breast pump use.
- Whether or not the addition of “hands on” to the electric breast pump yielded greater milk was not answered due to the observational, non-randomized study design.

105 mothers of premature infants randomly assigned to 3 intervention groups, each of which trialed an initiation and a maintenance breast pump suction pattern (BPSP) in the Symphony Breast Pump. Groups were statistically similar.

Mothers who used the Initiation BPSP during the first 3 days PB and then switched to the maintenance (Standard 2.0) BPSP were compared to mothers who used the Standard 2.0 BPSP for both the initiation and maintenance of lactation.

Initiation BPSP mothers demonstrated greater cumulative milk (7000 vs 4000 mLs) and greater milk output per minute of time spent pumping over the first 14 days PB.
What is the Evidence for Breast Pump Dependent Mothers?

- Hand expression in the absence of breast pump use should be avoided.
- The “type” of breast pump and suction pattern does matter.
- The default best practice for timing of first pumping is within 1 hour post-birth.

Are there unmodifiable risks to initiation and coming to volume in this population?

- Underlying maternal health problems and medications
- PIH and medications
- Diabetes
- Pre-pregnancy BMI
- High-fat diet during pregnancy
- SSRIs
- Maternal stress during labor and delivery
- Premature Birth (immature mammary gland)
- Preterm Labor and Medications to treat
- Excessive Maternal Blood Loss
- Prolonged Bedrest

References:
Impact of High Maternal BMI

- Approximately 67% of childbearing women in US are overweight or obese
- Lactation problems have been documented in this population worldwide
  - Delayed lactogenesis
  - Suboptimal breastfeeding
  - Low rates of exclusive breastfeeding
  - Shortened duration of any breastfeeding
  - Poor weight gain in recipient infants
- Sufficient data are available to classify these women as “at-risk” for lactation insufficiency
  - Proactive approach to insuring adequate milk production and infant intake
  - Referral to expert for assessment

Nommsen-Rivers et al., Am J Clin Nutr 92: 574-584, 2010

Is the Lactation Failure a Result of Inadequate Support and/or Intervention?

- In a Baby Friendly hospital environment, intensive breastfeeding support did not have any impact on exclusive breastfeeding rates, but did improve the rates of “any” breastfeeding beyond 2 weeks
  - 3 Prenatal Visits
  - Daily Visits in Maternity Setting
  - 11 Postpartum Visits

Breastfeeding Education and Support Trial for Overweight and Obese Women: A Randomized Trial
Donzo J, Chapmann, Katherine Mosel, Angela Bernstein-Millien, Swo Young, Denise Diano and Rafael Perez-Escamilla
Pediatrics 2013;131:e1512; originally published online December 3, 2012
DOI: 10.1542/peds.2012-0888

What do we know about the impact of overweight/obesity in the lactation capacity of other mammals?
High Fat Diets and/or Overweight/Obesity Impact Lactation in All Species via Multiple Mechanisms

- Pediatrics 2004
- Annual Reviews in Nutrition 2007
- American Journal of Clinical Nutrition 2014
- PLOS ONE 2012

What are the modifiable risks to initiation and coming to volume in this population?: Proactive and reactive approaches

- Information about milk volume that is specific to a breast pump dependent mother with a NICU infant
- NICU specific talking points that standardize information that is evidence-based
- Techniques and instruments to monitor milk volume and achievement of maternal goals for milk provision
- Milk volume records
- Coming to Volume Assessment Tool
- My “Feeding Plans” tool
- Evidence-based equipment and NICU-specific lactation care
- Availability of breast pumps
- Individualized breast shield fitting
- Encouragement by entire NICU staff

Prioritizing Mothers’ Own Milk Volume over all other NICU Human Milk Practices
Consider Initiation and Coming to Volume for a Breast Pump-Dependent Mother with a NICU Infant

- The volume of milk needed to feed the infant is much less than the volume needed to maintain lactation
- Nurses typically note if there is "enough" milk for their shift
- Mothers have heard that "supply equals demand", and think that when their babies need more milk, they will make more.


Proactive: Teach mothers that there are two separate milk volume targets

- Enough milk for infant to receive exclusive feeds
- Enough milk to program the mammary gland and protect milk synthesis and secretion for the duration of lactation


MILK VOLUME TARGETS (mLs per day) FOR BREAST PUMP-DEPENDENT MOTHERS AT 14 DAYS POST-BIRTH

- IDEAL: 1000
- Equal to "Term" Mother and Baby: 500
- Minimum for 2 kg baby at NICU discharge: 350

Proactive: Maternal milk diaries help prevent and identify problems with maternal milk volume

My Mom Pumps for Me

Proactive: Monitor coming to volume until mothers achieve a daily milk output of ≥ 500 mLs per day

There is no substitute for watching mothers use the breast pump each day

Proactive: The Coming to Volume Assessment Tool


© Rush Mothers’ Milk Club, Chicago, IL
Proactive: Breast Shield Sizing

A common Coming to Volume problem is breast shields that are not sized correctly.

Because breasts come in all sizes....

Abruaded skin in breast shield

Lacerations at nipple base

Goals for Human Milk Feeding in Mothers of Very Low Birth Weight Infants: How Do Goals Change and Are They Achieved During the NICU Hospitalization?

Breastfeeding Medicine 10: 305-311, 2015

- After giving birth to a VLBW infant, mothers changed their original HM feeding goal
  - From partial to exclusive HM
  - From no HM to either partial or exclusive HM
- Even with excellent in-hospital support, as the NICU hospitalization progressed, their goals were less likely to be achieved—primarily due to insufficient HM volume
Milk synthesis is regulated by milk removal.

All research demonstrates that the mother’s milk yield adapts to the infant’s appetite.

The pump and milk removal practices must replace the breastfeeding infant for the partially or completely pump-dependent mother.

In the NICU, milk removal practices impact the quality and composition of milk to be fed to the infant.


Proactive: Provide mothers guidance about continued pumping once at-breast feeding begins.

Mothers often assume that feeding their infants replaces the need to pump.

Once infants are receiving cue-based feedings, mothers want to make sure they have milk in the breasts when infants awaken.

These common NICU practices impact the maintenance of milk volume.

Mothers had faith that their milk would mitigate the impact of prematurity in highly specific ways.

- Mothers described the “ritual” of pumping in a manner similar to the “ritual” of attending church.
- Faith served as a motivator to maintain pumping, even if mothers did not want to feed at breast and/or disliked the actual process of pumping.
Proactive: Minimally Breast Pump Dependent Mothers Who Return to the Workplace

- Mothers who do not visualize pumped milk on a regular basis throughout a 24-hour period are often unaware of the marked variability in normal intake patterns for healthy breastfeeding infants.
  - 463 mLs to 1370 mLs per day
  - 0 to 240 mLs per feeding
  - More productive and less productive breast (different amounts from the two breasts)
- These mothers need proactive information about these normal variations

Reference:

Summary

- Protecting milk volume can be conceptualized in 3 phases, each of which involves different physiology, common problems and evidence-based proactive interventions.
- Breast pump use can be conceptualized into 3 categories, depending upon the extent to which the breast pump replaces the infant for milk removal and mammary gland stimulation.
- For all women, the initiation and coming to volume stages are the most fraught with problems and suboptimal breastfeeding outcomes. However, these problems are especially pronounced in partially and completely breast pump dependent mothers.
- Proactive lactation care includes: standardized messaging for families, the use of specialized NICU lactation care providers and equipment and the incorporation of milk volume monitoring tools to help mothers achieve their personal human milk provision goals.