Best Pumping and Expression Practices to Maximize Milk Production

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Introduction
Learning Objectives

• The physiology of milk production

• Evidence based strategies for milk expression

• Emerging technologies that support lactation and expression
And also...

- Why I chose this topic
- Tips compiled from pumping moms and experts
- Galactagogues
- How to get a breast pump
Breastmilk is Best
Maximize Breast Milk Production
Anatomy and Physiology

Anatomy of the breast

- Second rib
- Pectoralis major muscle
- Pectoralis minor muscle
- Intercostal muscles
- Retromammary fat
- Lobes of mammary gland
- Areola
- Nipple
- Lactiferous ducts
- Intraglandular fat
- Subcutaneous fat
- Suspensory (Cooper’s) ligaments
- Sebaceous gland
- Montgomery tubercle
Lactogenesis I: Initiation

- Hormonally driven; occurs during pregnancy
- Alveoli and ducts

- Alveoli – lactocytes – prolactin

- Ducts – smooth muscle cells – oxytocin
Lactogenesis II: Coming to Volume

- **Hormonally driven**
- Prolactin levels rise
- Lactocytes start making milk
- Prolactin receptors get turned on
**Lactogenesis III: Maintenance**

- **Locally driven**
  - Baseline prolactin levels fall
  - Prolactin surges are triggered by nipple stimulation
  - Prolactin acts at level of alveoli to produce milk
  - More prolactin peaks means more prolactin overall: frequency

- Feedback Inhibitor of Lactation

- Remove milk to make milk
- Remove milk to protect milk supply
Oxytocin

- Milk Ejection Reflex
- Conditioned response
- Nipple stretch
Best Practices: Early, Often and Well

- **Early**: Stimulate nipples early: early skin-to-skin, early feeding
- **Often**: Express milk every 2-3 hours
- **Well**: Breasts must be emptied
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

• Background: mothers often advised to begin expressing milk within 6 hours; would earlier be better?

• Milk expression: 15 minutes, 8 times a day, double electric pump

• Initiation of milk expression within 1 hour following delivery increased milk volume and time to lactogenesis stage II

• Also significantly more milk at the 3 week mark compared to late group

• Parker et al 2012
Association of Timing of Initiation of Breastmilk Expression on Milk Volume and Timing of Lactogenesis Stage II...

- ...Among Mothers of Very Low-Birth-Weight Infants

- Again working on the question of timing

- Larger sample size with more power

- Early expression group produced more milk than Late expression group at 1 week (significant), 3 weeks and 6 weeks.

- When early early expressers were removed from analysis the differences were no longer significant

- Parker et al, 2015
A Randomized Trial of Hand Expression Versus Electric Breast Pump Expression

- Effective removal of milk is a priority
- Randomized to Hand vs. Electric Pump for first week
- Even though groups did not differ in number of expression sessions, Pump expression group had greater cumulative milk volume at 7 days
- This deficit was **not** corrected when the Hand group added Pumping, at 28 days.
- **Early priming of the breast matters**
- Daily Breastmilk Volume in Mothers of Very Low Birth Weight Neonates: A Repeated-Measures Randomized Trial of Hand Expression Versus Electric Breast Pump Expression

- Lussier et al, 2015
Combining hand techniques with electric pumping increases milk production in mothers of preterm infants

- Before 6 hours postpartum
- Pumping 8 times a day for 15 minutes AND hand expressing colostrum as much as possible for the first three days

- Later were taught Hands on Pumping (HOP): combining electric pump with breast massage, compressions, and hand expression

- Based on self reporting of hand expression, three groups of hand expressers analyzed: frequent expressers made more milk

- After introduction of HOP nearly every mother had a significant increase in milk output, from mean daily volumes of 580 to 860 per day. Statistically and clinically significant!

- Morton et al, 2009
Combining hand techniques with electric pumping increases milk production in mothers of preterm infants

- Secondary results:
  - Pumping more than 7 times a day influenced mean daily milk at 2 weeks
  - Pumping more than 7 times a day made more milk at 8 weeks, though not significantly.
  - Mothers taught HOP increased their mean daily volume despite pumping less

  - Morton et al 2009
Hand Expression: Press, Compress, Relax

- All lactating women should be taught to hand express

Press (back towards your chest)  Compress  Relax
How much Milk?

- 500 mls by day 5
- 700 mls by day 7
- Up to 1000 by day 10

- A full term baby takes an average of 20-30 ounces, or 600-900 mls per day from ages 1-6 months.
Summary Points: Early On

- Adequate milk supply is critical to exclusive and long term breastfeeding or breastmilk feeding
- **Early**, frequent and effective milk expression sets the stage for later milk supply
- Time sensitive: within an hour
- Frequency sensitive: keep Prolactin levels high, set the stage for Prolactin receptor success
- Emphasize effectiveness with hands-on-pumping
Lactogenesis III: Maintenance

- Remove milk to make milk
- Remove milk to protect supply
- **Remove milk efficiently and effectively**
Best Practices: Remove milk effectively and efficiently

1. Use the right pump
2. Use the correct flange size
3. Achieve let down, more than once
4. Use hands on pumping
5. Pump the right number of times a day
6. Pump at the right time
7. Power pump to boost production
8. Learn to make pumping as efficient as possible: life hacks
1. Use the right pump

- Manual
- Single electric
- Double electric

- Hospital Grade: an unregulated term; motor life

- Single user (open system) versus Multiple user (closed system)

- Suction strength:
  - Baby 70-190 mm Hg
  - Pump up to 300 mm Hg: use highest comfortable for mother
  - Use maximum comfortable suction (Kent, 2008)
Closed System

- **Ameda**: Elite, Platinum, Purely Yours
- **Ardo**: Calypso, Carum
- **Bailey**: Nurture III
- **Freemie**: Freedom, Equality
- **Hygeia**: EnDeare, EnJoye
- **Lansinoh**: Signature Pro, Smartpump
- **Lucina**: Melodi One
- **Medela**: Lactina, Symphony
- **PJ’s**: Comfort, Bliss
- **Rumble Tuff**: Serene Express Duo
- **Spectra**: M1, S1, S2, Dew 35

Open System

- **Medela**: *all* pumps except the Lactina and Symphony
Which Breast Pump for Which Mother:

- An Evidenced-Based Approach to Individualizing Breast Pump Technology
- Breastfeeding infant is gold standard
- Percent of available milk removed: PAMR

- Placing an emphasis on efficiently emptying the breast
  - Hospital grade electric pump
  - Simultaneous versus serial pumping (Prime et al 2012)
  - Warmed, correctly sized breast shields
  - Mimicking human infant suckle patterns during pumping (Meier 2012)

- Meier et al 2016
Novel Technology: Early Suckling Pattern

- Medela Symphony
- Preemie suckling pattern
- Program card
Novel Technology: Early Suckling Pattern

- Stimulation phase: rapid sucking
- Expression phase – during the colostrum period: irregular sucking with random pauses: “burst-pause pattern”

- This novel expression pattern hypothesized to program the breast for later milk supply

- (Standard is a rapid suckling followed by slow rhythmic sucking)

- Early suckling pattern group made significantly more milk at 6-13 days
- (Not as much as the HOP mothers though)
- Meier et al, 2012
2. Use the correct flange size

- Correct flange size enhances milk output
- Too big: draws in areola and compresses outflow
- Too small: rubs and traumatizes nipple
Flange size

- Medela suggests measuring diameter of base of nipple and adding 4 mm
- Tissues are elastic and change during pumping session
- Trial and error

Your nipple diameter measurement

- Up to 17 mm
  - 21 mm
- Up to 20 mm
  - 24 mm
- Up to 23 mm
  - 27 mm
- Up to 26 mm
  - 30 mm
- Up to 32 mm
  - 36 mm

The PersonalFit breastshield size recommended for you
Flange size

- Pumpin Pal Flange
- Eliminate angle between shield and tunnel
- Compatible with many pumps and sold in sets that have multiple sizes
Novel Technology: Soft Silicone Cups

- Limerick PJ
- Soft silicone cups
Novel Technology: Massaging cups

- Anabella
- Prototype phase
- Flange has a motor that mimics tongue motion
Novel Technology: Massaging cups

- [https://nayahealth.com/assets/video/Loop_Naya_Expression_4.mp4](https://nayahealth.com/assets/video/Loop_Naya_Expression_4.mp4)
- Naya
- Water filled massaging cups
- Rental model
3. Achieve Let Down, more than once

- **Oxytocin**
  - First let down releases the most milk
  - Subsequent letdowns release less, but more letdowns = more milk

- **Conditioned response:**
  - See, hear, or smell infant
  - Guided relaxation (Keith et al, 2012)

- **Tactile stimulation:**
  - Nipple and breast massage
  - Warming of breast shields
  - Cycle through the “stimulation” phase of electric pump
How long to pump?

- No standardized time
- Goal is to achieve best emptying
- Pump until milk stops dripping, then try and achieve another let down
Effect of Warm Breastshields on Breast Milk Pumping

- Warm breastshields decreased the time to remove 80% of available milk and removed more milk at 5 and 10 minutes
- Taking advantage of milk ejection reflex
- Overall milk volume pumped was comparable at 15 minutes
- Breastshields kept in a water bath – practical?

- Kent et al, 2001
Novel Technology: Breast Warmer

• Jade’s Arrival
4. Use Hands On Pumping

- Massage breasts during pumping
- Hand express after pumping

- More milk will be pumped and the milk will be higher in fat
- More milk out means more milk made

- Morton et al, 2009
- Foda et al, 2004
Novel Technology: Hands Free Compression

- Lilu Compression Bra
- Preorder for Sep 2018
- $250
Novel Technology: Compression Device

- Uboost
- Kickstarter Phase
• The "Make the Breast Pump Not Suck" Hackathon

• September 20 - 21, 2014, MIT Media Lab
5. Pump the right number of times a day

- Initially: match the baby: 8 or more times a day
- Initially: Go no longer than 5 hours between pumps
- This means pumping every 2 hours during the day for a longer sleep stretch at night
- Keep a log!

The must-have app for exclusive pumpers

Simple interface for easy entry

Watch stats to see your production trends

Calculate when you can stop pumping

Yale SCHOOL OF MEDICINE
The magic number

- After *at least* 4 weeks the volume of breastmilk reaches its peak

- When full milk volume established (600-900 mls per day) and control of breast milk production is at the level of the breast, experiment with decreasing frequency

- Magic Number is determined by storage capacity
- How fast do breasts fill up?

- Keep a log!

- Range: 4-10
6. Pump at the right time

- Pump to take advantage of prolactin
- One of the daily pumps needs to be overnight between 10p and 4a

- One expert recommends:
  - Pump at 10 PM and drink a liter of water
  - Wake to void and pump around 2 AM
  - Drink another liter of water...

- Waking to a full bladder will yield more milk than waking to an alarm: reference? Lecture from Diane Spatz’s group at CHOP
7. Powerpump to boost Production

- Growth spurt pattern
- 10 minutes on, 10 minutes off, for an hour
- Encourage Prolactin!

- Reference?
8. Make pumping as efficient as possible: Life Hacks

- Make it hands free:
Life Hacks

- Learn to pump anywhere
- Have a go bag and a hooter hider
Newer Technology: Hands free

- Freemies
- Flange and collection in one
- Can retrofit to multiple existing pumps
Novel Technology: Fully self contained

- Willow
- Flange, bag, pump all in one
Life Hacks

- Use a big water bottle to contain multiple sessions worth of milk
- Have extra parts
Life Hacks: make it easy

• Keep pump parts in fridge between pumpings
  – Caveat: 2017 CDC recommendation re. Cronobacter

• Have a pumping wardrobe
  – Wrap front tops and dresses, button down shirts

• Make it a treat
  – Keep a new book or special snack for a pumping session

• Powerpump in front of a movie

• Make the night pump easy
  – Have a drink, a snack and a cooler bag with a cool pack set up
Galactogogues and other things

- No galactogogue will replace best practices
- Evidence is not strong
- Emphasizing a galactogogue may detract from best practices
- The Academy of Breastfeeding Medicine does not endorse regular use of galactogogues

- Starbucks Pink Drink (Mead 1963?)
- Gatorade
- Lactation Cookies
- Oatmeal
- Guinness
- Malt beverages
How to get a pump

- ACA endorses breastfeeding support

- “Your health insurance plan **must** cover the cost of a breast pump. It may be either a rental unit or a new one you’ll keep. Your plan may have guidelines on whether the covered pump is manual or electric, the length of the rental, and when you’ll receive it (before or after birth).”

- Call your insurance company (including Medicaid and TRICARE) for options

- Call early
Review: Learning Objectives

• The physiology of milk production
  – Prolactin. Stimulate it early for success later.
  – Oxytocin. Milk ejection reflex.

• Evidence based strategies for milk expression
  – Use hands, use heat, use relaxation

• Emerging technologies that support lactation and expression
  – Infant suckling patterns
Best Practices

- **Initiation and Coming to Volume**
  - Start early expression, < 1 hour, with hand and pump
  - Express as often as baby would nurse, > 8 times / 24 hours
  - Pump for 15 minutes or more
  - No break > 5 hours, pump at least once overnight
  - Use a double electric pump
  - Use hands on expression techniques
Best Practices

• Maintenance:
  – Express as often as needed to maintain daily volume
  – Maximize efficient milk removal with best pump, flange size, hands on pumping, maximum comfortable suction
  – Pump until breasts are as empty as possible; work for let down
    • Warm breasts, practice relaxation
  – Use maximum comfortable suction
  – Incorporate Life Hacks that make the pumping relationship possible

• To build supply:
  – Incorporate an overnight pump
  – Powerpump
  – Hands on pumping to maximize milk removal
I do it like Mommy does