

More Milk !!!!
Maximizing Milk Supply with Early Hand Expression and Hands-on Pumping
Minnesota Breastfeeding Coalition
May 19, 2016
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1

Jane Morton has nothing to disclose
except she loves chocolate!



Dark Chocolate Could Improve Memory by 25%
Small SA. 2014 Nature Neuroscience

2

Outline

- Milk production in mothers of preterm and term infants
- Research on **hand expression** used in the first 3 postpartum days and **hands-on pumping** used after lactogenesis and the influence of these techniques on milk production and composition
- Subsequent research and clinical implications

3

AAP Policy Statement:
“a public health issue and not a lifestyle choice”

Keith Hansen, Global Practices Vice President World Bank: “In sheer, raw bottom line economic terms, breastfeeding may be the single best investment a country can make.” Annual Breastfeeding Summit, Washington, DC June 2015

“An ounce of prevention is worth a pound of cure.”
Benjamin Franklin

4

Breastmilk production

- Hormones set the stage: ↓ progesterone (placenta) precedes lactogenesis. Oxytocin release (let-down) enables episodic milk removal
- Yet the early, frequent and effective removal of colostrum determines future production potential
- Production is strongest determinant of duration and exclusivity of breastfeeding
 - Production within first 4 days predictive

5

Conceptualizing Causation for Impaired Production

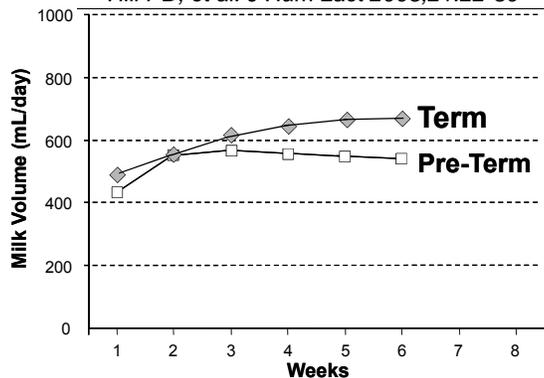
Morton J.A. The Clinical Usefulness of Breast Milk Sodium. *Pediatrics* 1994

- **Pre-glandular:**
 - Hormonal: (prolactin, progesterone, estrogen, oxytocin: EXAMPLE: retained placenta
- **Glandular**
 - Anatomy: EXAMPLE: reduction mammoplasty
- ★ **Post-glandular**
 - Interference with early, frequent and effective colostrum removal

6

Milk output in mothers of term infants vs. VLBW infants

Hill PD, et al. *J Hum Lact* 2005;21:22-30



7

Pump-dependent mothers of VLBW infants

- Milk production, strongest determinant of duration and exclusivity
- Insufficient milk production
 - Most common reason for stopping
 - ~ 3 times greater risk in preterm mothers compared to term mothers
- High production correlates with transition from bottle or tube feeding to breastfeeding.

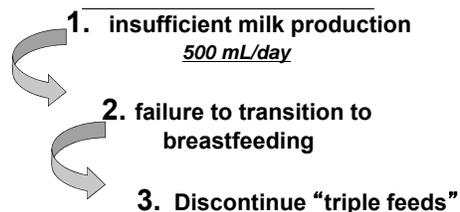
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What is too little?

- 500 mL/day
 - Minimum volume *
 - Predictive, early establishment of high volume
- Routine advice for increasing production
 - Increase use of electrical pumping

*Hill PD, Aldag JC, Zinaman M, Chatterton RT. Predictors of preterm infant feeding method and perceived insufficient milk supply at 12 weeks postpartum. J. Hum Lact 2007;23(1):1-7. 9

WHY Do Mothers of Preterm Infants Stop?



Remember the reverse: When production is high, post discharge transition to full breastfeeding is more likely

COMMON EXPLANATIONS What accounts for low production?

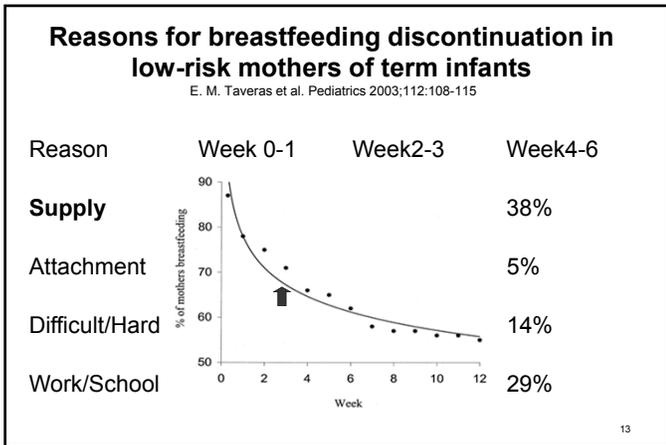
- **Intrapartum period**
 - Poor physical health and disease
 - Underdeveloped mammary gland (prematurity)
- **Early postpartum period**
 - Late pumping initiation
 - Few pumping sessions
- **Late postpartum factors**
 - Not pumping enough
 - Psychosocial issues...stress?

11

WHY Do Mothers of TERM Infants Stop?

- In the first year, 60% of mothers stop breastfeeding earlier than desired; most common reasons given relates to milk production/intake.
- Complications of suboptimal breastmilk intake are major reasons for delayed discharge and readmission within 2 weeks worldwide.
 - Excessive wt loss, hyperbilirubinemia

12



CAN INSUFFICIENT PRODUCTION BE PREVENTED?

What have we learned already?

14

Looking for the wrong culprit

Factors shown NOT to affect milk production

- Under-nutrition
- Stress
- Fluid intake
- Diet
- Sleep

Kurpad A Public Health Nutr. 2005, Oct;8(7A):1053-76
Hill PD West J Nurs Res. 2005 Oct;27(6):676-93

15

High production in mothers of VLBW infants

Furman L, Minich N, Hack M. Correlates of Lactation in Mothers of Very Low Birth Weight Infants
Pediatrics 2002; 109(4): e57 URL: www.pediatrics.org/cgi/content/full/109/4/e57

- Early expression initiation (within 1st hr.)
Parker LA. 2012; Parker LA. 2015
- Express often (8-10 times per day?)
- Skin-to-skin
- In other words....what stimulates production is contact and early, frequent and EFFECTIVE colostrum removal

16

Effect of early breastmilk expression

Parker LA. J Perinatol. 2012

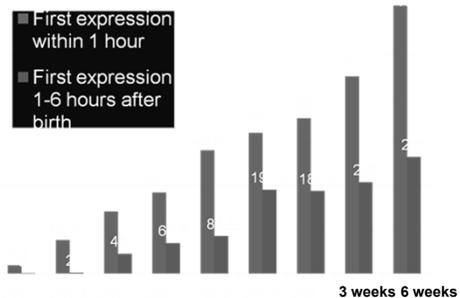
Parker LA. Breastfeeding Medicine 2015

- First hour expression (.vs. hrs. 2-6) ↓ time to lactogenesis and ↑ production by 130% at 6 weeks (613.0 vs. 267.2)



17

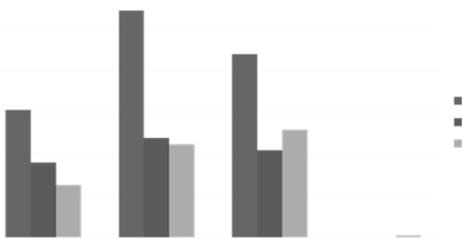
Milk Volumes From Day 1 To 6 Weeks



18

Milk Volume Advantage ONLY If Express in 1st Hr

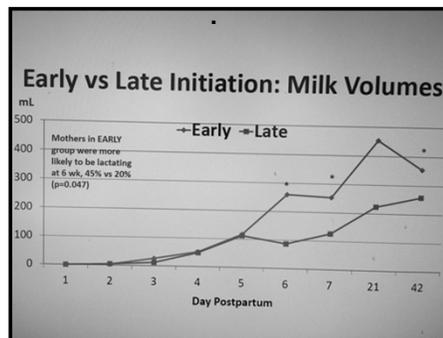
Parker LA. Breastfeeding Medicine 2015, 10(2) 84-91.



Notice decline in production after week 3, peak at 550ml₉

45% vs. 20% lactating at 6 weeks

Parker LA. J Perinatol. 2012; Parker LA. Breastfeeding Medicine 2015



20

WHAT MORE CAN WE DO?

More Effective Expression?
Oxytocin nasal spray or galactagogues? No studies support prophylactic use galactagogue medication

Fewtrell MS. Randomised, double blind trial of oxytocin nasal spray in mothers expressing breast milk for preterm infants. Arch Dis Child Fetal Neonatal Ed., 2006
Donavan TJ. Cochrane Database Syst Rev 2012

Pumping after breastfeeding in C-section mothers during the first 72 hours

– Breastfed for a shorter duration than mothers who breastfed only
Chapman DJ. Impact of breast pumping on lactogenesis stage II after cesarean delivery: a randomized clinical trial. Pediatrics. 2001

Pumps with different features or pumping patterns

Fewtrell MS. Pediatrics. 2001. Meier PP, J Perinatol. Breast pump suction patterns that mimic the human infant during breastfeeding. J Perinatol 2012

Music? (<0.5 ml difference)... Heat? ...Relaxation?

Ak J. J Clin Diagn Research 2015 Impact of music therapy on breast milk secretion in mothers of premature newborns. 21

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22

Part I:

Production in pump-dependent mothers

- **Objective:**
 - We observed that after mechanical pumping, a significant fraction of milk can be expressed using manual techniques. We hypothesized therefore, that two manual techniques, hand-expression of colostrum and hands-on pumping (HOP) of mature milk, can improve production.

1. J Morton, JY Hall, RJ Wong, WE Benitz, L Thairu, WD Rhine. J Perinatol. 2009 Nov;29(11):757-64. 2009
2. J Morton, RJ Wong, JY Hall, WD Rhine et al. J Perinatol 2012

23

METHODS

- 67 mothers of babies < 31 weeks gestation
- For 8 weeks, at each pumping session, participants recorded:
 - Time and duration
 - Milk volume expressed from each breast
- Collected milk samples from each breast with each expression over 24 hours once a week for 8 weeks

24

METHODS

On day one, each mother was taught both
hand expression
 +
electric pumping

25

METHODS “HANDS-ON PUMPING”

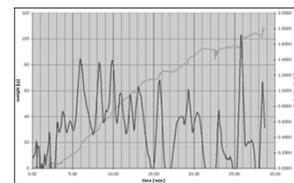
- After 2 weeks, mothers participated in monitored pumping sessions, during which they learned “hands-on pumping” to improve emptying.
 - Mean, day 21

26

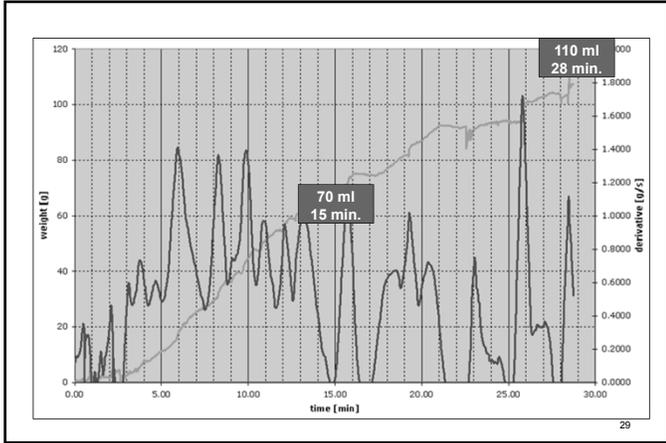
What is “HANDS-ON PUMPING”?

- HOP: manual techniques, (such as breast massage, stripping, compression and hand expression) used during the electrical pumping session to enhance breast emptying
 - **NOT** passive dependence on electric pump to suction milk from breast

27



28



**Teaching Videos (step by step)
Available Stanford Website
5000 visits/day**

STEPS for HAND EXPRESSION
<http://newborns.stanford.edu/Breastfeeding/HandExpression.html>

STEPS for HANDS-ON PUMPING
<http://newborns.stanford.edu/Breastfeeding/MaxProduction.html>

29



RESULTS

What is the influence on milk production at two time points?
2 weeks (establishment)
8 weeks (maintenance)
of
Predetermined Factors
Modifiable Factors

32

Predetermined Factors

- Maternal Age: 32.3±6.867 (18.7–50.5)
- Birth Weight: 1026±26284 (534–1553)
- Gestational Age: 27.9±1.967 (23.9–30.7)
- Singletons: 45/67 (67%)
- Education, ≥ College: 43/55 (78%)
- No partner: 8/55 (15%)
- C-section 72%
- IVF 26%
- Postpartum BMI 26.9±4.8 (18.8–41.5)
- History of Breastfeeding 21/55 (38%)
- Race:
 - African American 8/67 (12%)
 - Caucasian (non-Hispanic) 29/67 (43%)
 - Hispanic 13/67 (19%)
 - Asian and Pacific Islander 17/67 (25%)

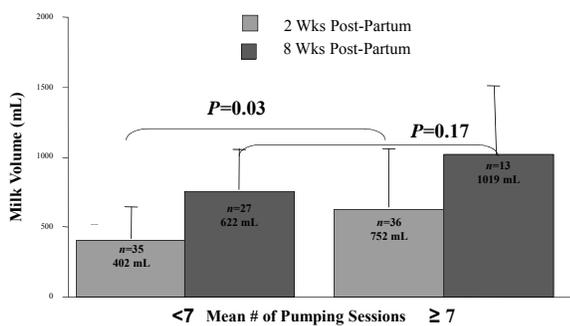
Language barrier?

Predetermined & Modifiable Factors

FACTOR	WEEK 2	WEEK 8
Maternal Age	YES inverse	NO
Gestational age	NO	YES inverse
Pumping frequency ★	YES p=.008	YES p=.002
Duration pumping session	NO	YES p=.033
Hand Expression	YES	YES < wk 8
Hands-on Pumping	N.A.	YES p<.001

34

High frequency pumping (≥ 7/day) influenced early (2 week) but not late (8 week) MDV.



35

Week	Pumping frequency (n)	Minutes of session (n)	Longest interval (min) (n)	Volume (mL/day)
Day 6-7	6.4±1.6 (59)	21.3±8.0 (43)	390±148 (59)	309±221, n=58
2	6.4±1.4 (58)	22.3±8.7 (45)	389±128 (57)	481±341, n=59
3	6.5±1.4 (57)	23.0±9.4 (53)	383±120 (55)	591±358, n=57
4	6.4±1.3 (55)	23.8±8.1 (52)	395±122 (54)	659±332, n=54
5	6.3±1.3 (56)	25.5±9.5 (50)	401±119 (56)	711±386, n=56
6	6.4±2.1 (54)	25.0±8.8 (46)	398±118 (53)	755±400, n=54
7	6.0±1.5 (53)	25.2±9.3 (46)	414±136 (53)	776±432, n=53
8	6.0±1.5 (52)	24.9±9.0 (45)	414±136 (53)	820±480, n=52

36

HAND EXPRESSION

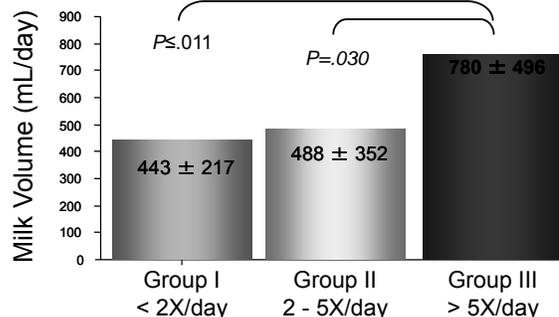
- 48/66 (73%) of participants recorded hand expression in first 3 days postpartum
- Hand Expression Frequency: 3 groups
 - Group I:** NO/LOW, <2 per day, n=15
 - Group II:** MEDIUM, 2 to 5 per day, n=18
 - Group III:** HIGH, >5 per day, n=16



across 3 groups

- No significant differences in pumping frequency across 3 groups

MILK OUTPUT BY DAY 14

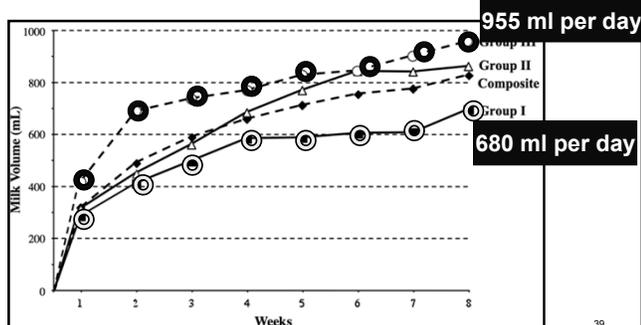


38

Combining pumps and hand expression on days 1-3 (>5x/day) augments production up to 8 weeks

FIGURE 2

Morton J. 2009, 2012

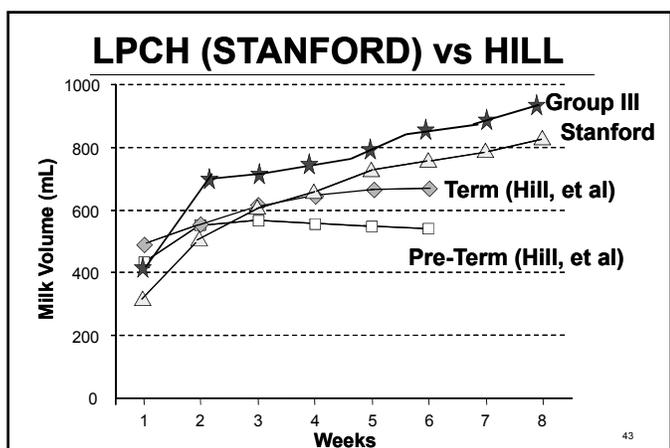
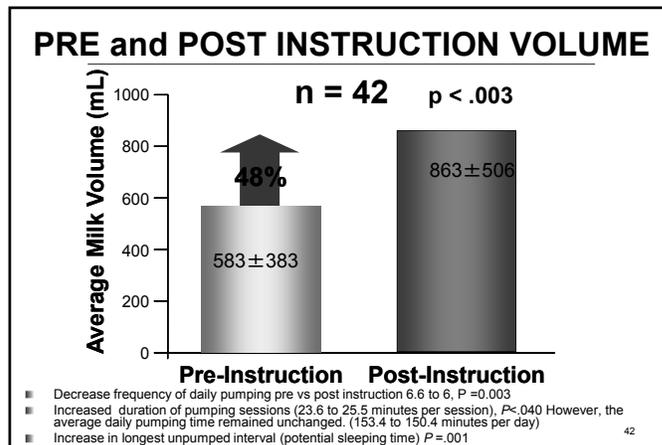
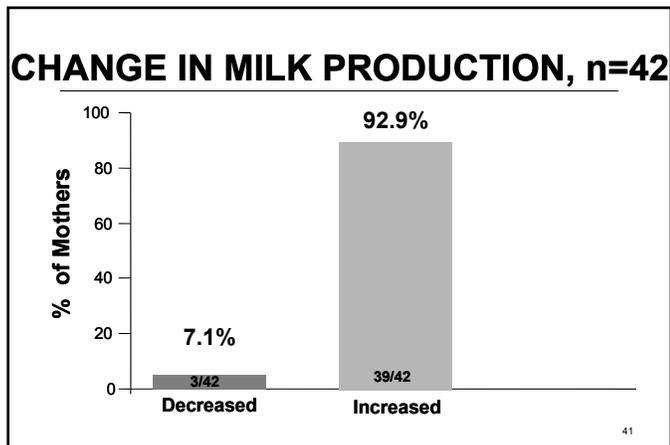


39

HANDS-ON PUMPING

- To investigate whether mothers could reach and sustain sufficient milk production over the 8-week study period by using hands-on pumping
- Mean daily volume (MDV) over 3 days prior to instruction compared to MDV over week 8 in 42 mothers with complete records (Mean, day 21)

40



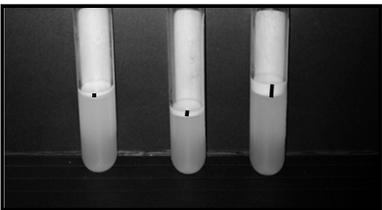
Other Influential Factors?

- Lack of correlation between volume and variables believed to influence production suggests that these factors may be mitigated by techniques supporting effective and frequent milk removal.
 - type of delivery
 - maternal BMI
 - history of previous breastfeeding
 - Multiples
 - IVF

44

Milk Composition

- Milk fat, but not other macronutrients increases in relation to breast emptying.



EARLY
MID
LATE

45

Milk Composition

J Morton, RJ Wong, JY Hall, WD Rhine et al. J Perinatol 2012

- >5000 samples from 52 mothers
 - Mothers contributed samples from each breast from each pumping session over 24 h once weekly for 8 weeks.
- Protein and lactose tracked reported norms
- Fat and caloric value (wks 2–8) exceeded norms
 - 62.5 g/l fat (typical range is between 25–45 g l)
 - 892.7 cal/l (26.4 cal/oz)
 - unrelated to production differences (high vs. low)

46

Mothers' (partners') acceptance of hand techniques

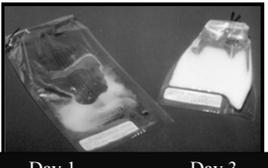
Jules DaLou



47

PROPOSED REASONS: EARLY HAND EXPRESSION

- Colostrum may be too viscous for effective pump removal
- Frequent alternation between breasts may simulate “pauses”
- Milk removal in the first 3 days may “program” the breast for future production potential



Day 1
Day 3

48

PROPOSED REASONS: HANDS ON PUMPING

- Fat-rich (hind-milk) milk may be too viscous for effective pump removal
- Tactile stimulation may increase frequency of let-down reflex
 - ~ 4 times per expression, as per ultrasound
- Compression may increase forward flow and reduce post let-down retrograde flow

49

CONCLUSIONS

- The influence of hand expression in the first 3 days was independent of pumping frequency and affected production up to week 8.
- Establishing high volume may be associated with early use of:
 - More frequent expression (hands **PLUS** pump)
 - More effective removal of colostrum with hands
- Sustaining and attaining high volume may be associated with:
 - More effective emptying with HOP
 - High fat content consistent with effective emptying

50

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51

What we know already...

1. Hormones set the stage, yet the early, frequent and effective removal of colostrum determines future production potential
2. Time sensitive: 1st hour colostrum removal strongest signal for future production, not hrs 2-6 or thereafter
3. High Frequency: most important early on for establishment
4. Effective techniques: Hand expression vs. pump suction? What is the evidence?

52

Supporting research for hand expression

- 1998, Alekseev NP: suction and compression, increased rate of milk flow over suction alone.
- 2001, Jones: suction with hand compression, increased output and patients preferred
- 2009, Morton J: Early hand expression, then “hands-on pumping” (HOP) to establish and maintain escalating output x 8 weeks
- 2010, Ohyama M: more volume with hand expression colostrum
- 2010, Flaherman VJ: early hand vs. pump ↑ bf rates by 25% at 2 mos.
- 2012, Morton J: HOP expressed high volume of fat-rich milk
- 2013, Larkin T: Early hand expression and HOP established and maintained escalating output x 6 weeks. Earlier use of HOP resulted in production by day 14 (817 ml/d)★
- 2015, Mangel L: Higher fat/cal. in hand vs. pump expressed colostrum

53

HAND EXPRESSION vs. PUMPING of colostrum is:

1. More comfortable
2. ↑ bf rates by 25% at 2 mos.
3. Higher fat and caloric content
4. Same or increased volume
5. Hand expression days 1-3 (>5x/d) augments production in pump-dependent mothers up to 8 weeks

54

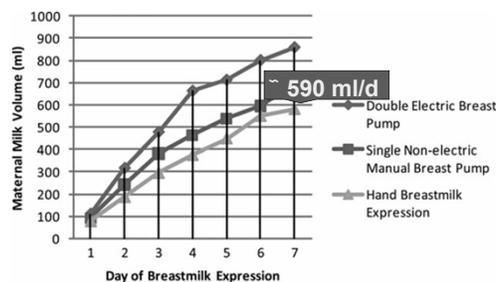
Conflicting Research Hand Expression and Pumping

- 2012, Slusher TM, Breastfeed Med. EE more effective than HE ...in a culture traditionally familiar and dependent on manual techniques). HE alone yield (590) 0 ml/ day 7.
- 2015, Lussier MM. Breastfeeding Med EE (n=14) more effective than HE (n=12) ...low output in both groups (day 7, 380 (100) 0 ml/d) perhaps due to low frequency expression.

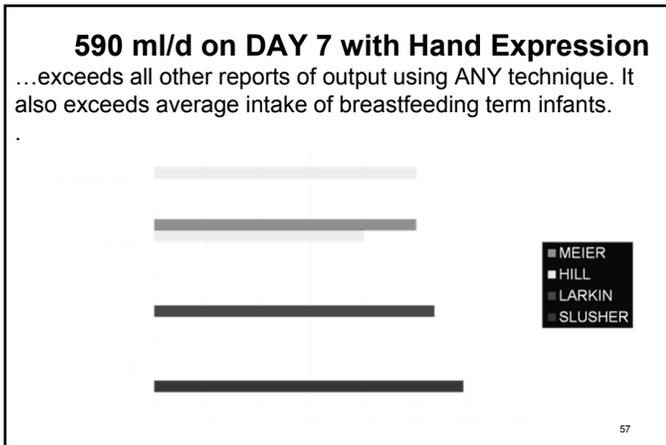
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Comparison of maternal milk expression method in an African nursery

Slusher TM, Breastfeed Med. 2012 Apr;7(2):107-11..



56



- Techniques Matter especially with small volumes**
- Milk collects deep in the breast, possibly more so in the inferior lateral quadrants
 - Deep pressure
 - First let down offers highest pressures for available milk removal with dampening over time
 - Importance of stimulating a let-down
 - Milk redistributes with lateral and retrograde flow over time
 - Importance of compression and feeling for fullness
 - Pauses may allow redistribution and ↑availability
 - ↑ Alternating breasts with lower volume states
- 58

- Feb., 2015 Cochrane review**
Methods of milk expression for lactating women
- "...low-cost measures such as early initiation, relaxation, hand expression, and lower cost pumps may be as or more effective, than large electric pumps for some outcomes."
 - Greater volume with:
 - initiation within 1st hr
 - high frequency
 - when breasts warmed before expressing or massaged [compressed] while expressing
- 59

1st hour hand expression

60

4 Summary Points

1. Critical ingredient to long-term and exclusive breastfeeding is adequate milk supply.
2. Early, frequent and effective removal of colostrum influences later production.
Time sensitive: What we do (or do not do) in the first 3 days (1st hour) influences the duration and exclusivity of breastfeeding.

61

4 Summary Points

3. Evidence supports numerous beneficial outcome measures for women taught hand expression and hands on pumping, with no reported negative consequences. Stress early initiation, high frequency and careful techniques
4. Over-reliance on pump suction alone (without breast compression) may jeopardize some favorable outcomes.

62

An Action Plan

- An action plan to address these issues must combine science with best practices. How do we keep both low and high risk infants safe, preserve the cornerstone of long-term, exclusive breastfeeding, milk production, while addressing the constraints of time, skills and resources?

63



“All right, then...enough about breasts”...for now!
Thank you!

64