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Evaluation of Labor Mirror Use During the Active Pushing Phase of the Second Stage of Labor

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ABSTRACT

Objective: To evaluate whether the use of a labor mirror during the active pushing phase of the second stage of labor is associated with a shorter duration of pushing. Additionally, we examined maternal and neonatal outcomes secondary to mirror use versus non–mirror use.

Design: Retrospective observational cohort study.

Setting/Local Problem: Community hospital in the midwestern United States with a Level 3 maternity center and approximately 2,000 births annually.

Participants: Four hundred fifty-three women ≥18 years old who had a singleton pregnancy at term (37–41 weeks' gestation) with a spontaneous vaginal birth.

Intervention/Measurements: The use of a ceiling-mounted labor mirror offered before or at the beginning of the active pushing phase of the second stage of labor. Use was determined by patient choice.

Results: One hundred seventy-seven (39.1%) women elected use of the labor mirror. Mirror users and nonusers were similar in terms of clinical and demographic characteristics except for epidural use (93.2% vs. 86.6%, respectively; $p = .0298$). Among nulliparous women who used the mirror, second stage labor duration was shortened by an average of 19.4 minutes ($p = .0198$). This effect was not seen in multiparous women ($p = .2208$). Mirror users and nonusers did not differ on rates of postpartum hemorrhage ($p = .5498$) or chorioamnionitis ($p = .6528$). Among nulliparous and multiparous women, Apgar scores and NICU admission rates did not differ between mirror users and nonusers.

Conclusion: The labor mirror represents a simple, noninvasive tool for labor and delivery units. Use of the labor mirror during the active pushing phase of the second stage of labor may be associated with decreased pushing duration for nulliparous women.

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Nurses play an important role during the intrapartum period by providing education, encouragement, comfort measures, and advocacy for laboring women in collaboration with their care providers (Association of Women's Health, Obstetric and Neonatal Nurses [AWHONN], 2018). Ongoing labor support provided by nurses is a vital factor to accomplish improved birth experiences such as a shorter duration of labor, improved neonatal outcomes, and increased maternal satisfaction (Bohren et al., 2017). The responsibility of nurses is especially significant during the active pushing phase of the second stage of labor because continuous bedside attendance is required to assess fetal well-being, uterine activity, and fetal descent (AWHONN, 2019; Dent et al., 2023).

The second stage of labor begins when the cervix becomes fully dilated and ends with birth of the neonate. This stage includes the passive fetal descent phase and the active pushing phase. The active pushing phase of the second stage is the most physiologically stressful time of labor for the fetus (Wright et al., 2021). There are small but significant risks with prolonged second stage labor (Huang et al., 2019; Sandstrom et al., 2017). Therefore, decreasing the duration of this phase of labor is important for providers (Huang et al., 2019) and may reduce exposure to potential harm. According to the American College of Obstetricians and Gynecologists (ACOG), prolonged second stage of labor may be defined as more than 3 hours of pushing in nulliparous individuals and 2 hours of pushing in multiparous individuals (ACOG, 2024). Risks associated with prolonged duration of labor may include chorioamnionitis, postpartum hemorrhage, lower Apgar scores, and greater rates of admission to the NICU (Caughey et al., 2014). There are many factors that may influence the duration of the second stage, including parity, use of regional anesthesia, maternal weight, maternal position, maternal fatigue, fetal weight, fetal position, and bedside support (Cheng & Caughey, 2017).

See Table 2: 40% reduction of second stage labor for Nulliparous women using the mirror.

Background

Visual biofeedback has been investigated as a method for potentially decreasing the duration of the second stage of labor. This technique is a behavioral method using graphic feedback to teach individuals how to decrease physical symptoms via self-regulation of bodily functions (Bellussi et al., 2018; Gilboa et al., 2018). Visual biofeedback may improve the effectiveness of pushing by giving a woman awareness of the state of her body and her ability to control

CLINICAL IMPLICATIONS

- The labor mirror is a simple and effective device that may positively affect the duration of the active pushing phase of the second stage of labor for nulliparous women.
- Alterations in nursing interventions during the second stage of labor may influence birth outcomes.
- Nurses can advocate for laboring women by providing education and offering use of the labor mirror during the active pushing phase of the second stage of labor.

her efforts (Bellussi et al., 2018; Gilboa et al., 2018). A labor mirror is a simple, noninvasive device that provides information to the laboring individual and may be an option for effective visual biofeedback.

A labor mirror may encourage or motivate the patient to push more effectively by viewing the progress and fetal descent and, consequentially, shorten the length of the active pushing phase of the second stage of labor (Palompon et al., 2011). Variations in nursing interventions such as encouraging position changes and providing education, positive feedback, and advocacy may affect maternal and neonatal outcomes (Waller-Wise et al., 2020). The use of a labor mirror is one intervention related to nursing support; second stage management; and, ultimately, birth outcomes such as a shortened duration of pushing and improved maternal satisfaction.

There are limited data supporting the use of a labor mirror to shorten the active pushing phase of the second stage of labor. Palompon et al. (2011) conducted a small nonrandomized trial of 20 patients that suggested a reduced duration of the second stage of labor in primiparous patients who used the labor mirror. Both groups had a very short second stage of labor (a mean of 6.8 minutes in the mirror users and 18.9 minutes in nonusers), and with the small sample size, the generalizability of the results is limited. Doyle et al., 2016 surveyed 500 women in the postpartum unit regarding self-reported experiences with a labor mirror. Slightly more than half agreed that the mirror helped them focus on how to push during labor and enhanced their birthing experience.

Further research is warranted to examine the clinical utility of the labor mirror during the active pushing phase. The objective of this study was to evaluate whether the use of a labor mirror during the active pushing phase of the second stage of labor was associated with a shortened duration of pushing. Additionally, this study examined maternal and neonatal outcomes secondary to mirror use versus non–mirror use.

> Nurses play an important role during the intrapartum period by providing education, encouragement, comfort measures, and advocacy for laboring women

Methods

Design and Setting

We conducted a retrospective observational cohort study of women admitted to the labor and delivery (L&D) department of a large community hospital with a Level 3 maternity center. This facility is in the midwestern United States with approximately 2,000 births annually. The L&D department includes a five-bed triage unit, 12 birthing suites, two operating rooms, and a seven-bed antepartum unit. Approximately 70 registered nurses are employed on the unit and are cross-trained to function within all areas of L&D. A physician house officer, certified registered nurse-anesthetist, and a certified nurse-midwife are available on the unit 24 hours per day 7 days per week. Study activities were reviewed and approved by the health system institutional review board.

Participants

Inclusion criteria were patients age of 18 years and older with a singleton pregnancy at term (37 0/7 to 41 6/7weeks' gestation) and a spontaneous vaginal birth. Women with a gestational age of <37 weeks, multiple gestation, fetal demise, operative vaginal birth, and cesarean birth were excluded. Only women who were offered the mirror were included in this study. The mirror may have been offered at any time during labor; however, it must have been offered within 5 minutes of active pushing. Those who were offered the mirror more than 5 minutes after the start of pushing were excluded. The time the mirror was offered was documented in the medical record. A total of 453 women who had a spontaneous vaginal birth between December 1, 2019, and April 20, 2021, were included.

Procedure

The hospital uses a ceiling-mounted labor mirror (LDM 100 Labor and Delivery Mirror, Adroit Industries, LLC), installed in every birthing suite on the unit as a visual biofeedback device. The mirror measures 60.96 x 60.96 cm and can be precisely positioned by the nurse via remote control. Use of the mirror was offered to women, who could accept or decline, near the beginning of the second stage of labor. Patients were not aware data were being collected as to whether they accepted or declined the mirror because this is a routine care

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component. Once positioned for viewing by the woman, the mirror stayed in place during pushing until birth. The informed consent requirement was waived by the health system institutional review board for this medical record review study.

Measurements

The primary outcome was the duration of the active pushing phase of the second stage of labor, defined as the time from initiating pushing until the time of birth. Secondary outcomes included birth complications that could be influenced by pushing duration: chorioamnionitis, postpartum hemorrhage, Apgar scores at 1 and 5 minutes, and whether the neonate was admitted to the NICU. Other variables collected were time from admission to the intrapartum unit until time of initiating pushing and time from offering the mirror until time of initiating pushing. The following clinical and demographic characteristics of maternal patients were collected because they may influence second stage length and management: age, body mass index, gravidity and parity, gestational age at birth, use of oxytocin for augmentation or induction of labor, and epidural anesthesia. Birth weight was also recorded.

All study data points were routinely recorded in the electronic medical record. A list of all potentially eligible women was obtained by reviewing the birth log, which contains details such as name, date, gravida, para, gestational age, birth type, and complications for all women who gave birth on the unit. Data from patients meeting all inclusion and no exclusion criteria were entered by the principal investigator into the research database. The eligible patient list was maintained in a locked drawer of the principal investigator's locked office. The database included only deidentified data.

Analysis

Descriptive statistics were used to analyze demographic and clinical characteristics of the participants. Numeric outcomes and factors were compared between mirror users and nonusers with the Wilcoxon rank sum test, and categoric variables were compared with Fisher's exact test. To account for potential confounding between the study groups, multiple linear regression was used to analyze factors associated with the primary outcome. Missing data were $<5\%$ for all variables, and imputation was not done; p values of $>.05$ were considered statistically significant. Data were analyzed using SAS, version 9.4.

Results

Of the 453 total participants, 276 (60.9%) did not use the labor mirror, and 177 (39.1%) did use the labor mirror. Table 1 provides demographic and clinical characteristics of the participants. Mirror and non–mirror users were generally well matched with respect to their baseline characteristics. Nonusers were less likely to have an epidural ($p = .0298$). Pertinent maternal clinical outcomes, including postpartum hemorrhage and chorioamnionitis, were not statistically significant between the two study groups. Table 2 displays the time pushing was initiated to birth ("Pushing to birth"). Time factors were then separated based on parity. Mirror use was statistically shorter only among nulliparous women, with the mean pushing time for mirror users being an average of 19.4 minutes shorter ($p = .0198$). The participant groups were different with respect to some characteristics, and other factors were examined to see if they might have caused a confounding effect that affected the results. The association of these other factors with pushing time are shown in Table 3 for categorical variables and in Table 4 for numeric variables.

> Visual biofeedback may improve the effectiveness of pushing by giving a woman awareness of the state of her body and her ability to control her efforts

Many of the factors in Tables 3 and 4 were associated with duration of pushing time in the expected direction. These factors were tested in multiple linear regression models to evaluate whether they changed the findings from Table 2 regarding to the association of the mirror with reduced pushing time in nulliparous women (see Table 5).

The linear regression in Table 5 suggests that the mirror does not have an overall effect on laboring women. However, for this sample, the model predicted that mirror use reduces pushing time by approximately 17 minutes among nulliparous women ($p = .0008$). This reduction in pushing time was not explained by oxytocin use, birth weight, or whether the woman had a complication. As expected, greater birth weight, oxytocin use, and having a labor complication were associated with a longer active pushing phase of the second stage of labor. However, after including these variables in the model, the relationship of mirror use and shorter pushing time among nulliparous participants remained statistically significant.

Regarding neonatal outcomes, there were no differences between neonates of mirror users and nonusers with respect to Apgar scores or admission to the NICU (see Table 6). Outcomes were generally positive for neonates included in the study, regardless of mirror use.

Discussion

In this retrospective observational cohort study, there was a statistically significant decrease in the duration of the active pushing phase of the second stage of labor for nulliparous women who used the mirror. Nulliparous mirror users had an average 19.4-minute shorter active pushing phase than nulliparous non–mirror users. The shorter duration of pushing was not explained by any differences in oxytocin use, birth weight, or pregnancy complications between mirror users and nonusers. Additionally, this improvement in pushing time was

TABLE 1 DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF STUDY PARTICIPANTS BY MIRROR USE

Characteristics	Mirror Users	No Mirror Use	*p* Value
Age, years, *M* (*SD*)	28.0 (5.1)	28.6 (5.8)	.4707
BMI, kg/m^2, *M* (*SD*)	31.6 (5.5)	31.0 (6.6)	.0604
Gravida, *M* (*SD*)	2.8 (1.9)	2.7 (1.6)	.9535
Para, *M* (*SD*)	1.3 (1.4)	1.4 (1.4)	.8597
Nulliparous, *n* (%)	56 (31.6)	81 (29.4)	.6022
Gestational age, weeks, *M* (*SD*)	38.8 (1.0)	38.9 (1.0)	.9727
Oxytocin use, induction or augmentation, *n* (%)	123 (69.5)	202 (73.2)	.3948
Epidural, *n* (%)	165 (93.2)	239 (86.6)	.0298[a]
Admission to pushing, minutes, *M* (*SD*)	609.3 (408.1) Median = 540.5	630.8 (401.6) Median = 581.5	.3624
Postpartum hemorrhage, *n* (%)	9 (5.1)	19 (6.9)	.5498
Chorioamnionitis, *n* (%)	1 (0.6)	4 (1.5)	.6528

Note. No mirror use, $n = 276$; mirror use, $n = 177$. BMI = body mass index.
[a]Statistically significant difference between groups.

not explained by differences in the timing of offering the labor mirror. Use of the labor mirror did not appear to influence the duration of pushing among multiparous patients. Maternal and neonatal outcomes, which included postpartum hemorrhage, chorioamnionitis, Apgar scores, and NICU admissions, were not significantly different between the two groups.

Our findings from this study support the results obtained by Palompon et al. (2011), which suggested a reduced duration of the second stage of labor in primiparous patients who used the labor mirror. Our results are pertinent because data suggest that prolonged pushing has been associated with an increased risk for complications such as postpartum hemorrhage, low Apgar score, and neonatal asphyxia-related diagnoses (Huang et al., 2019). Admittedly, our cohort did not encounter prolonged pushing, and the results must be interpreted with that knowledge. Setting initial measurements to capture critical aspects related to pushing duration as well as birth outcomes was important to inform results.

Our finding that use of a labor mirror was not associated with a shortened active pushing phase in multiparous women is not surprising given the already decreased time spent pushing in this patient group (a mean of about 12 minutes in

TABLE 2 START OF PUSHING TO BIRTH BY MIRROR USE

Time Period	Mirror Users	No Mirror Use	*p* Value
All patients			
Pushing to birth, minutes	*M* (*SD*) = 16.9 (20.3) Median (range) = 9 (0–118)	*M* (*SD*) = 22.7 (32.2) Median (range) = 10 (0–203)	.1839
Nulliparous (para = 0)			
Pushing to birth, minutes	*n* = 56 *M* (*SD*) = 27.9 (22.3) Median (range) = 22 (3–118)	*n* = 81 *M* (*SD*) = 47.3 (45.1) Median (range) = 33 (1–203)	.0198
Parous (para > 0)			
Pushing to birth, minutes	*n* = 121 *M* (*SD*) = 11.8 (17.0) Median (range) = 6 (0–97)	*n* = 195 *M* (*SD*) = 12.4 (16.6) Median (range) = 6 (0–134)	.2208

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TABLE 3 CATEGORICAL VARIABLES POTENTIALLY ASSOCIATED WITH DURATION OF PUSHING TO BIRTH

Factor	*n*	Time From Pushing to Birth, Minutes, *M* (*SD*)	Time From Pushing to Birth, Minutes, Median (Range)	*p* Value
Nulliparous (para = 0)	137	39.4 (38.7)	29 (1–203)	<.0001[a]
Parous (para > 0)	316	12.2 (16.7)	6 (0–134)	
Oxytocin use (induction or augmentation)	325	23.1 (31.5)	12 (0–203)	.0182[a]
No oxytocin use	121	13.5 (16.0)	8 (0–97)	
Epidural use	404	21.1 (28.8)	10 (0–203)	.2120
No epidural	49	14.6 (23.1)	9 (1–154)	

[a]Statistically significant.

both mirror users and nonusers; see Table 2). Shorter pushing time in multiparous compared to nulliparous women has been consistently observed in prior research (Cheng & Caughey, 2017; Tilden et al., 2022). Although there may be other benefits to labor mirror use in multiparous women, such as increased patient satisfaction (Doyle et al., 2016), our study was limited to duration and outcome aspects.

Based on the study results, the use of a labor mirror during the active pushing phase of the second stage of labor is a noninvasive, risk-free intervention that may decrease the duration of the active pushing phase for nulliparous women. Although other interventions, such as using a squat bar, peanut ball, or rocking chair and frequent position changes, may be helpful to decrease the length of the active pushing phase, they may be challenging for women who receive epidural analgesia (Bianchi & Adams, 2009). Regional anesthesia is a common practice at our institution (89% of births in the present study) and across the United States (Butwick et al., 2018). The study findings emphasize the rationale for providing the patient an opportunity to use a labor mirror.

In the modern climate of interventional labor and birth, patients and their partners should be provided activities and skills to increase confidence, communication, and advocacy

Implications for Practice

Providing evidence-based nursing care for laboring women requires a specific skill set to promote a positive birth experience (Adams & Bianchi, 2008). Nurses provide education, support, and advocacy during the intrapartum period. It is especially important for nurses to empower women to make informed decisions regarding the use of a labor mirror by educating them about potential benefits and limitations. Nurses can use techniques and tools to promote second stage labor progress (AWHONN, 2018). A labor mirror is a tool that a nurse can easily use to help a woman increase pushing focus and effort, thus potentially reducing pushing time while enhancing the overall birth experience (Doyle et al., 2016). Although the labor mirror is a singular aspect of management of the second stage of labor, if it can contribute to a decrease in pushing time, there may be an opportunity to influence birth outcomes.

Perhaps the most important implication for nursing practice is to celebrate the impact professional nurses make in supporting laboring patients. From assessment and monitoring to planning for labor interventions, instruction, role modeling, and collaboration, the support of a registered nurse is critical (AWHONN, 2018). Variations in nursing interventions during the second stage of labor have an impact on outcomes (Waller-Wise et al., 2020). Intrapartum support through offering the option for the use of a labor mirror is one aspect that can be considered as the second stage of labor commences.

In the modern climate of interventional labor and birth, patients and their partners should be provided activities and skills to increase confidence, communication, and advocacy

TABLE 4 NUMERIC VARIABLES POTENTIALLY ASSOCIATED WITH DURATION OF PUSHING TO BIRTH

Factor	Correlation Coefficient	*p* Value	Interpretation
Age, years	–0.07	.1460	Not statistically significant
BMI, kg/m^2	–0.01	.8019	Not statistically significant
Gestational age, weeks	0.11	.0161[a]	As gestational age increased, pushing time increased
Birth weight, g	0.17	.0035[a]	As birth weight increased, pushing time increased
Admission to pushing	0.27	<.0001[a]	As time from admission to pushing increased, time from pushing to birth increased

Note. BMI = body mass index.
[a]Statistically significant.

(Budin, 2018). ACOG (2019) outlines strategies for limited intrapartum interventions and advocates for regular nursing care as part of that effort to maximize birth outcomes and patient satisfaction. AWHONN (2018) supports advocacy related to continuous labor support and strategies to maximize birth outcomes. Although limited empirical evidence exists related to direct influence on pushing time and birth outcomes with the use of a labor mirror, nurses can advocate for its use as another option to individualize intrapartum care.

Limitations, Strengths, and Areas for Further Research

Limitations of the study include its observational nature. The timing of events (start of the active pushing phase of the second stage, birth, offering the mirror to the woman) was documented as part of usual clinical care, and data used for this study are limited to the accuracy of the clinician documentation. In addition, the results of this study are limited to one facility and those situations involving women who had a spontaneous vaginal birth and to whom the labor mirror was offered before or within a few minutes of the start of pushing. Based on these factors, generalizability is limited. Other limitations include characteristics that may affect the duration of the active pushing phase but were not collected. These factors include maternal pushing effort, maternal fatigue, fetal station, and fetal position. Unfortunately, these details were not consistently documented in the medical record and, therefore, are not included in the analysis.

TABLE 5 MULTIPLE LINEAR REGRESSION TO EXAMINE FACTORS ASSOCIATED WITH DURATION OF PUSHING

Factor	Estimated Change in Pushing Time, Minutes	95% Confidence Interval for Estimate	*p* Value
Mirror: yes vs. no	–0.39	[–6.00, 5.21]	.8900
If nulliparous woman uses mirror	–17.22	[–27.23, –7.21]	.0008
Nulliparous vs. parous	34.61	[28.23, 41.00]	<.0001
Oxytocin: yes vs. no	5.90	[0.82, 10.99]	.0230
Birth weight (per 500-g increase)	3.82	[1.25, 6.39]	.0037
Complication: yes vs. no	7.22	[1.85, 12.59]	.0086

Note. R^2 for the model is 0.304.

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TABLE 6 APGAR SCORES AND NICU ADMISSION BY PARITY AND MIRROR USE

Outcome	Nulliparous, Mirror (n = 56)	Nulliparous, No Mirror (n = 81)	p Value
Apgar 1, *M* (*SD*)	8.0 (0.7)	7.8 (0.9)	.0877
Apgar 5, *M* (*SD*)	8.9 (0.6)	8.9 (0.4)	.1579
NICU admission, *n* (%)	2 (3.57)	1 (1.23)	.5672
	Parous, Mirror (n = 121)	Parous, No Mirror (n = 195)	
Apgar 1, *M* (*SD*)	7.9 (0.8)	7.9 (0.7)	.6124
Apgar 5, *M* (*SD*)	8.8 (0.6)	8.9 (0.3)	.0961
NICU admission, *n* (%)	1 (0.83)	3 (1.54)	>.999

Strengths of this study include a large sample size, which enabled us to evaluate the effect of the labor mirror in multiparous as well as nulliparous women while examining potential influences from many demographic and clinical factors. By excluding women who were offered the mirror after they had already spent more than a few minutes pushing, we avoided difficulties in interpreting the data in the mixed context of the labor mirror as a regular component of the birth process or as a "rescue" intervention.

Limited studies are available regarding use of the labor mirror. Therefore, future research is necessary. Researchers should focus on outcomes and patients' perspectives with the labor mirror. Although it has also been noted in this and previous studies (Doyle et al., 2016) that use of the mirror was declined by a significant proportion of women, their reasons for declining should also be a topic for research. Further research should also include nurses' perceptions and potential barriers to integration of the mirror into nursing practice.

Conclusion

The second stage of labor is often the most demanding time for the woman and the fetus (Huang et al., 2019). In this sample, the use of a labor mirror during the active phase of the second stage of labor was associated with a statistically significant decrease in the duration of active pushing for nulliparous women. However, there was no statistically significant difference in the duration of the active phase of the second stage of labor for multiparous women. Additionally, maternal and neonatal complications that were examined in this study did not differ between the two groups. Therefore, the labor mirror is a simple, noninvasive, and effective tool that may provide clinical benefit by shortening the duration of pushing during the second stage of labor.

Author Disclosures

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