

Medical Technology and Related Interventions on Maternal-Fetal Attachment: A Literature Review

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Abstract

Importance: In this review of recent research on the effects of interventions on maternal–fetal attachment. There are limited data from several countries to demonstrate the impact of medical technology and intervention programs on maternal-fetal attachment.

Objective: To examine studies on the effects of using medical technology and applying related interventions on maternal–fetal attachment, to identify gaps in this research, and to suggest future areas of research in this field.

Methods: The PubMed, Medline, and Cumulative Index to Nursing and Allied Health Literature electronic databases were searched using the following keywords: maternal–fetal attachment, prenatal, paternal, yoga, mindfulness, medical technology, and intervention. Because of the limited number of studies, the publication year and type of study was not restricted.

Results: Ten studies were selected for review. Ten studies that met the inclusion criteria were identified and used for further examination. The studies were conducted in the United States, Japan, Taiwan, Norway, the Netherlands, Sweden, Iran, and South Korea.

Conclusion: Despite preliminary studies indicating that medical technology and related interventions enhance the level of maternal–fetal attachment, the small sample sizes and nonrandomized controlled research designs limit the generalizability of the results. Future research is recommended to measure the correlation between prenatal and postnatal attachment in participants who receive abnormal fetus or unexpected gender results in ultrasound screening and reproductive technology. Additionally, future studies should focus on the benefits of postnatal attachment in trained fathers by using a longitudinal research design.

Introduction

Maternal-fetal attachment is viewed as the main form of affection between a pregnant woman and her fetus [3], and this affection reflects the images that the mother conceives of her fetus during pregnancy [4, 5]. The conceived images of the fetus gradually and steadily form the identification by the mother for the child, from the early stages of pregnancy until the postpartum period [6]. In other words, during pregnancy, a woman gradually gains an understanding of her fetus by means of physical activities such as fetal movement, eating well, and avoiding unsafe environments and preparing clothing for the unborn baby [3, 4, 7], as well as through emotional activities such as talking with and naming the fetus [7]. Additionally, Bowlby [8] suggested that attachment is an inseparable relationship between the mother and infant after childbirth, which is a major factor for developing a child's unique social and emotional characteristics.

Although the original intention of a fetal ultrasound scan is to detect and diagnose fetal abnormalities of the face, spine, extremities, and body surface [9], an additional benefit facilitating a positive initial relationship between a pregnant woman and her unborn baby. Hence, pregnant women can have many pleasant moments and positive experiences during prenatal care because an ultrasound scan helps them imagine their unborn baby [10-12]. Furthermore, intervention studies on maternal–fetal attachment have been published in several countries. Therefore, the purpose of this review was to evaluate the effects of using medical technology and related interventions on maternal–fetal attachment, and to recommend future areas of research in this field.

Methods

An electronic search was conducted to find relevant research articles by using the PubMed, Medline, and Cumulative Index to Nursing and

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Allied Health Literature Plus databases. The following search terms were used to identify relevant articles:

Maternal-fetal attachment, prenatal attachment, paternal attachment, yoga, mindfulness, reproductive technology, and intervention. The inclusion criteria for research articles were as follows: 1) studies clearly measuring maternal–fetal attachment during pregnancy; and 2) studies on pregnant women, couples, or both. Because of the limited number of studies, the publication year and type of study was not restricted. Only studies written in English were included.

After the database search, the titles and abstracts of the articles were reviewed (Table 1), and duplicated articles between the three databases were eliminated. Ten articles were identified and used for further examination. These studies were conducted in the United States, Japan, Taiwan, Norway, the Netherlands, Sweden, Iran, and South Korea.

Results and Discussion

Although assisted reproduction technology (ART) provides numerous benefits to women with infertility problems, concerns involve not only reproductive issues but also emotional, familial, and social issues [13,14]. A study conducted by Fisher et al. [13] used an

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PubMed Search Satisfied inclusion criteria Keywords	CINAHL and MEDLINE Satisfied inclusion criteria Keywords
1. Maternal fetal attachment +mindfulness yoga = 2 articles	1. Maternal fetal attachment +mindfulness yoga = 2 articles
2. Maternal-fetal attachment +reproductive technology =2 articles	2. Maternal-fetal attachment +reproductive technology =0 articles
3. Maternal-fetal attachment +intervention =8 articles	3. Maternal-fetal attachment +intervention =3 articles
4. Prenatal attachment +mindfulness yoga = 1 article	4. Prenatal attachment +mindfulness yoga = 1 article
5. Prenatal attachment + intervention =5 articles	5. Prenatal attachment + intervention =1 article
6. Paternal attachment + reproductive technology = 4 articles	6. Paternal attachment + reproductive technology = 0 articles
7. Paternal attachment + intervention =2 articles	7. Paternal attachment + intervention =0 articles

Selected articles
1. Maternal fetal attachment +mindfulness yoga =2 articles
2. Maternal-fetal attachment +reproductive technology =1 articles
3. Maternal-fetal attachment +intervention =8 articles
4. Prenatal attachment +mindfulness yoga = 1 article
5. Prenatal attachment + intervention =5 article
6. Paternal attachment + reproductive technology = 0 article
7. Paternal attachment + intervention = 2 articles

Final selected articles N=11

Table 1: Results of the Literature Search.

antenatal attachment questionnaire [15] to assess maternal attachment in 183 women. The findings showed that women in the late stages of pregnancy spent more time talking to and dreaming about the fetus, than those in the early stages. Furthermore, for women who had used ART, the later the stage of pregnancy was, the more emotional and protective were their thoughts regarding the fetus.

Chen et al.[14]compared maternal-fetal attachment between women treated using ART and women who became pregnant naturally. The results showed that the former had higher maternal-fetal attachment scores than the latter. Because the women who used ART experienced difficulties in conceiving naturally, they had stronger protective thoughts and behaviors toward their fetus than those who did not use ART. By contrast, Hjelmstedt et al. [16] found that the level of maternal attachment remained constant from the second trimester to the third trimester for both women who underwent in vitro fertilization and those who did not. In another study, Hjelmstedt, Widstrom, and Collins [17] repeatedly measured the level of paternal attachment of fathers whose partners were in Gestational Weeks 26 and 36 and had used ART and those who conceived naturally. There were no differences in paternal attachment levels at these two time points. However, fathers showed higher paternal attachment in Week

26 than in Week 36; the low level of ambivalent feelings toward the unborn baby and the high level of anxiety toward future fatherhood were influential factors in Gestational Week 26 [17]. Although the method of conception was found not to influence attachment with unborn babies in both mothers [16] and fathers [17], the potential influencing factors of maternal attachment are yet to be identified and explored. In addition, earlier research indicated inconsistent maternal-fetal attachment findings for women who used ART compared with those who became pregnant naturally [13, 14, 16], demonstrating a need for additional studies.

Using Technology in Maternal-Fetal Attachment

The essential elements of maternal-fetal attachment are the feelings of love and affection for the unborn baby. These attachment emotions initially occur when the pregnant woman feels the first fetal movement, but continue with advanced medical technology, continuously establishing attachment between pregnant woman and her fetus throughout gestation [10]. The ultrasound scan is one such technology that can satisfy a pregnant woman's curiosity by producing images of the unborn baby [12].

Previous studies have revealed that two-dimensional (2D) ultrasound scans positively influence maternal-fetal bonding before quickening [18, 19]. Several recent studies compared the levels of prenatal emotional attachment for different dimensional ultrasounds [1,10,12,20,21]. Righetti et al. [10]revealed no difference in the maternal antenatal attachment score between three-dimensional (3D) or four-dimensional (4D) and 2D ultrasound scanning groups. Another study found that a 3D or 4D ultrasound scanning group had a higher maternal antenatal attachment score than did a 2D ultrasound scanning group because of the clear fetal image visibility [12]. Sixty healthy pregnant women were interviewed for one study to compare maternal attachment scores in the second and third trimester between 2D and 3D ultrasound scanning groups [20]. The results showed that the 3D ultrasound scanning procedure did not increase maternal attachment; however, it developed an opportunity for pregnant woman to be familiar with her unborn baby, which might increase her acceptance of the unborn baby [20]. Thus, a benefit of ultrasound scanning is that pregnant women can emotionally accept and identify with the fetus. This acceptance and acknowledgement is the first crucial step in establishing maternal-fetal attachment during pregnancy, and in later continuing the relationship after the postpartum period [10]. Ji et al.[1] found that 2D and 3D ultrasound scanning procedures provided an intimate interaction between a pregnant woman and her fetus; it allowed a pregnant woman to learn more about the fetus' health, to see a real image of the fetus, and to closely attach to the fetus. In summary, levels of maternal-fetal attachment are not influenced by the use of different dimensional ultrasound scans, but using a 3D or 4D ultrasound scanning technique may enhance a woman's positive acceptance of her fetus because of the clearer visibility of the fetus image.

Related Intervention Studies on Maternal-Fetal Attachment

Several studies have indicated that maternal-fetal attachment can be increased through interventions such as mindfulness-based prenatal yoga [22,23], attachment skills training [24], Qi exercise [25], music therapy [26], nursing interventions in fetal activities and maternal interactions [27], and abdominal palpations using Leopold maneuvers [28].

Mindfulness-based yoga combines yoga with mindfulness-based

practices. The primary purpose of mindfulness-based practices in the health field is to assist people in improving psychological flexibility in daily life [29]. The principles of mindfulness are “non-judgmental, trust/self-reliance, non-striving, acceptance, and letting go” [29]. Through practicing mindfulness skills, pregnant women learn how to view their physical symptoms and psychological stress with acceptance and patience [29]. In addition, yoga practice using different body postures, breathing, and meditation produces numerous positive health benefits during pregnancy, such as a decrease in physical discomfort and a shortening of the first stage of labor [30]. Previous studies have illustrated that mindfulness-based yoga is not only useful for reducing physical and psychological discomfort resulting from illness but is also helpful in reducing physical pain, emotional stress, and sleep disorders in healthy pregnant women [22,31-33]. However, research on the influence of mindfulness-based yoga on maternal-fetal attachment is limited. One study examined the effects of mindfulness yoga on maternal-fetal attachment in at-risk depressive women [22]. The findings showed that mindfulness yoga increased maternal attachment to the fetus as well as developing a mother-role identity and positive thoughts regarding pregnancy. It could have positive consequences by alleviating depression levels in at-risk depressive women. However, the small sample size in the study was a key limitation in the generalizability of this finding. The authors suggested that future studies recruit a large sample size of women from different social backgrounds [22]. In summary, further research on mindfulness yoga as an intervention to enhance maternal attachment is necessary.

Whereas most studies focused on maternal-fetal attachment, one study investigated the effectiveness of training attachment skills on paternal-fetal attachment [24]. The results showed that a father's fetal attachment skills increased after the training program. Similarly, the results of a study on the Taeyo training program [34] were consistent with the findings by Akbarzade et al. [24], whereby parents expecting their first child who received the Taeyo program had significantly increased fetal attachment after receiving intervention programs [25,34,35].

One study found that abdominal palpation using Leopold maneuvers to perceive the fetal position as a nursing intervention program developed higher levels of maternal-fetal attachment in the late gestational stage [28]. The study compared an intervention group with a nonintervention group for maternal-fetal attachment with reference to the daily frequency of talking to the fetus at a late gestational stage. The results showed that mothers in the intervention group, who exercised more frequently and talked to the fetus every day in Gestational Weeks 34 and 36, had a higher level of maternal-fetal attachment. According to earlier studies, increasing the frequency of talking to the fetus every day is another approach to increasing fetal attachment [36-38]. However, one study observed no difference in the level of maternal-fetal attachment for women with and without intervention regardless of the frequency of talking to the fetus in Gestational Week 30, because the gestational age was a strong predictor of maternal-fetal attachment [39]. Several variables may strongly influence maternal attachment, such as the level of social support, level of depressive syndrome, social background (age, marital status, and education), amount of adequate social resources, gravida, and whether the pregnancy was planned [39,40]. In the study on abdominal palpitations using Leopold maneuvers, maternal attachment was independent of social background because all participants had similar social backgrounds [28]. Because that study was the only one to examine abdominal palpation using Leopold maneuvers

to enhance maternal attachment, further research is necessary. Although several intervention studies found enhanced levels of maternal-fetal attachment, others, for example, using music therapy during transvaginal ultrasound [26], did not show any improvement in attachment. Two studies on fetal movement counts and maternal-fetal attachment showed opposite results. The first study showed that women who counted fetal movements at the late gestational stage did not have enhanced levels of maternal-fetal attachment, compared with women who received standard prenatal care [41]. By contrast, the second study found that 1 month of fetal movement counting increased the level of maternal-fetal attachment [42]. The research examining the effect of fetal movement counts on maternal-fetal attachment is limited. Thus, further research is required.

Conclusion

The importance of maternal-fetal attachment is frequently acknowledged and is associated with postnatal attachment. However, there are limited data demonstrating the effects of medical technology and related interventions on prenatal and postnatal attachment, and on the correlation between prenatal and postnatal attachment. Despite preliminary studies indicating that medical technology and related interventions enhance levels of maternal-fetal attachment by using training program, abdominal palpation, and visual and hearing perception of the fetus, their small sample sizes and nonrandomized controlled research designs limited the generalizability of the results. The majority of studies were conducted in healthy pregnant women, with only one study conducted in psychiatrically at-risk pregnant women [22]. Thus, there is little evidence to demonstrate the benefits of prenatal attachment for at-risk pregnant women. Although the research on technology and related interventions is limited, most of the studies reviewed here demonstrated significant benefits in prenatal attachment.

Only one study used a randomized, controlled trial design to study the effectiveness of fathers' attachment skills [24]. The results revealed that trained fathers were able to develop the same level of prenatal attachment with the fetus as their partners. Future studies should focus on the benefits of postnatal attachment in fathers by using a longitudinal research design. Furthermore, further research is recommended to measure the correlation between prenatal and postnatal attachment in participants who receive abnormal fetus or unexpected gender results in ultrasound screening.

Competing Interests

The author has no conflict of interest directly relevant to the content of this article.

Author contributions

Chia-Wen Vianne Lee conceived the article, and drafted and edited the manuscript.

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