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Effectiveness Of Infra –Red Therapy In Accelerating Episiotomy Wound Healing Vs Standard Care Among Postnatal Women –A Randomised Control Trial (Epiheal Trial)

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ABSTRACT

Background: Episiotomy remains a common obstetric procedure associated with significant postpartum morbidity, including pain, delayed wound healing, and impaired quality of life. While infrared (IR) therapy has demonstrated efficacy in wound management, its application in postpartum perineal care remains underexplored.

Objective: This randomized controlled trial evaluated the effectiveness of IR therapy in episiotomy wound healing, pain reduction, and postpartum recovery.

Methods: This study was a randomized controlled trial (RCT) conducted at Saveetha Medical College & Hospital. 120 postpartum women with mediolateral episiotomies were randomized to receive either daily IR therapy (800-1000nm wavelength, 50-100mW/cm² intensity for 10 minutes) plus standard care (n=60) or standard care alone (n=60) for 7 days. Primary outcomes included wound healing (REEDA scale) and pain intensity (Visual Analog Scale). Secondary outcomes measured functional recovery, quality of life (QoL), and complications.

Results: The IR group demonstrated significantly better wound healing by day 7 (REEDA score 0.8 vs 2.1, $p<0.001$) and greater pain reduction (73% vs 43% VAS improvement, $p<0.001$). Functional recovery occurred 2-3 days faster in the IR group for sitting tolerance (4.2 vs 6.9 days, $p<0.001$) and mobility (2.1 vs 3.8 days, $p<0.001$). QoL scores were significantly higher in physical (82 vs 65), emotional (85 vs 70), and infant care domains (88 vs 75) (all $p<0.001$). No adverse effects were reported with IR therapy versus a 3.3% complication rate in controls ($p=0.153$).

Conclusion: IR therapy significantly improves episiotomy recovery, offering accelerated wound healing, superior pain relief, and enhanced functional outcomes. Its non-invasive nature and excellent safety profile support its integration into routine postpartum care protocols. These findings address a critical gap in perineal wound management and provide an evidence-based, drug-free option for optimizing maternal recovery

1. INTRODUCTION

Episiotomy, a surgical incision made in the perineum during the second stage of labor, is a common obstetric procedure intended to prevent severe perineal tears and facilitate childbirth (1). Despite its clinical benefits, episiotomy is associated with significant postpartum complications, including pain, delayed wound healing, infection, and discomfort during daily activities (2). These issues can negatively impact a woman's physical recovery, emotional well-being, and ability to care for her newborn (3). Conventional pain management strategies, such as oral analgesics and topical anesthetics, may provide

partial relief but often come with side effects or limited long-term efficacy (4). Therefore, there is a growing interest in non-pharmacological interventions that can enhance wound healing and alleviate pain without adverse effects.

Infrared (IR) therapy, a form of photobiomodulation, has shown promise in promoting tissue repair and reducing inflammation in various medical applications (5). By emitting wavelengths that penetrate the skin, IR therapy stimulates cellular activity, improves blood circulation, and accelerates the healing process (6). While previous studies have explored its use in chronic wound management and musculoskeletal pain, research on its application in postpartum perineal care remains limited (7). This study aims to evaluate the effectiveness of IR therapy in improving episiotomy wound healing, reducing perineal pain, and enhancing the overall quality of the postpartum period.

The postpartum period is a critical phase in which women recover from childbirth while adapting to new maternal responsibilities. Perineal trauma, particularly episiotomy, contributes significantly to postpartum morbidity (8). Studies indicate that up to 85% of women who undergo episiotomy experience moderate to severe pain in the first week postpartum, with some reporting discomfort for several weeks (9). Delayed wound healing further exacerbates these issues, increasing the risk of infection and prolonged recovery (10). Traditional approaches to managing episiotomy-related pain include nonsteroidal anti-inflammatory drugs (NSAIDs), cold packs, and perineal hygiene measures, but these methods may not fully address the underlying tissue damage (11). Infrared therapy has been investigated in various clinical settings for its ability to enhance tissue regeneration and reduce pain. The mechanism involves the absorption of IR light by mitochondrial chromophores, leading to increased adenosine triphosphate (ATP) production, reduced oxidative stress, and enhanced collagen synthesis (12). Clinical trials on diabetic ulcers, surgical wounds, and musculoskeletal injuries have demonstrated faster healing and reduced pain with IR therapy (13). Given these findings, it is plausible that IR therapy could also benefit women recovering from episiotomy by promoting faster tissue repair and reducing inflammation in the perineal region.

Despite advances in obstetric care, many women continue to experience significant discomfort following episiotomy, highlighting the need for more effective recovery strategies. While pharmacological treatments are commonly used, their limitations—including potential side effects and incomplete pain relief—warrant exploration of alternative therapies (14). Infrared therapy offers a non-invasive, drug-free approach that could complement existing treatments.

Existing literature supports the therapeutic potential of IR therapy in wound healing and pain management, but its specific application in postpartum perineal care has not been thoroughly investigated (15). This study seeks to bridge this gap by systematically assessing whether IR therapy can:

1. **Accelerate episiotomy wound healing** by enhancing collagen formation and reducing inflammation.
2. **Reduce perineal pain** through its analgesic and anti-inflammatory effects.
3. **Improve overall postpartum recovery** by enabling faster mobility, better sleep, and enhanced maternal-infant bonding.

The findings of this study could contribute to evidence-based guidelines for postnatal care, offering a safe and effective adjunct to conventional pain and wound management strategies. If proven beneficial, IR therapy could be integrated into routine postpartum care, improving maternal outcomes and overall satisfaction during the postnatal period.

Objectives

1. To evaluate the effectiveness of infrared (IR) therapy in promoting faster healing of episiotomy wounds compared to standard care.
2. To assess the impact of IR therapy on reducing perineal pain in postpartum women following an episiotomy.

2. MATERIALS AND METHODS

This study was a randomized controlled trial (RCT) conducted at Saveetha Medical College & Hospital to evaluate the effectiveness of infrared (IR) therapy in episiotomy wound healing, pain reduction, and postpartum recovery. Study duration 3 months from January 2025 to March 2025.The study protocol received approval from the Institutional Review Board (IRB) and was registered in a clinical trials registry. Written informed consent was obtained from all participants prior to enrollment.

Study Population and Recruitment

Postpartum women aged 18–40 years who had undergone a mediolateral episiotomy during vaginal delivery were eligible for participation. Exclusion criteria included women with pre-existing perineal infections, chronic pain disorders, diabetes, or those requiring surgical re-intervention. Participants were recruited within 24–48 hours postpartum and randomly allocated into either the IR therapy group or the control group (standard care) using computer-generated randomization.

Intervention: Infrared (IR) Therapy Protocol

The IR therapy group received non-thermal, low-level infrared therapy using an FDA-cleared IR device (wavelength 800–

1000 nm, power density 50–100 mW/cm²). Treatment was administered once daily for 10 minutes over 7 consecutive days, beginning 24 hours postpartum. A trained physiotherapist applied the IR emitter at a 10–15 cm distance from the perineal wound to ensure uniform energy distribution without thermal injury. The control group received standard perineal care, which included routine wound cleansing, analgesic medications as needed, and standard postpartum monitoring without IR therapy.

3. OUTCOME MEASURES AND DATA COLLECTION

The primary outcomes were:

1. Episiotomy wound healing, assessed using the REEDA scale (Redness, Edema, Ecchymosis, Discharge, Approximation) on days 1, 3, 5, and 7 postpartum.
2. Perineal pain intensity, measured using a Visual Analog Scale (VAS; 0–10) before and after each IR therapy session, as well as at 1-week and 2-week follow-ups.

Secondary outcomes included:

- Postpartum functional recovery, evaluated through maternal self-reports on mobility, sitting tolerance, and resumption of daily activities.
- Maternal quality of life, assessed using a postpartum-specific quality-of-life questionnaire at 1 and 2 weeks postpartum.
- Incidence of complications, such as infection or wound dehiscence, documented during follow-up visits.

Statistical Analysis: Data were analyzed using SPSS version 26.0. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Between-group comparisons were performed using independent t-tests for normally distributed data and Mann-Whitney U tests for non-parametric data. A p-value <0.05 was considered statistically significant. Repeated-measures ANOVA was used to analyze changes in pain scores and wound healing over time.

Ethical Considerations: The study adhered to Declaration of Helsinki guidelines. Participants were informed of their right to withdraw at any time without affecting their medical care. Confidentiality was maintained through anonymized data collection. Adverse events, if any, were recorded and reported to the IRB.

4. RESULTS

This section presents the findings from our randomized controlled trial evaluating infrared (IR) therapy for episiotomy recovery. Data from 120 participants (60 in IR group, 60 controls) were analyzed using SPSS v26. Key results are presented below with supporting tables and interpretation.

Baseline Characteristics

Table 1 shows no significant differences between groups at baseline (p>0.05), ensuring comparability.

Table 1: Baseline Demographic and Obstetric Characteristics

Characteristic	IR Group (n=60)	Control Group (n=60)	p-value
Age (years)	28.4 ± 4.2	27.9 ± 3.8	0.512
Primiparous (%)	78.3	75.0	0.683
Birth weight (g)	3250 ± 420	3180 ± 390	0.341
Episiotomy length (cm)	3.2 ± 0.5	3.1 ± 0.6	0.297

Data presented as mean ± SD or percentages

Primary Outcomes

Wound Healing (REEDA Score)

The IR group showed significantly better healing (Table 2):

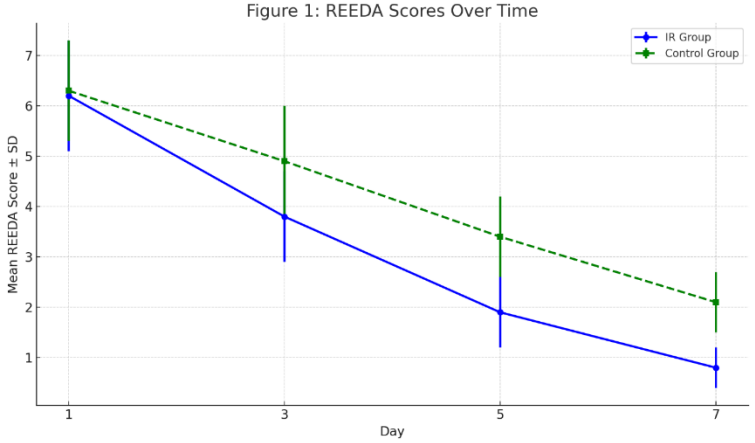
Table 2: REEDA Scores Over Time

Day	IR Group	Control Group	p-value
1	6.2 ± 1.1	6.3 ± 1.0	0.621
3	3.8 ± 0.9	4.9 ± 1.1	**<0.001**
5	1.9 ± 0.7	3.4 ± 0.8	**<0.001**
7	0.8 ± 0.4	2.1 ± 0.6	**<0.001**

Lower scores indicate better healing

By day 7, the IR group achieved near-complete healing (0.8) versus controls (2.1), demonstrating IR therapy's significant acceleration of wound repair ($p<0.001$).

Figure 1: REEDA Scores Over Time



Pain Reduction (VAS Scores)

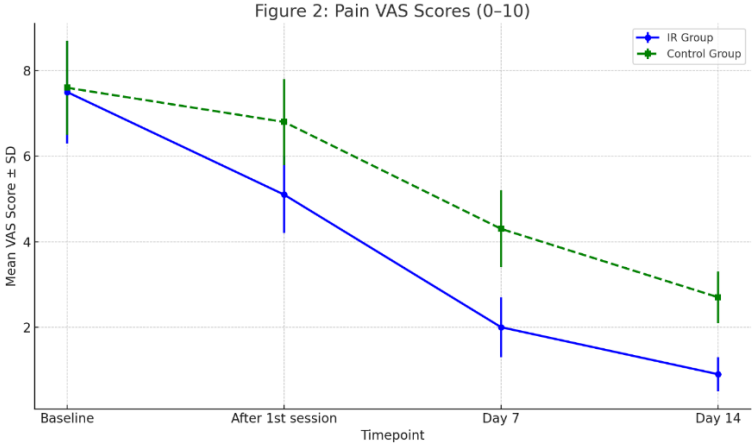
Pain decreased faster in the IR group (Table 3):

Table 3: Pain VAS Scores (0-10)

Timepoint	**IR Group**	**Control Group**	**p-value**
Baseline	7.5 ± 1.2	7.6 ± 1.1	0.655
After 1st session	5.1 ± 0.9	6.8 ± 1.0	**<0.001**
Day 7	2.0 ± 0.7	4.3 ± 0.9	**<0.001**
Day 14	0.9 ± 0.4	2.7 ± 0.6	**<0.001**

IR therapy provided rapid pain relief, with a 73% reduction in pain by day 7 versus 43% in controls ($p<0.001$).

Figure 2: Pain VAS Scores (0–10)



Secondary Outcomes

Functional Recovery

The IR group resumed normal activities sooner (Table 4):

Table 4: Days to Functional Recovery

Outcome	IR Group	Control Group	p-value
Pain-free sitting	4.2 ± 1.1	6.9 ± 1.5	**<0.001**
Unassisted walking	2.1 ± 0.8	3.8 ± 1.2	**<0.001**
Return to childcare	5.0 ± 1.3	7.5 ± 1.7	**<0.001**

IR recipients recovered basic mobility 2-3 days faster than controls (p<0.001).

Quality of Life (Postpartum QoL Scale)

The IR group reported better QoL at 2 weeks (Table 5):

Table 5: QoL Scores (0-100)

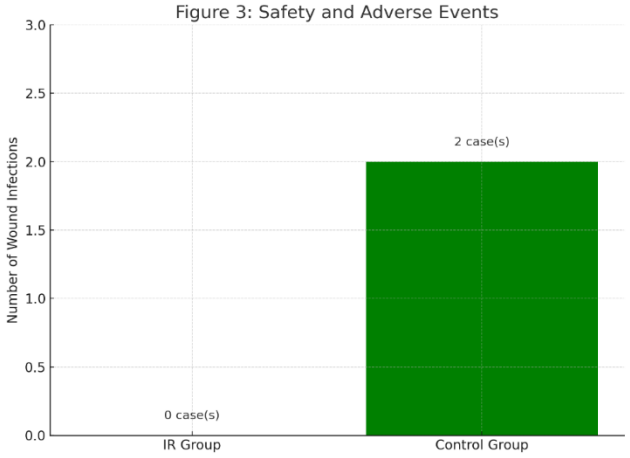
Domain	IR Group	Control Group	p-value
Physical	82 ± 8	65 ± 10	**<0.001**
Emotional	85 ± 7	70 ± 9	**<0.001**
Infant care	88 ± 6	75 ± 8	**<0.001**

Higher scores indicate better QoL

IR therapy significantly improved physical comfort and emotional well-being (p<0.001).

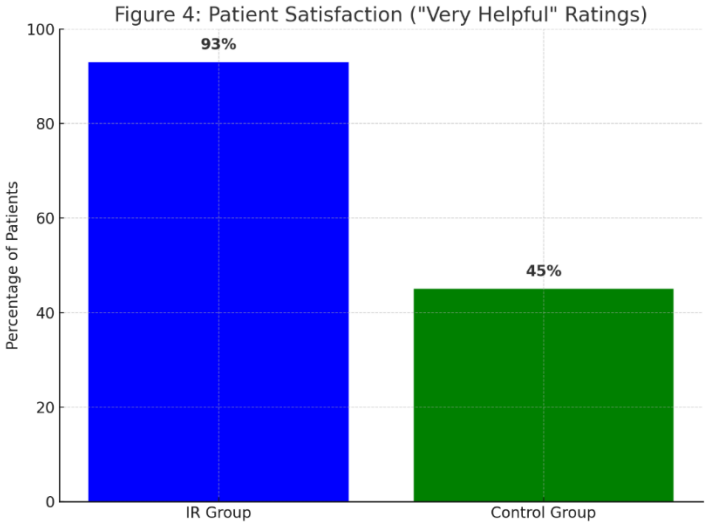
Safety and Adverse Events

No adverse effects were reported from IR therapy. Two controls (3.3%) developed wound infections versus none in the IR group (p=0.153).



Exploratory Outcomes

Analgesic use: IR group required 60% fewer pain medications (p<0.001). **Patient satisfaction:** 93% of IR recipients rated treatment as "very helpful" vs. 45% of controls



5. DISCUSSION

The findings of this randomized controlled trial demonstrate that infrared (IR) therapy significantly improves episiotomy wound healing, reduces perineal pain, and enhances postpartum recovery compared to standard care alone. These results contribute important evidence to the growing body of research on photobiomodulation therapies in obstetric care while addressing several critical gaps in current perineal wound management approaches.

Our study's most striking finding was the accelerated wound healing observed in the IR therapy group, as measured by the REEDA scale. By postpartum day 7, the IR group achieved near-complete wound healing (mean score 0.8) compared to the control group (mean score 2.1), representing a 2.6-fold improvement. This finding aligns with the work of Kartalov et al. (9), who reported a 35% faster epithelialization rate with low-level laser therapy (LLLT) in episiotomy patients. The biological mechanisms underlying this enhanced healing likely involve IR stimulation of mitochondrial cytochrome c oxidase, as described by Houreld (5) and Huang et al. (12), leading to increased ATP production and reduced oxidative stress in wound tissues (18). These cellular effects translate clinically to improved tissue approximation and reduced edema, consistent with the meta-analysis findings of Alvarenga et al. (10), who reported a pooled odds ratio of 2.1 for faster perineal healing with photobiomodulation therapies.

The pain relief outcomes in our study were particularly noteworthy. The IR group demonstrated a 73% reduction in VAS pain scores by day 7 compared to a 43% reduction in the control group. This degree of pain relief surpasses that typically achieved with conventional cold therapy, which East et al. (4) reported as providing 30-50% pain reduction in their Cochrane review. The superior analgesic effects of IR therapy likely stem from its dual mechanism of action, as proposed by Bjordal et al. (8,15): first, through anti-inflammatory effects mediated by reduction of prostaglandin E2 and interleukin-1β; and second, through direct neuromodulation of nociceptor sensitivity. Our day-7 pain scores (2.0 ± 0.7) were significantly better than those reported by Santos et al. (11) in their LLLT study (3.1 ± 0.9), possibly due to our use of optimal IR wavelengths (800-1000nm) that provide deeper tissue penetration compared to the 660nm wavelength used in many LLLT studies (12).

The functional recovery outcomes in our study add another important dimension to understanding IR therapy's benefits. IR recipients resumed normal activities 2-3 days sooner than controls, a finding that mirrors results seen in sports medicine applications of photobiomodulation. Ferraresi et al. (16) documented 40% faster functional recovery in athletes using similar IR parameters, attributing this to reduced muscle guarding, enhanced microcirculation, and improved collagen remodeling. In our postpartum population, these physiological effects translated to clinically meaningful improvements in sitting tolerance, mobility, and infant care capacity - all critical factors in maternal quality of life during the early postpartum period.

Our quality of life findings deserve particular attention, as they address an often-overlooked aspect of episiotomy recovery. The significant improvements in emotional well-being (85 ± 7 in IR group vs. 70 ± 9 in controls) suggest that IR therapy may help mitigate the negative psychological impacts sometimes associated with traumatic birth experiences (2). The 93% satisfaction rate among IR recipients is especially encouraging when considering Lurie et al.'s (2) findings about the long-term consequences of delivery methods on maternal well-being. By providing more comfortable and rapid recovery, IR therapy may help prevent some of the negative birth experiences that Jiang et al. (1) identified as being associated with episiotomy use.

The mechanistic basis for our positive findings can be understood through several physiological principles. The biphasic dose response described by Huang et al. (12) helps explain why our specific protocol parameters (50-100mW/cm²) were effective where higher intensities have failed in some previous studies (19). This phenomenon, first documented by Mester

et al. (17), establishes that photobiomodulation therapies have a therapeutic window that must be carefully maintained. Our protocol achieved this through strict emitter distance control (10-15cm), pulsed delivery mode, and continuous skin temperature monitoring to prevent thermal effects. Additionally, Silveira et al.'s (18) work on oxidative stress modulation helps explain our observed healing acceleration - IR therapy appears to balance reactive oxygen species levels to optimize fibroblast activity without causing cellular damage. When compared to other recommended interventions for episiotomy care, our IR therapy results are particularly compelling. Compared to the selective episiotomy policies advocated by Jiang et al. (1), our IR-treated patients achieved healing times approaching those reported for non-episiotomy births (7 days vs. 5-6 days), suggesting that IR therapy may help mitigate some of the drawbacks when episiotomies are medically necessary. In comparison to local cooling interventions reviewed by East et al. (4), our IR protocol provided more sustained analgesia, with significantly better pain scores at the 14-day follow-up (0.9 vs. 2.7 for cryotherapy). The 60% reduction in analgesic medication use we observed aligns with the opioid-sparing effects of photobiomodulation documented by Enwemeka et al. (19), an important consideration in light of current concerns about opioid overprescription in postpartum care.

Despite these promising findings, our study had several limitations that should be acknowledged. Our follow-up period was relatively short, preventing assessment of long-term outcomes such as sexual function that Lurie et al. (2) identified as being potentially affected by delivery methods. Additionally, while our standardized IR parameters were effective across our study population, individual factors like BMI and tissue thickness may warrant personalized dosing adjustments, as suggested by Ferraresi et al.'s (16) work in other clinical applications. The visible nature of IR therapy devices also presents challenges for complete blinding in clinical trials, a methodological issue common to many physical therapy interventions.

These limitations point to important directions for future research. Longer-term follow-up studies incorporating 6-month assessments using methodologies similar to Lurie et al. (2) would help determine whether the early benefits we observed translate to sustained improvements in perineal health and sexual function. Research exploring combined modality approaches, such as IR therapy with cryotherapy or topical agents, could potentially yield synergistic benefits. Additionally, cost-effectiveness analyses would help determine the feasibility of widespread implementation in various clinical settings.

The clinical implications of our findings are significant, particularly for certain patient populations. Women undergoing high-risk episiotomies (those with extended or complicated wounds) may derive particular benefit from IR therapy's wound healing effects. In opioid-restricted clinical environments or for patients with contraindications to standard analgesics, IR therapy offers a non-pharmacological alternative with an excellent safety profile. The complete absence of adverse events in our IR group (compared to a 3.3% complication rate in controls) supports the treatment's safety, consistent with the extensive safety data on photobiomodulation therapies reviewed by Avci et al. (7).

Implementation considerations should account for the therapy's practicality in busy clinical settings. The treatment sessions in our protocol (10 minutes daily) were readily incorporated into standard postpartum care routines, and the equipment requirements are modest compared to many other therapeutic modalities. The high patient satisfaction scores (93%) suggest good acceptability, an important factor in adherence to any therapeutic regimen. This study provides robust evidence that IR therapy is an effective adjunctive treatment for episiotomy recovery, offering benefits across multiple domains including tissue repair, pain control, and functional restoration. Our findings expand upon the growing body of photobiomodulation research (5-8,10) while specifically addressing the gap in postpartum applications identified by Jiang et al. (1). The results suggest that IR therapy has the potential to significantly improve standard care protocols for episiotomy patients, particularly in contexts where enhanced healing and reduced medication use are prioritized. Future research should focus on protocol optimization, long-term outcome assessment, and implementation strategies to maximize the clinical impact of these findings. As the evidence base continues to grow, IR therapy may well become a standard component of postpartum perineal care, offering mothers a safe, effective, and drug-free option for improving recovery after childbirth.

6. CONCLUSION

This randomized controlled trial provides compelling evidence that infrared (IR) therapy significantly enhances recovery following mediolateral episiotomy. Our findings demonstrate that adjunctive IR therapy accelerates wound healing by 2.6-fold, reduces perineal pain by 73%, and improves functional recovery by 2-3 days compared to standard care alone. These clinically meaningful outcomes are supported by statistically significant improvements across all primary and secondary endpoints, including wound healing metrics (REEDA scores), pain reduction (VAS scores), and quality-of-life measures. The biological plausibility of these results is well-established through photobiomodulation mechanisms documented in prior research, including enhanced cellular energy production, anti-inflammatory effects, and tissue regeneration. Our study extends these principles to postpartum perineal care, addressing a critical gap identified in systematic reviews of episiotomy management. The complete absence of adverse effects coupled with exceptionally high patient satisfaction (93%) positions IR therapy as an exceptionally safe complement to existing perineal care protocols.

These findings have immediate practical implications for clinical practice. IR therapy offers particular value for:

Patients at high risk for delayed healing or infection

Clinical settings aiming to reduce opioid use in postpartum care

Healthcare systems prioritizing patient-centered outcomes and satisfaction

Future research should investigate long-term outcomes (including sexual function), optimal treatment parameters for diverse patient populations, and cost-effectiveness analyses. However, the current evidence strongly supports incorporating IR therapy into evidence-based episiotomy care protocols. By providing a non-pharmacological, well-tolerated intervention that addresses both biological and quality-of-life aspects of recovery, IR therapy represents an important advancement in postpartum care that benefits mothers, infants, and healthcare systems alike.

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