JANISZEWSKA, Michalina, FEJA, Ewa and ŁUCZAK, Janusz. Comprehensive management of diastasis recti abdominis after childbirth: a literature review. Journal of Education, Health and Sport. 2025;85:66585. eISSN 2391-8306.
https://doi.org/10.12775/JEHS.2025.85.66585
https://apcz.umk.pl/JEHS/article/view/66585

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).
The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 12.11.2025. Revised: 16.11.2025. Accepted: 16.11.2025. Published: 24.11.2025.

Comprehensive management of diastasis recti abdominis after childbirth: a literature review

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Abstract

Introduction:

Diastasis recti abdominis (DRA) is a frequent postpartum condition characterized by separation of the rectus abdominis muscles along the linea alba. Although often considered benign, it may contribute to trunk instability, low back pain, pelvic floor dysfunction, and body image concerns. Increasing evidence recognizes DRA as both a functional and psychosocial component of postpartum recovery.

Methods:

This narrative review summarizes latest studies, including randomized trials, observational cohorts, systematic reviews, and expert consensus statements. The analysis focuses on pathophysiology, diagnosis, conservative rehabilitation, pelvic floor integration, and minimally invasive surgery.

Results:

Evidence supports early, guided exercise programs emphasizing transversus abdominis activation, hypopressive breathing, and pelvic floor co-contraction as effective in reducing inter-rectus distance (IRD) and improving functional stability. Adjunctive modalities such as neuromuscular electrical stimulation, manual therapy, and Kinesio taping may enhance recovery and psychological well-being. For persistent or severe DRA (>3–5 cm) or DRA with midline hernia, minimally invasive repairs such as MIRRAD and retromuscular or endoscopic sublay approaches offer high patient satisfaction, rapid recovery, and low complication rates. Recent classification systems and national consensus statements have improved diagnostic clarity and treatment planning.

Conclusions:

DRA management requires a multidisciplinary, individualized approach. Early screening, evidence-based physiotherapy, and integration of pelvic floor and psychological support are essential to optimize recovery. Future work should prioritize standardized diagnostic methods, long-term functional outcomes, and the creation of international rehabilitation guidelines.

Keywords:

diastasis recti abdominis; postpartum rehabilitation; pelvic floor; core stability; physiotherapy; minimally invasive surgery;

Introduction

The rectus abdominis is a key postural and respiratory muscle within the abdominal wall. It flexes the lumbar spine, bringing the rib cage and pelvis closer together, and contributes to trunk stabilization. Additionally, it supports forceful exhalation, maintains intra-abdominal pressure, and helps protect internal organs during activities such as lifting, defecation, and childbirth.

Diastasis recti abdominis (DRA) is a connective tissue condition reffered to a separation of the two rectus abdominis (RA) muscles along the linea alba (LA) due to stretching and thinning. It is often visible as a bulge or invagination through the midline of the anterior abdominal wall [1, 2].

As it is one of the most common musculoskeletal adaptations to pregnancy, it affects up to 60% of women in the early postpartum period and persisting in approximately one-third of women one year after delivery [3, 4, 5]. Some studies report a DRA prevalence ranging from 66% to 100% during the third trimester of pregnancy [6].

Spontaneous resolution typically occurs within the first eight weeks postpartum, after which further improvement tends to plateau [7].

DRA is assessed and diagnosed by measuring the inter-recti distance (IRD) [8].

Diagnostic methods have progressed from physical examination to advanced imaging, including ultrasound, CT, MRI, and shear-wave elastography, enabling more precise assessment of the abdominal wall.

In recent years, DRA has attracted increasing scientific and clinical interest.

In the past, diastasis recti abdominis (DRA) was mostly seen as a cosmetic problem in women after childbirth and was usually treated by plastic surgeons. Today, however, it is recognized as a condition that significantly contributes to musculoskeletal dysfunction leading to many further problems. The separation of the rectus abdominis disrupts core muscle synergy and intra-abdominal pressure regulation, leading to excessive loading of the pelvic floor during activities such as coughing or sneezing. Moreover, most women perform RA dominant tasks that increase abdominal pressure during daily activities and infant care.

This may result in pelvic organ prolapse or stress urinary incontinence. Prolonged compensation can cause pelvic floor muscle fatigue, weakness, or hypertonicity, manifesting as prolapse, sexual dysfunction, and related complications. Moreover, altered tension of the thoracolumbar and pelvic fascia may reduce pelvic stability and increase the risk of lower back pain and pelvic floor dysfunction, ultimately impairing quality of life. [9]

including reduced trunk stability, low back pain, urinary incontinence, and decreased body confidence [10, 11, 12].

In many countries, DRA is still not classified as a pathological condition and its treatment is not covered by public health insurance [13].

DRA etiology is complex and involves many factors such as: hormonal influences, mechanical stretch, and connective tissue remodeling.

The abdominal wall functions as an integrated system composed of the rectus abdominis, transversus abdominis (TrA), oblique muscles, and the linea alba [1, 2]. Hormonal relaxation and progressive stretching lead to fascial thinning and elongation during pregnancy [2, 4, 5].

DRA is increasingly seen as part of a broader pattern of lumbopelvic instability [11, 12]. Its relationship with pelvic floor dysfunction, such as stress urinary incontinence or pelvic organ prolapse, highlights the need for an integrated rehabilitation model [10, 11, 12, 14, 15].

According to recent guidelines, the management of diastasis recti abdominis (DRA) should be primarily conservative, with physiotherapy regarded as the gold standard of treatment [16].

Surgical repair, involving plication of the linea alba and anterior rectus sheath with or without mesh reinforcement, is reserved for severe cases unresponsive to conservative therapy or those with a symptomatic hernia. Because of possible complications and recurrence after subsequent pregnancies, conservative management is recommended for at least six months before surgery [16].

From a psychosocial point of view, many women report concerns about their abdominal appearance and decreased strength, which can reduce confidence and limit daily activities [10-12].

Multidisciplinary management combining physiotherapy, urogynecology, and psychological support is recommended [6, 11, 12].

Pathophysiology and Diagnosis

Pregnancy is the main risk factor for diastasis recti abdominis (DRA), as the growing uterus and hormonal changes increase intra-abdominal pressure and soften connective tissue, leading to stretching of the linea alba. The risk rises with multiple pregnancies, and cesarean section may further contribute to the development of DRA, particularly in women with repeated deliveries. Prolonged elevation of intra-abdominal pressure, as seen in obesity or other conditions that strain the abdominal wall, also increases the likelihood of muscle separation. Hormones such as relaxin, progesterone, and estrogen promote connective tissue laxity, while

the viscoelastic nature of collagen makes the linea alba prone to elongation under mechanical stress. Obesity and excessive gestational weight gain not only elevate abdominal pressure but is also associated with reduced collagen content, resulting in weaker connective tissue integrity. Diabetes mellitus adds to this risk by causing muscle atrophy and altering muscle fiber composition in the rectus abdominis. Furthermore, systemic connective tissue weakness, as seen in patients with abdominal aortic aneurysm, may predispose individuals to DRA. Smoking is another contributing factor, as it impairs collagen synthesis and weakens the structural support of the abdominal wall [1, 2, 4, 5].

Despite the common belief that women with strong abdominal muscles prior to pregnancy may be more prone to developing diastasis recti abdominis (DRA), a recent review on its prevalence and risk factors found that exercise training level before, during, or after pregnancy was not a statistically significant risk factor for DRA [4].

Diagnostic methods have advanced from basic physical examination to modern imaging techniques, including ultrasonography (the most commonly used), computed tomography (CT), and magnetic resonance imaging (MRI), which allow more accurate and detailed assessment of the abdominal wall. Newer tools, such as shear-wave elastography, also provide quantitative evaluation of muscle elasticity, improving diagnostic accuracy [17].

Electromyography (EMG) studies reveal altered activation of the TrA and pelvic floor muscles in women with DRA, suggesting compensatory strategies and functional instability [1, 12]. Because the rectus abdominis helps maintain intra-abdominal pressure, trunk stability, and pelvic support, its separation may disturb coordination between abdominal and pelvic muscles, causing extra tension in the pelvic floor. Even without visible anatomical changes, EMG findings may be early signs of pelvic floor dysfunction and might be considered during assessment. DRA is regarded as a functional as well as anatomical disorder. Early ultrasound screening (6–8 weeks postpartum) supports prompt intervention and better long-term outcomes [3-6].

Currently, there is no consensus about cut-off points for diagnosis. Several classification systems have been proposed to standardize the diagnosis and management of diastasis recti abdominis (DRA), varying in detail and clinical utility. Ranney first defined severity by inter-recti distance (IRD) as mild (<3 cm), moderate (3–5 cm), or severe (>5 cm). Nahas expanded this by incorporating abdominal aesthetics and myoaponeurotic deformities into four surgical types. The German Hernia Society and International Endohernia Society proposed a comprehensive system including IRD dimensions, hernias, and patient factors, though its complexity limits routine use. The European Hernia Society (EHS) later simplified

classification using patient type, IRD width, and hernia presence. Keramidas linked DRA width to specific suture techniques, while Corvino described five ultrasonographic patterns guiding exercise recommendations. Shen et al. combined EHS and Corvino features into a width–length system to guide conservative or surgical management [12]. A summary of the main DRA classification systems is presented in Table 1.

Table 1. Summary of the main DRA classification systems.

Classification	Basis / Criteria	Key Features	Clinical Use
Ranney	Inter-recti distance (IRD) measurement	Three grades based on IRD width: **mild (<3 cm)**, **moderate (3–5 cm)**, **severe (>5 cm)**	Simple, quantitative assessment of DRA severity
Nahas	Abdominal aesthetics and myoaponeurotic deformities	**Type A:** postpartum DRA in patients with well-defined waistline → managed by anterior rectus sheath plication. **Type B:** postpartum DRA in patients with poor lateral tension → manager by L-shaped external oblique plication + rectus plication. **Type C:** congenital lateral insertion +/- midline hernia → bilateral rectus sheath opening, plication, and advancement. **Type D:** poor waistline definition → anterior rectus plication + external oblique release for contour improvement.	Guides aesthetic and surgical correction
German Hernia Society (DHG) & International Endohernia Society (IEHS)	DRA width/length, presence of hernia, prior surgeries, parity, BMI, age, comorbidities and symptoms	Incorporates **IRD dimensions**, **hernia coexistence**, **skin quality**, **surgical history**, and **patient factors** individualized assessment	Comprehensive and patient-specific, however challenging and complex for daily clinical use
European Hernia Society (EHS)	Patient type (T), IRD width (D), Hernia presence (H)	**T1 = postpartum**, **T2 = obese patient**; **D1 = 2–3 cm**, **D2 = 3–5 cm**, **D3 > 5 cm**; **H0 = no hernia**, **H1 = presence of umbilical or epigastric hernia**	Simplified and standardized system for clinical reporting and research; not specific for surgical planning
Keramidas	IRD linked to surgical suture technique	**Type A – mild (2–3 cm):** two continuous interlocking sutures (single layer).	Provides clear correspondence between

		Type B – moderate (3–5 cm): same as A + interrupted sutures every 2 cm (two layers). **Type C – severe (5–7 cm):** same as A + interrupted sutures every 1 cm (two layers). **Type D – very severe (7–9 cm):** "ouroboros" double suture + interrupted sutures every 2 cm (three layers).	DRA width and surgical repair method
Corvino	Ultrasonographic evaluation of the linea alba	**Pattern 1:** above umbilicus; **Pattern 2:** below umbilicus; **Pattern 3:** at umbilicus; **Pattern 4:** complete, widest above umbilicus; **Pattern 5:** continuous, widest below umbilicus	Useful for identifying RD distribution and tailoring exercise or rehabilitation recommendations
Shen et al.	Ultrasound measurement of IRD at five anatomical points (M1–M5)	**Type 1:** RD only at M3. **Type 2:** RD at M3 + M2/M4, IRD < 47 mm. **Type 3:** RD at M3 + M2/M4, IRD ≥ 47 mm. **Type 4:** RD at M3 + two other sites (M1, M2, M4, M5). **Type 5:** RD at M2–M4 + M1 or M5 (or both).	Combines Corvino and EHS criteria; recommends conservative treatment for Types 1–2 and surgical repair for Types 3–5

Conservative Rehabilitation

Conservative management remains the cornerstone of DRA therapy. Findings suggest that the most effective intervention to improve postpartum DRA in women, particularly for mild or moderate cases, is abdominal isotonic exercises. It can be combined with electrical stimulation [18]. The primary goals are restoring linea alba tension, improving neuromuscular coordination, and correcting posture.

Exercise Therapy

Recent reviews, including the 2024 scoping review by Skoura et al. [6], report considerable variation in exercise protocols but consistently demonstrate the benefits of early, supervised training for reducing inter-recti distance (IRD) in diastasis recti abdominis (DRA). Effective interventions emphasize deep core activation, pelvic floor co-contraction, and breathing retraining to normalize intra-abdominal pressure. Traditional abdominal muscle training, including crunches, sit-ups, and pelvic tilts, was the most frequently used approach and generally produced measurable IRD reduction. Exercises activating the rectus abdominis, particularly curl-ups, showed significant short-term IRD narrowing, while transversus

abdominis (TrA) activation through abdominal drawing-in maneuvers yielded mixed results, sometimes increasing IRD initially but improving outcomes with long-term training. Co-activation of deep and superficial abdominal muscles appeared to reduce linea alba distortion and improve functional stability. Eccentric exercises, such as reverse sit-ups, also contributed to IRD reduction and improved abdominal strength. Pelvic floor muscle (PFM) training, especially when combined with electromyographic biofeedback or neuromuscular stimulation, enhanced the effect of abdominal exercises. Functional exercises (planks, bridges, squats) and alternative programs such as yoga, suspension training, or aerobic routines also showed positive effects on IRD closure [6].

Hypopressive and pilates-based exercises enhance proprioception and breathing control [19, 20, 21], while traditional TrA activation remains central for fascial tension restoration [18, 19-21, 22]. Meta-analyses confirm that supervised programs are superior to unsupervised ones [6, 18-20].

Adjunctive Modalities

Adjunctive tools can complement exercise-based rehabilitation:

- Neuromuscular electrical stimulation (NMES) combined with exercise can maximize IRD reduction. Evidence for the effectiveness of NMES in managing diastasis recti abdominis remains limited and inconsistent. While several studies report additional benefits when NMES is combined with exercise, the overall certainty of evidence is low due to small sample sizes, heterogeneous protocols, and lack of standardized outcome measures [19].

- Kinesio taping supports posture and proprioception. It can reduce rectus abdominis diastasis and improve abdominal shape, however the overall certainty of evidence is also low [6, 22].

- Manual therapy (massage, fascial release) improves comfort and function. Manual massage shows a positive therapeutic effect on early postpartum DRA. When combined with biomimetic electrical stimulation, it further reduces DRA, waist circumference, and lower back pain. In addition, massage promotes relaxation, helping to improve physical comfort and relieve postpartum depression [21]

- Abdominal binders facilitate confidence during mobilization [19]. They are often used as an adjunct to exercise therapy in women with diastasis recti abdominis to support the abdominal wall and temporarily reduce inter-recti distance. However, scientific

evidence for their effectiveness—particularly regarding long-term outcomes—is very limited and of low quality.

The new scoping review emphasizes that early physiotherapist-led education and patient engagement are crucial determinants of success [6].

Surgical Management

When conservative treatment fails, or in cases of large or symptomatic DRA (>3–5 cm), surgical repair may be indicated [2, 13, 23-28]. Modern techniques include laparoscopic, endoscopic sublay, and minimal incision procedures, offering strong fascial repair with low recurrence rates. Surgery for diastasis recti abdominis (DRA) with ventral hernia has recently moved toward minimally invasive methods, using pre-aponeurotic, retromuscular, or intraperitoneal approaches [24].

The minimal incision repair of rectus abdominis diastasis (MIRRAD) enables day-case correction with minimal scarring and rapid return to activity [27]. MIRRAD appears to be a safe and effective method for treating diastasis with or without ventral hernia. The minimally incision repair of rectus abdominis diastasis is a small-incision open procedure performed under general anesthesia through an umbilical approach. The technique involves double-line plication of the rectus diastasis with barbed sutures, with any concomitant hernia closed using non-absorbable sutures before plication. The umbilicus is reattached, and the skin is closed with absorbable sutures, allowing same-day discharge and shorter recovery. Patients use an abdominal binder for six weeks postoperatively. Performed by one experienced surgeon, MIRRAD achieves results comparable to SCOLA but without mesh reinforcement [26, 27]. It provides a safe, cost-effective alternative between traditional open and advanced laparoscopic techniques, offering effective repair with minimal invasiveness and faster recovery. The procedure causes little pain, has few complications, and allows fast recovery, often on the same day. Most patients reported less pain, stronger abdominal muscles, and high satisfaction after one year. Compared with open surgery, MIRRAD offers quicker recovery and similar results. It is simpler and easier to perform than other minimally invasive techniques. Registry data report complication rates below 5% and reoperation rates under 3% [28].

Guidelines recommend surgery after at least six months of structured rehabilitation [6, 13, 24, 29, 30]. Importantly, surgical repair is now considered a functional reconstruction—not merely aesthetic—restoring core stability and improving continence and posture [2, 13, 23-28, 30].

In case of severe postpregnancy diastasis recti - the treatment remains a significant challenge for plastic and reconstructive surgeons. Standard rectus plication is often insufficient in cases of marked abdominal wall flaccidity. Anatomical reconstruction of the linea alba, combined with posterior sheath plication and mesh reinforcement, is essential to restore both function and appearance. When autologous materials provide comparable strength to synthetic meshes, their use offers a safe and effective alternative. Dermal mesh is easy to handle for experienced surgeons, provides adequate tensile strength, and achieves excellent aesthetic and functional outcomes in patients with severe diastasis recti and abdominal wall laxity [25]

Integration with Pelvic Floor Rehabilitation

The abdominal and pelvic floors operate as a functional continuum. Weakness in one region can compromise the other [10-12, 14, 15].

Diastasis recti abdominis (DRA) and pelvic floor dysfunction (PFD) often coexist postpartum, sharing risk factors such as pregnancy, delivery trauma, and increased intra-abdominal pressure. Evidence from the International Continence Society (ICS) and related studies highlights that the abdominal wall and pelvic floor function as a coordinated unit in maintaining core stability and continence, suggesting rehabilitation should target both systems together. Combined exercise programs integrating transversus abdominis and pelvic floor muscle training, supported by biofeedback or electrical stimulation, appear to improve strength, posture, and functional outcomes more effectively than isolated approaches. Early postpartum intervention may help reduce back pain, urinary incontinence, and pelvic instability. However, current evidence remains limited and heterogeneous, emphasizing the need for standardized, evidence-based protocols that integrate abdominal and pelvic floor rehabilitation for optimal postpartum recovery [14, 15].

Combined rehabilitation enhances recovery by optimizing pressure distribution and co-contraction efficiency.

The ICS/IUGA joint reports advocate this integrative approach, recommending synchronized assessment of both regions postpartum [14, 15]. Electromyographic studies confirm that TrA activation promotes pelvic floor recruitment, reinforcing this synergy [12, 14, 15].

This integrative model—now widely reflected in contemporary reviews [6]—has both functional and psychological benefits, improving continence, trunk control, and confidence.

Quality of Life and Psychological Wellbeing

DRA impacts self-image, activity, and mood [10-12]. Women often report anxiety, frustration, or embarrassment regarding abdominal appearance, even with mild anatomical changes.

The study by Chen et al. (2024) [21] demonstrated that diastasis recti abdominis (DRA) has a considerable impact on women's physical function and psychological wellbeing after childbirth. DRA weakens the abdominal wall, leading to low back pain, pelvic instability, and reduced ability to perform daily activities. In addition to these physical symptoms, many women experience dissatisfaction with their body appearance, decreased confidence, and emotional distress. The presence of DRA has also been associated with an increased risk of postpartum depression. Early management of DRA is therefore important not only for physical recovery but also for mental health. Chen et al. found that manual massage combined with biomimetic electrical stimulation effectively reduced abdominal separation, waist circumference, and back pain, while improving mood and emotional balance. The relaxation response promoted by massage contributed to reduced stress and improved psychological wellbeing. These results highlight the importance of a comprehensive rehabilitation approach that integrates physical and emotional care. Effective DRA treatment can restore abdominal stability, enhance self-image, and improve overall quality of life in postpartum women [21].

Patient education and supportive communication are essential in promoting empowerment and adherence throughout DRA rehabilitation [11, 12]. Providing clear explanations about the condition, its causes, and the expected outcomes of therapy helps patients better understand their recovery process and actively participate in it. Educating women on safe exercises, posture, and daily movement techniques reduces fear of injury and increases confidence in performing rehabilitation activities. Supportive communication between healthcare providers and patients fosters trust and motivation, which are crucial for maintaining long-term adherence to exercise programs. Emotional support and reassurance also help address anxiety, frustration, or negative body image often associated with postpartum recovery. Encouraging self-monitoring and involving patients in goal setting can further enhance engagement and a sense of control over their progress. Ultimately, an empathetic, patient-centered approach not only improves treatment compliance but also supports psychological wellbeing and overall satisfaction with recovery.

Rehabilitation should therefore be viewed as both physical restoration and psychological renewal, helping women rebuild trust in their bodies [31].

Discussion and Future Directions

Current evidence highlights a paradigm shift in the understanding and management of diastasis recti abdominis (DRA), moving from an aesthetic concern toward a functional and psychosocial condition requiring multidisciplinary care. Early, supervised rehabilitation focusing on

transversus abdominis activation, breathing control, and pelvic floor co-contraction remains the cornerstone of conservative management, supported by growing evidence of improved inter-recti distance, posture, and quality of life. Integrating pelvic floor training is essential, as both systems operate as a coordinated unit maintaining trunk and pelvic stability. Adjunctive modalities such as neuromuscular electrical stimulation, manual therapy, and Kinesio taping may enhance physical and emotional recovery, though evidence remains limited and heterogeneous. For women with persistent or severe DRA, minimally invasive surgical options such as MIRRAD or retromuscular sublay repair have demonstrated safety, functional improvement, and high patient satisfaction.

Despite these advances, significant challenges remain. Diagnostic definitions, assessment methods, and rehabilitation protocols vary widely, limiting the comparability of research and clinical outcomes. Future studies should prioritize standardized ultrasound-based measurement, validated functional outcomes, and long-term follow-up. The integration of digital tools such as mobile applications and wearable feedback devices may improve patient adherence and self-monitoring. Equally important is the recognition of the psychological dimension of DRA recovery—empowering women through education, supportive communication, and shared decision-making enhances engagement and emotional wellbeing.

Looking ahead, multidisciplinary models linking physiotherapy, urogynecology, surgery, and mental health support are essential to achieve holistic, patient-centered postpartum care. The development of international consensus guidelines and large-scale prospective studies will be crucial to establish evidence-based standards and promote global alignment in DRA management. Ultimately, DRA rehabilitation should be viewed not only as physical restoration but also as an opportunity to rebuild confidence, function, and quality of life after pregnancy.

Emerging Trends

New trends in the management of diastasis recti abdominis (DRA) show a move toward more standardized and patient-centered care. Ultrasound is now more often used to measure the inter-recti distance, and new classification systems, such as the one from the European Hernia Society, help to make diagnosis clearer. Rehabilitation programs more often include pelvic floor training, because both muscle groups work together to keep the trunk and pelvis stable. Digital tools, such as mobile apps, tele-rehabilitation, and wearable devices, support home exercises and help patients follow their programs better. Treatment plans are becoming more individual, focusing on each woman’s anatomy, goals, and emotional needs. There is also more attention to education and supportive communication, which improves motivation and confidence during

recovery. Minimally invasive surgical techniques, like MIRRAD, SCOLA, or eTEP, continue to develop and offer faster recovery with smaller scars. Finally, international experts are working on guidelines and research standards to make DRA management more consistent and evidence-based around the world.

Postpartum recovery is increasingly seen as a stage of empowered rebuilding rather than passive healing. The integration of physical, emotional, and social dimensions defines modern rehabilitation.

Conclusions

Diastasis recti abdominis (DRA) is increasingly recognized as a condition that affects both physical function and psychological wellbeing, requiring a comprehensive and individualized approach to care. Early, supervised physiotherapy focused on transversus abdominis activation, breathing control, and pelvic floor co-contraction remains the foundation of effective conservative management, while minimally invasive surgical options such as MIRRAD or SCOLA provide promising results for severe or persistent cases. Modern rehabilitation should integrate not only physical restoration but also patient education, emotional support, and empowerment to improve adherence and long-term outcomes.

Future research in physiotherapy should explore the optimal intensity, frequency, and duration of core and pelvic floor training, as well as the role of digital tools such as mobile applications and wearable sensors in supporting home-based rehabilitation. Surgical research should focus on comparing outcomes between minimally invasive techniques, defining the ideal timing for intervention, and evaluating new biomaterials that enhance safety and recovery. Interdisciplinary studies are also needed to determine how integrating psychological support and patient-centered communication influences motivation, adherence, and overall quality of life. Finally, the development of international guidelines and standardized assessment tools remains essential to unify research and clinical practice, ensuring that DRA management is both effective and accessible for women worldwide.

Disclosure:

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All authors have read and agreed with the published version of the manuscript.

Funding Statement.
The authors did not receive special funding.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Conflict of Interest Statement:
The authors declare no conflict of interest.

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