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Self-Adhesive versus Cohesive Bandages: A comparative review of material performance, skin compatibility, and clinical utility in wound care

Kothwala Deveshkumar, Lad Hirenkumar, and Lad Nirav *

Meril Medical Innovations Private Limited, Bilakhia House, Survey No.879, Muktanand Marg, Chala, Vapi, Dist-Valsad, Gujarat, 396191, India.

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Abstract

Bandages are a crucial part of clinical and sports medicine and serve the purpose of wound management, providing compression, and supporting the musculoskeletal structure. Self-adhesive and cohesive bandages are commonly used, but they differ in their adhesion mechanisms and their clinical applications. Adhesive bandages stick directly on the skin, thus ensuring secure fixation for dressing of wounds, while cohesive bandages stick only to each other. So, they provide stable compression and support to the joints without coming into direct contact with the skin. This review presents a systematic comparison of these two types of bandages based on the published literature, technical specifications, and clinical observations, with a focus on adhesion, skin tolerance, ease of application, durability under perspiration, and functional performance. The quantitative data reveal that self-adhesive bandages can have a loss of adhesion of up to 30-40% due to very humid conditions or sweating and in some cases may lead to mild-to-moderate skin irritation, especially in sensitive patients. On the other hand, cohesive bandages not only hold their grip and compression but also are painless when removed and need proper wrapping to ensure the right pressure is applied throughout. The discussion is around the advantages, disadvantages, and best-use scenarios which are critically appraised, and a clinical decision framework is proposed for choosing bandages with regard to skin sensitivity, activity level, and therapeutic goals. The gaps that have been identified include a lack of standardized testing, variability in outcomes over the long term, and the unexploited potential of advanced materials such as hypoallergenic adhesives, textile composites, and smart fabrics. The review points out that the proper bandage selection weighs the factors of clinical effectiveness, patient comfort, and environmental conditions. The use of new materials and better application methods may further improve performance and safety, thus leading to better results not only in healthcare but also in sports.

Keywords: Self-adhesive bandage; Cohesive bandage; Wound dressing; Compression therapy; Sports medicine; Bandage materials; Skin compatibility

1. Introduction

Bandages play an essential role in both clinical and sports medicine, as they are used for wound protection, Hemostasis, and compression therapy, and they also provide musculoskeletal support during rehabilitation [1, 2]. If bandaging is done incorrectly, it can result in several complications such as circulation impairment, delayed wound healing, skin irritation, or joint instability. Out of the modern bandage types, self-adhesive and cohesive bandages rank as the top sellers because of their different adhesion methods, user-friendliness, and adaptability in both clinical and sport contexts [3, 4]. Self-adhesive bandages are secured to the skin, thereby allowing the dressing underneath to be firmly held in place, while cohesive bandages stick to themselves only with an added benefit of giving compression and providing support to the joint without touching the skin [5, 6]. Traditional band-aids like gauze, and cotton wraps have

* Corresponding author: Lad Nirav

been the mainstay for centuries for the coverage of wounds and the control of bleeding. The development of advanced material science and textile engineering has resulted in the creation of modern alternatives with excellent elasticity, better air permeability, and good compatibility with skin. Among the innovations are hypoallergenic adhesives, latex-free cohesive wraps, and textile composites which contribute to patient comfort with functional outcomes [7, 8]. These changes have caused a shift in the role of bandages from mere wound protection to active rehabilitation, compression therapy, and sports performance support. Although self-adhesive and cohesive bandages are commonly used, there is still very little comparative evidence available on their use. The majority of studies are descriptive without standardized testing, quantitative performance metrics, and long-term clinical outcomes. The increasing availability of advanced and hypoallergenic materials complicates the selection of bandages and creates a void of evidence-based guidance for health professionals, athletic trainers, and patients [9, 10]. This review intends to systematically evaluate adhesive bandages and cohesive bandages through their adhesion, skin compatibility, application methods, durability, and functional efficiency in various conditions. Besides, it aims at revealing the gaps in research, new technologies and the clinical judgment that can direct the choice of the best bandage. The new technologies like smart textiles, adaptive compression systems, and advanced polymer composites are still developing but already made a promising mark as the future of the next generation of bandaging solutions. It is highly recommended that, in the future, researchers would concentrate on the areas of performance evaluation, hypoallergenic formulations, and long-term clinical studies to improve safety, comfort, and efficacy in various patient populations.

2. Methodology

2.1. Literature Search Strategy

A structured literature review was performed using databases including PubMed, Scopus, and Google Scholar. Search terms applied included “self-adhesive bandage,” “cohesive bandage,” “wound dressing adhesion,” “compression bandage,” and “bandage application in sports medicine” [11,12]. Supplementary information was obtained from technical specifications and published practice guidelines [13].

2.2. Selection Criteria

Articles were included if they reported empirical data, clinical reviews, or technical evaluations describing bandage materials, adhesion mechanisms, skin compatibility, usability, or clinical applications. Studies limited exclusively to specialty bandages were excluded. Both peer-reviewed publications and technical reports were considered when relevant.

2.3. Data Extraction

Extracted information was organized into categories covering adhesive properties, comfort and skin tolerance, ease of application, performance under activity and perspiration, and general clinical or athletic effectiveness [14]. Qualitative observations from clinical and sports practice were included when documented [15]. A comparative framework was then developed to summarize similarities and differences between self-adhesive and cohesive bandages.

3. Current State of the Art

3.1. Overview of Existing Devices and Technologies

Self-adhesive bandages are designed with an adhesive surface that attaches directly to the skin, allowing fixation without auxiliary clips or tapes [16]. Cohesive bandages are structured to adhere only to themselves, preventing attachment to skin or hair [17]. Both types are widely used in medical and sports contexts, especially for wound management, compression, and joint supports.

3.2. Technological Advancements

Textile engineering and polymer science breakthroughs contributed to the increased breathability, elasticity, and better skin-friendly characteristics to both self-adhesive and cohesive bandages [18]. Innovations have been targeted to eliminate skin discomfort, raise the limit of tolerance, and prolong the life of the product through movement or sweating.

3.3. Regulatory and Clinical Landscape

Both bandage types are generally regulated as medical devices, with requirements for biocompatibility, safety, and labelling [19]. Clinical studies and practice reports have described their utility in wound management, compression therapy, and rehabilitation support, with selection influenced by patient needs and treatment objectives [17,20].

4. Mechanism of Action and Design Considerations

4.1. Design Principles

Self-adhesive bandages function through the application of a skin-contact adhesive layer that ensures fixation [14]. Cohesive bandages function by surface interaction that enables self-adherence without skin bonding. Structural design in both types emphasizes secure placement, stability, and appropriate pressure distribution depending on application requirements [19].

4.2. Performance and Efficacy

Evidence from published studies indicates that both types of bandages are effective when used in their appropriate contexts [15,18]. Self-adhesive bandages provide direct adhesion suitable for wound dressing fixation, while cohesive bandages allow compressive support and stabilization without direct skin adhesion [16]. Reported efficacy depends on application conditions and intended therapeutic goals.

5. Comparative Analysis

5.1. Comparison with Existing Devices

Self-adhesive and cohesive bandages demonstrate distinct differences in adhesion mechanism, application technique, and interaction with skin [11,14]. Self-adhesive bandages are commonly noted for ease of application, while cohesive bandages require controlled wrapping to achieve desired outcomes. Differences in skin compatibility, reusability, and functional applications have been consistently observed across reports [18,19].

5.2. Cost and Accessibility

Both self-adhesive and cohesive bandages are widely accessible in healthcare and sports practice [12]. Variations in cost may occur depending on material composition, packaging, and intended use. Accessibility has been reported as high across clinical and non-clinical settings [21].

Table 1 Comparative Analysis of Self-Adhesive and Cohesive Bandage

Parameter	Self-Adhesive Bandages	Cohesive Bandages
Adhesion and Retention	Adheres directly to skin; adhesion weakens with sweat/moisture; prone to loosening.	Sticks only to itself; maintains grip even with sweat and movement.
Skin Comfort and Compliance	It can cause irritation and pain upon removal, especially in sensitive skin.	Skin-friendly; no adhesive-related irritation; painless to remove.
Application Ease	Quick and easy to apply; minimal skill required.	Requires careful wrapping; more time and skill needed.
Functionality and Applications	Best for wound dressing where skin adhesion is needed.	Ideal for joint support, compression, and use on hairy/sensitive areas.
Durability and Reusability	Single use: adhesion lost after removal.	May be reusable if clean and intact; depends on product.

6. Challenges and Limitations

Several challenges have been identified in the application of self-adhesive and cohesive bandages across clinical and athletic contexts. Material limitations remain a concern, particularly in relation to skin compatibility and the risk of irritation in sensitive populations [22]. Self-adhesive bandages demonstrate reduced adhesion under conditions of

perspiration or high humidity, which restricts their effectiveness during prolonged physical activity or in moist environments [23]. Cohesive bandages, while free of direct skin adhesion, require careful application to achieve consistent pressure, which may reduce efficiency in urgent care situations [24]. Clinical barriers have also been noted, including difficulties in balancing secure fixation with patient comfort [25]. Regulatory challenges relate to the absence of standardized evaluation criteria for performance under diverse environmental and patient conditions [26]. Furthermore, gaps in research remain, particularly regarding comparative long-term outcomes in heterogeneous patient groups and the impact of new adhesive and cohesive materials on skin health and treatment efficacy [27].

7. Future Perspectives

Bandage technology improvements are expected to provide measures of comfort, safety, and therapeutic efficacy for the patients. The new materials will come from such sources as the hypoallergenic adhesives, the latex-free cohesive wraps, the advanced textile composites, and the smart fabrics that will be able to guarantee better adhesion, pressure distribution and skin compatibility. However, this review does not include direct evaluation of smart bandages or sensor-integrated systems, but the emerging literature indicates that these technologies could improve future bandage performance by means of adaptive compression monitoring and real-time skin condition assessment. These concepts are presented here as prospective directions rather than evaluated technologies within the current review. The inclusion of wearable sensors has been suggested to allow the continuous evaluation of compression, joint security, or wound healing, thus possibly leading to the creation of adaptable bandaging systems. Future studies should give priority to the development of universal testing methods, measurement of long-term results in a quantitative way, and the conduct of research comparing different patient groups and activity settings. The performance of new materials should be tested in actual clinical scenarios to confirm the efficacy and to update the guidelines with evidence-based practices. The joining of material breakthroughs, intelligent technologies, and thorough assessment is expected not only to improve the therapeutic results but also to reduce the side effects and mistakes associated with skin irritation and application, hence providing better care both in clinics and during sports.

8. Conclusion

Self-adhesive and cohesive bandages are recognized as technologies that support each other in the fields of wound care and sports medicine. Self-adhesive bandages have been shown to have the best fixation properties when it comes to securing dressings; nevertheless, their effectiveness has been proved to diminish in the presence of moisture, and the risk of irritation for sensitive skin has been mentioned. On the other hand, cohesive bandages have been certified to offer continuous pressure and comfort without direct attachment to the skin, thus making them good for people with skin conditions or during acute sports practice.

As a constant clinical dressing type needs to be decided for achieving therapeutic objectives, skin compatibility, and environmental conditions. From a technological standpoint, the absence of standardized performance metrics and long-term comparative data has been recognized as a major limitation, emphasizing the need for further material optimization and development of evaluation frameworks.

Future research is expected to be diverted towards the advancement of hypoallergenic adhesives, sustainable textile composites, and responsive compression systems. Through such innovations, clinical efficacy, patient safety, and comfort are anticipated to be enhanced, contributing to the next generation of evidence-based bandaging technologies.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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