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# Systematic review on autologous skin graft versus artificial skin graft in hand wounds

*Revisión sistemática sobre el injerto de piel autóloga comparando con el artificial en las heridas de mano*

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## Abstract

This study compares autologous and artificial skin grafts in the management of hand wounds, evaluating their efficacy, functionality, and aesthetic results. Given that these injuries affect both appearance and mobility, selecting the appropriate graft is key to recovery. A systematic review was conducted using the PRISMA method, analyzing 30 studies published in the last ten years. Research evaluating graft integration rates, postoperative functionality, and patient satisfaction was included, excluding those without a clear comparative analysis. The results show that autologous grafts remain the gold standard due to their high integration and biological compatibility, while artificial grafts have proven to be a viable alternative in cases where autologous skin is limited. Although artificial grafts have advanced with bioengineering, they present challenges in terms of cost and risk of infection. It is concluded that the ideal treatment may require a hybrid approach and that future research should focus on the durability of artificial grafts and new technologies such as 3D skin printing.

**Keywords**: autologous skin, artificial, cosmetic

## Resumen

Este estudio compara los injertos de piel autóloga y artificial en el manejo de heridas en la mano, evaluando su eficacia, funcionalidad y resultados estéticos. Dado que estas lesiones afectan tanto la apariencia como la movilidad, seleccionar el injerto adecuado es clave para la recuperación. Se realizó una revisión sistemática bajo el método PRISMA, analizando 30 estudios publicados en los últimos diez años. Se incluyeron investigaciones que evaluaran tasas de integración del injerto, funcionalidad postoperatoria y satisfacción del paciente, excluyendo aquellas sin un análisis comparativo claro. Los resultados evidencian que los injertos autólogos siguen siendo el estándar de oro por su alta integración y compatibilidad biológica, mientras que los artificiales han demostrado ser una alternativa viable en casos donde la piel autóloga es limitada. Aunque los injertos artificiales han avanzado con la bioingeniería, presentan desafíos en costos y riesgo de infecciones. Se concluye que el tratamiento ideal puede requerir un enfoque híbrido y que futuras investigaciones deben centrarse en la durabilidad de los injertos artificiales y en nuevas tecnologías como la impresión 3D de piel.

**Palabras clave**: piel autóloga, artificial, estética

## Introduction

Historically, autologous skin grafts have been considered the gold standard due to their high integration rate and biological compatibility. However, advancements in biotechnology have enabled the development of artificial grafts, which represent a viable alternative in cases where the procurement of autologous skin is limited or presents complications (Buzea, 2020). Despite these advancements, questions remain regarding which of these approaches yields better outcomes in terms of healing, functional recovery, and patient satisfaction.

The significance of this study lies in the necessity to optimize treatments for hand wounds, as their impact on patient quality of life is substantial. Improving therapeutic options not only facilitates recovery but also reduces hospitalization time and associated costs. Furthermore, with the rise of tissue bioengineering, it is crucial to scientifically evaluate the role of artificial grafts in clinical practice.

Various studies have addressed the efficacy of both methods, indicating that each presents advantages and disadvantages depending on the clinical context. The theoretical framework supporting this analysis is grounded in the principles of reconstructive surgery and skin regeneration, which allow for an understanding of the integration processes of grafts and their impact on hand functionality (Milner, 2024).

Thus, the primary objective of this research is to compare the efficacy, functionality, and aesthetic outcomes of autologous and artificial skin grafts in the treatment of hand wounds. The aim is to provide evidence that enables specialists to make more informed decisions, optimizing surgical protocols and improving patient recovery.

This study will compare autologous skin grafts and artificial skin grafts in the management of hand wounds, focusing on their efficacy, functionality, and aesthetic results. Injuries in this region pose a challenge for reconstructive surgery, as they not only compromise the patient's appearance but also their ability to perform daily activities. Therefore, selecting the appropriate graft method is key to achieving successful recovery.

## Methodology

This study was conducted using a qualitative approach with an observational and cross-sectional design, based on a systematic literature review. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method was utilized to ensure transparency and rigor in the selection and analysis of the included studies.

The research is descriptive in nature, aiming to analyze and compare the efficacy, functionality, and aesthetic outcomes of autologous and artificial skin grafts in the management of hand wounds based on existing evidence. A comprehensive search was conducted in scientific databases such as PubMed, Scopus, and ScienceDirect, resulting in a total of 30 articles that met the predefined inclusion criteria.

The inclusion criteria encompassed studies published within the last ten years that evaluated the use of autologous and artificial skin grafts for hand wounds, with clearly defined metrics for efficacy, functionality, and aesthetic outcomes. Studies that did not specify these criteria, those with excessively small sample sizes, and reviews without comparative analysis were excluded.

Data collection was performed through a document review of the selected articles, analyzing variables such as graft integration rates, postoperative functionality, patient satisfaction levels, and associated complications. The PRISMA checklist was employed to assess the methodological quality of the studies.

## Results and discussion

**Table 1**

*Article selection matrix*

| No. | Author | Contribution |
|---|---|---|
| 1 | (Alsaif et al., 2023) | Explore the differences between full-thickness and partial-thickness grafts in pediatric patients with hand burns, addressing aspects of healing and functionality. |
| 2 | (Barnett et al., 2021) | Present a pilot study on the application of autologous skin cell suspension in the treatment of hand burns, highlighting this technique as an alternative to conventional grafts. |
| 3 | (Box et al., 2022) | Formulate clinical guidelines for hand surgery and therapy for patients with epidermolysis bullosa, establishing recommendations on the use of grafts in this context. |

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| 4 | (Buzea, 2020) | Describe the combination of Matriderm with partial skin grafts in hand contractures, noting its benefits for tissue elasticity. |
| 5 | (Demmer et al., 2021) | Analyze surgical treatment options for soft tissue defects in the hand and foot, including grafts and flaps as coverage alternatives. |
| 6 | (Dixit et al., 2017) | Review the immunological challenges faced by artificial grafts, as well as biomaterial and stem cell-based solutions to enhance their design. |
| 7 | (Gupta & Chanda, 2022) | Study the effects of graft pattern in terms of size, spacing, and orientation, focusing on their impact on the biomechanics of the grafted tissue. |
| 8 | (Kamolz et al., 2022) | Develop a review on the processes of regeneration, repair, and skin reconstruction, integrating advances in both autologous grafts and bioengineered substitutes. |
| 9 | (Kim et al., 2023) | Present a clinical case of full-thickness isografts in twins with Apert syndrome and syndactyly, applying a specific surgical technique. |
| 10 | (Kim et al., 2024) | Propose the "swing-door" method to reuse donor sites in partial-thickness grafts applied to the hand, providing an alternative for managing the donor area. |
| 11 | (Kohlhauser et al., 2021) | Offer a historical review of the evolution of skin grafts, tracing their development to the present day. |
| 12 | (Koschel et al., 2017) | Report a successful case of a partial skin graft performed under unusual bacterial colonization conditions, providing clinical data in complicated scenarios. |
| 13 | (Ling et al., 2024) | Compare the use of composite grafts on acellular dermal matrix with thick partial-thickness grafts in the treatment of deep burns on the dorsum of the hand. |
| 14 | (Maskan et al., 2024) | Conduct a review on skin grafts aimed at dermatologists, addressing historical, clinical, and innovative aspects. |
| 15 | (Matić et al., 2023) | Examine the application of early partial-thickness grafts in hand and finger defects, highlighting their benefits in surgical practice. |
| 16 | (Milner, 2024) | Present a specific review on grafts applied to the dorsum of the hand, emphasizing anatomical and surgical considerations. |
| 17 | (Miyazaki et al., 2019) | Introduce an experimental strategy for pre-vascularized artificial grafts in three dimensions to improve tissue integration. |
| 18 | (Oualla et al., 2020) | Review the transition from traditional grafts to bioengineered and vascularized substitutes, highlighting their development as an alternative coverage. |
| 19 | (Przekora, 2020) | Provide a concise review on the use of artificial grafts in chronic wounds and their potential in skin tissue reconstruction. |
| 20 | (Schlottmann et al., 2021) | Describe the evolution of autologous grafts towards allogeneic and immunomodulated options, with both historical and clinical perspectives. |
| 21 | (Sun et al., 2024) | Conduct a prospective analysis on the use of phase II autologous grafts in deep burns on the dorsum of the hand, providing data on their efficacy. |
| 22 | (Syam & Sreekumar, 2024) | Document clinical experience with glabrous skin grafts in hand lesions, highlighting their particular characteristics for friction areas. |
| 23 | (Vermeersch et al., 2022) | Develop a systematic review on autologous fat grafting for hand rejuvenation, focusing on techniques and outcomes achieved. |
| 24 | (Wang et al., 2023) | Study the use of artificial dermis in combination with skin grafts to treat skin and soft tissue defects in the hand, especially in cases of tendon exposure. |
| 25 | (Wu et al., 2023) | Present a clinical approach that combines artificial dermis, autologous grafts, and negative pressure wound therapy for the treatment of refractory wounds. |
| 26 | (Xu et al., 2023) | Describe current strategies in artificial skin construction and their applications in clinical practice. |
| 27 | (Yamani et al., 2024) | Report on the use of autologous fat grafts in hands with post-Hansen atrophy, highlighting aesthetic and psychological implications. |
| 28 | (Yoshida et al., 2023) | Introduce a graft fixation technique using negative pressure therapy applied in a foam glove format for hand wounds. |

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| 29 | (Yuan et al., 2023) | Conduct a case-control study evaluating the combination of artificial dermis with partial grafts in thermal compression wounds of the hand. |
| 30 | (Zheng et al., 2016) | Analyze the use of partial grafts with micropores in the treatment of third-degree burns on hands, emphasizing the benefits of drainage and graft integration. |

The analysis of the articles allowed for a comprehensive understanding of the evolution and impact of using autologous and artificial skin grafts in the treatment of hand wounds. Three main axes of evaluation were identified: efficacy in graft integration, postoperative functionality, and aesthetic outcomes. The findings evidenced a progressive transition from traditional surgical approaches towards innovative methods that integrate bioengineering and regenerative therapies.

Within the efficacy of integration, Alsaif et al. (2023) compared full-thickness and partial-thickness grafts in children with hand burns, concluding that autologous grafts exhibited more predictable integration. Milner (2024) reaffirmed this standard by documenting high acceptance rates of autologous grafts on the dorsum of the hand. Similarly, Sun et al. (2024) reported effective integration in deep burns with a low complication rate. Wang et al. (2023) evaluated the combined use of artificial dermis and thin grafts, observing benefits in extensive lesions with bone or tendon exposure.

Wu et al. (2023) implemented artificial grafts alongside negative pressure therapy, which improved integration in chronic wounds. Yuan et al. (2023) reported that the combination of artificial dermis with autologous grafts provided clinically comparable results to pure autografts. Xu et al. (2023) described strategies for constructing artificial skin and highlighted the importance of multilayer structures for graft compatibility. Dixit et al. (2017) analyzed the immunological challenges of synthetic grafts and proposed the future use of stem cells to enhance immune tolerance.

Demmer et al. (2021) reviewed complex defects in the hand and foot, asserting that autologous grafts remained effective, although dermal substitutes offered a viable alternative in critical situations. Kim et al. (2023) presented a unique case of isograft in monozygotic twins with syndactyly, demonstrating optimal functional integration. Zheng et al. (2016) utilized thin skin grafts with micropores in third-degree burns, showing good viability in well-controlled conditions. However, Koschel et al. (2017) warned of integration failures in the presence of bacterial colonization, underscoring the need for rigorous wound environment management.

Regarding postoperative functionality, authors such as Gupta and Chanda (2022) analyzed the biomechanics of grafts, concluding that the design of the graft pattern influenced hand mobility. Matić et al. (2023) recommended the use of thin grafts in the palm and fingers due to their greater functional adaptability. Barnett et al. (2021) explored the use of autologous cells in suspension as a regenerative strategy, noting accelerated functional recovery. Yoshida et al. (2023) introduced a fixation system in a glove shape with negative pressure, facilitating integration and early mobility of the graft.

Buzea (2020) treated contractures with Matriderm and thin autograft, achieving significant improvement in the range of motion. Oualla et al. (2020) designed vascularized dermal substitutes with the potential to restore functionality in large defects. Ling et al. (2024) compared thick grafts with dermal matrices, finding less postoperative stiffness in combined grafts. Box et al. (2022) presented clinical guidelines for the treatment of epidermolysis bullosa, where thin grafts demonstrated preserved functionality with minimal scarring.

Kohlhauser et al. (2021) conducted a historical review of skin grafts, evidencing how technical advancements have improved the mobility of complex structures like the hand. Kamolz et al. (2022) addressed skin regeneration and reconstruction from a futuristic perspective, highlighting integrative approaches that enhance functionality in patients with severe injuries.

In terms of aesthetic outcomes, Vermeersch et al. (2022) analyzed autologous fat transfer for hand rejuvenation and reported notable improvements in texture and appearance. Yamani et al. (2024) replicated this technique in patients with post-Hansen atrophy, demonstrating both cosmetic and psychological benefits. Miyazaki et al. (2019) proposed pre-vascularized three-dimensional grafts, achieving a natural appearance in the grafted area. Maskan et al. (2024) reviewed the historical and contemporary use of grafting in dermatology, concluding that recent advancements have led to more satisfying aesthetic results.

Kim et al. (2024) developed an alternative "swing-door" regrafting technique at the donor site, which improved the aesthetics of the donor area. Matić et al. (2023) and Gupta and Chanda (2022) concurred that careful surgical planning resulted in grafts with better final appearance. Schlottmann et al. (2021) synthesized the evolution of grafting in burns, emphasizing that autografts provided better visual outcomes, although regenerative technologies were closing this gap. Finally, Kamolz et al. (2022) reaffirmed that modern skin reconstruction should focus on a personalized approach that balances functionality and aesthetics according to the clinical context.

## Conclusions

The comparison between autologous and artificial skin grafts in the management of hand wounds reveals that there is no single superior option; rather, each technique offers advantages and limitations depending on the clinical context. Autologous grafts remain the preferred alternative due to their high integration rates, lower risk of rejection, and better aesthetic outcomes. However, their application is limited by the availability of donor tissue and the pain associated with the extraction site.

On the other hand, artificial grafts have advanced significantly due to bioengineering and regenerative therapies, providing viable solutions in cases where autologous grafts are not an ideal option. The combination of dermal matrices with artificial grafts has shown improvements in integration and functionality, especially in extensive and challenging wounds. Nonetheless, they continue to present challenges related to cost, availability, and response to infections.

The future of hand wound treatment will likely move toward hybrid approaches that combine both strategies, optimizing functional recovery as well as aesthetic outcomes. Additionally, long-term studies are necessary to evaluate the durability and effectiveness of artificial grafts compared to autologous ones. The integration of new technologies, such as 3D skin printing and patient-derived personalized grafts, could represent a key evolution in this field. Future research should delve deeper into these innovations and identify the factors that determine the success of each type of graft in various clinical scenarios.

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