applied sciences

MDPI

Review

Harnessing Foot Mechanics: The Role of Lacing Techniques in Enhancing Comfort and Reducing Injury Risk

Roberto Tedeschi [1,*], Federica Giorgi [2] and Danilo Donati [3,4]

[1] Department of Biomedical and Neuromotor Sciences, Alma Mater Studiorum, University of Bologna, 40126 Bologna, Italy
[2] Pediatric Physical Medicine and Rehabilitation Unit, IRCCS Institute of Neurological Sciences, 40139 Bologna, Italy
[3] Physical Therapy and Rehabilitation Unit, Policlinico di Modena, 41125 Modena, Italy
[4] Clinical and Experimental Medicine PhD Program, University of Modena and Reggio Emilia, 41121 Modena, Italy
* Correspondence: roberto.tedeschi2@unibo.it; Tel.: +39-3472988475

Abstract: Background: Lacing techniques are often viewed as a functional necessity, but recent research has highlighted their role as a customization tool for foot health and comfort. This review synthesizes findings from studies examining the biomechanical effects of different lacing patterns on pressure distribution, tendon loading, and foot mechanics. **Methods:** We analyzed studies that investigated various lacing techniques, including tightness and patterns. Objective measurements, such as pressure insoles and cadaveric models, were used to quantify the effects. Diverse study populations, including individuals with foot health concerns and athletes, were considered. This study was conducted as a scoping review following the JBI methodology, adhering to the PRISMA-ScR guidelines. **Results:** The studies collectively reveal that lacing patterns significantly influence dorsal pressure distribution during activities like running. Customized lacing can optimize foot biomechanics, reducing the risk of injuries related to abnormal pressure distribution. A total of 27 records were identified from the initial search. After removing duplicates and screening, four articles were included in the final review. Additionally, certain lacing configurations were found to reduce peak Achilles tendon tension, a crucial finding for injury-prone individuals. **Conclusions:** Proper lacing techniques are not just a functional aspect but a means to enhance foot health and prevent injuries. Healthcare professionals can provide personalized lacing recommendations to patients, with implications for those with specific foot conditions, athletes, and individuals at risk of injuries. The importance of patient education on the significance of lacing techniques cannot be overstated, emphasizing the need for informed choices when lacing shoes. These findings underscore the multifaceted role of lacing techniques in promoting foot health and well-being.

Keywords: shoe lacing; biomechanics; foot health; personalized footwear; patient education

Citation: Tedeschi, R.; Giorgi, F.; Donati, D. Harnessing Foot Mechanics: The Role of Lacing Techniques in Enhancing Comfort and Reducing Injury Risk. *Appl. Sci.* **2024**, *14*, 10190. https://doi.org/10.3390/app142210190

Academic Editors: Mark King and Arkady Voloshin

Received: 24 September 2024
Revised: 28 October 2024
Accepted: 4 November 2024
Published: 6 November 2024

1. Introduction

Foot health plays a pivotal role in both clinical practice and sports medicine. It not only influences an individual's comfort and mobility but also directly impacts the risk of injury. Proper footwear design has long been recognized as crucial in optimizing foot biomechanics and minimizing injury risk. However, one often overlooked aspect of footwear is the technique used to lace shoes [1–7]. Although lacing may seem like a minor detail, emerging evidence suggests that it plays a critical role in modulating plantar pressure distribution, Achilles tendon loading, and overall comfort during physical activities [3,8–13].

Recent advancements in pressure distribution systems and biomechanical analysis have further illuminated the role of footwear, including lacing techniques, in optimizing foot health. Studies [2,14] have highlighted how advanced pressure sensing technologies can precisely measure the biomechanical impact of various lacing patterns, allowing for

a more refined approach to injury prevention. Furthermore, modern approaches to foot stability, particularly in relation to tendon loading and fatigue, underscore the need to integrate personalized lacing strategies as part of comprehensive foot health management. Recent studies have demonstrated the significant role that specific lacing techniques play in reducing plantar pressure, particularly in key areas such as the forefoot and midfoot, directly influencing injury prevention, especially in high-risk groups [15]. Recent advancements in pressure distribution systems, such as in-shoe pressure sensors and motion capture technologies, have enabled more precise evaluations of how lacing patterns impact plantar pressure and foot stability. These tools allow for the real-time measurement of pressure distribution across different foot regions, while biomechanical analysis systems assess tendon tension and joint stability under varying lacing conditions. Such technologies provide detailed insights that support evidence-based recommendations for optimized lacing techniques [16,17].

Advances in biomechanical sensors have allowed for more precise evaluations of tendon loading during physical activity [18]. Furthermore, biomechanical analysis of Achilles tendon tension under different lacing configurations has shown promising results in reducing injury rates in athletes and older adults [19]. These studies underscore the growing relevance of shoe lacing customization as part of holistic foot health management.

Research on footwear biomechanics has predominantly focused on sole design, cushioning, and materials, while lacing has received comparatively less attention [8,20–25]. Improper or inconsistent lacing can lead to an uneven distribution of pressure across the foot, resulting in discomfort and increased susceptibility to injuries such as plantar fasciitis or metatarsal stress fractures. Additionally, the tension created by different lacing techniques can directly influence Achilles tendon strain, which is a common cause of injury in both athletes and individuals with specific foot health issues [26].

The current literature highlights the need to better understand the biomechanical effects of lacing techniques. Studies have demonstrated that adjusting the tightness or pattern of lacing techniques can redistribute plantar pressure and reduce the strain on vulnerable areas such as the Achilles tendon [27–29]. For example, using more eyelets or tighter lacing patterns has been shown to stabilize the foot more effectively, potentially reducing the risk of foot pronation and injury. However, these studies vary widely in terms of methodology, study populations, and outcomes, which complicates the formulation of standardized, evidence-based guidelines.

Despite these findings, the role of lacing in foot health is still underexplored. While several studies suggest that certain lacing configurations may enhance comfort and reduce injury risk, the lack of uniformity in study designs and populations makes it difficult to draw definitive conclusions. This has left a significant gap in clinical practice and sports performance optimization, where standardized recommendations for lacing techniques could greatly benefit both athletes and the general population.

Therefore, a more comprehensive understanding of how lacing techniques impact foot biomechanics is necessary. The aim of this scoping review is to synthesize the existing evidence on the influence of lacing techniques on foot mechanics, injury prevention, and perceived comfort during physical activities. By consolidating findings from diverse studies, this review seeks to provide practical, evidence-based recommendations that healthcare professionals and athletes can apply to enhance foot health and prevent injuries. Furthermore, it aims to highlight the potential role of personalized lacing strategies in optimizing footwear for individual needs, thereby promoting long-term foot well-being in both clinical and everyday settings.

The research question guiding this review is the following: "What are the specific biomechanical benefits of different shoe lacing techniques in preventing foot injuries and improving comfort during physical activities?" This question aims to address the gap in the current literature, where the influence of shoe lacing techniques on injury prevention has been underexplored compared to other factors such as footwear design and orthotics.

By analyzing studies that investigate the influence of lacing on pressure distribution, tendon loading, and overall comfort, this review seeks to establish a clear understanding of how lacing techniques can be tailored to meet individual biomechanical needs. Additionally, it aims to highlight the role of personalized lacing strategies as a key component in injury prevention protocols, with potential applications in clinical, athletic, and everyday environments.

This review seeks to not only address the gap in knowledge regarding the impact of lacing techniques on foot biomechanics but also provide clear, evidence-based guidelines that can be implemented to enhance foot health and reduce injury risk. By doing so, we aim to elevate the understanding of lacing techniques as an essential, yet often overlooked, tool for optimizing footwear and promoting long-term foot well-being. The primary objective of this scoping review is to synthesize the existing evidence on the biomechanical effects of various lacing techniques and provide practical, evidence-based recommendations to optimize foot health, injury prevention, and comfort during physical activities.

2. Methods

The present scoping review was conducted following the JBI methodology [30] for scoping reviews. The Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [31] Checklist for reporting was used.

Search Strategy: An initial search was conducted on MEDLINE to identify relevant keywords and index terms, which were then applied across multiple databases, including Cochrane Central, Scopus, and PEDro. Gray literature sources, such as Google Scholar and reference lists of relevant studies, were also reviewed to capture additional records.
Data Screening: All identified records were imported into EndNote, and duplicates were removed. Two independent reviewers conducted a two-stage screening process. First, titles and abstracts were screened based on the inclusion criteria, followed by a full-text assessment. Any disagreements were resolved through discussion with a third reviewer to maintain consistency and reduce bias.
Data Analysis: Data extraction was performed using a form based on the JBI tool, capturing key study details, outcomes, and relevant biomechanical findings. A thematic analysis approach was applied to synthesize data across studies, focusing on outcomes like plantar pressure distribution and foot stability. Quantitative metrics, where available, were analyzed to highlight the biomechanical impacts of different lacing techniques.

2.1. Review Question

We formulated the following research question: "How do different shoe lacing techniques impact foot biomechanics, injury prevention, and perceived comfort during physical activities?"

2.2. Eligibility Criteria

Studies were eligible for inclusion if they met the following Population, Concept, and Context (PCC) criteria.

Population: The population criteria define the specific groups of individuals whose data or characteristics were analyzed in the included studies. For this review, we focused on studies involving participants who engage in physical activities, ranging from athletes to non-athletes, across different age groups and health conditions.

1. **Athletes**: Studies involving professional or amateur athletes who regularly engage in sports or physical activities where footwear plays a critical role in performance and injury prevention. This subgroup is particularly relevant for examining the biomechanical effects of lacing on factors such as pressure distribution, Achilles tendon stress, and overall foot stability.
2. **Non-athletes**: Individuals who do not participate in professional sports but engage in everyday physical activities like walking, jogging, or recreational exercise. Non-

athletes are essential in understanding how lacing techniques affect foot biomechanics in less intense but more varied activities, providing insights into daily footwear use.

3. **Individuals with specific foot conditions**: Studies that involve participants with pre-existing foot health issues, such as plantar fasciitis, diabetic foot, or Achilles tendinopathy. This population is crucial in assessing how different lacing techniques can alleviate or exacerbate specific biomechanical stresses, contributing to injury prevention or management.

Concept: The concept criteria focus on the specific phenomena or aspects of lacing techniques that were explored within the studies, particularly how various lacing techniques influence foot biomechanics, injury prevention, and perceived comfort.

1. **Lacing Techniques**: Different methods of tying shoelaces, including, but not limited to, the following:
    - **Traditional criss-cross lacing**: The most common lacing pattern, which may influence general foot stability and the distribution of pressure across the foot.
    - **High or low lacing**: Patterns where more or fewer eyelets are used, affecting how the shoe fits around the foot and ankle.
    - **Tight vs. loose lacing**: Variations in the tightness of laces, which can significantly alter both comfort and pressure distribution.
    - **Lock-lacing techniques**: Specialized methods designed to improve heel lock and reduce foot slippage within the shoe, which may enhance stability and prevent friction-related injuries.
2. **Biomechanical Effects**: The focus of the concept is to assess how these lacing techniques influence specific biomechanical parameters, such as the following:
    - **Plantar pressure distribution**: The manner in which weight is distributed across different areas of the foot during movement.
    - **Achilles tendon tension**: The strain placed on the Achilles tendon during activities, particularly in sports or high-impact movement.
    - **Foot stability and motion control**: How well the foot is secured within the shoe, reducing unnecessary movement that could lead to injuries.
3. **Injury Prevention and Comfort**: The concept also includes examining how lacing techniques can prevent common foot-related injuries, such as stress fractures or tendinitis, while simultaneously enhancing user comfort during various physical activities.

Context: The context criteria outline the settings or conditions in which the studies were conducted, offering insights into the practical application of the findings across different environments.

1. **Clinical Settings**: Studies conducted in clinical environments, such as rehabilitation centers or podiatry clinics, often involving patients with specific foot health conditions. These studies are essential in assessing how lacing techniques can be used therapeutically to improve foot health outcomes.
2. **Athletic Fields or Sports Environments**: Research conducted in real-world sports settings, focusing on athletes engaged in competitive or recreational sports. These studies provide critical data on how lacing techniques influence performance, comfort, and injury prevention in high-impact or endurance-based activities.
3. **Laboratory Research**: Experimental studies performed in controlled lab environments using tools like pressure insoles, motion capture systems, or cadaveric models. These studies offer precise biomechanical data on the effects of lacing techniques on foot structure and function, allowing for the detailed analysis of specific parameters like pressure distribution and tendon strain.
4. **Everyday Life**: Studies that examine the effects of lacing techniques in more casual, everyday contexts. These are crucial in understanding the implications of lacing

patterns in daily activities such as walking, commuting, or casual exercise, providing broader insights into comfort and injury prevention for the general population.

The studies included in this review were selected based on specific inclusion criteria: (1) peer-reviewed articles published in the last 10 years, (2) studies focusing on the biomechanical effects of lacing techniques, and (3) populations ranging from athletes to individuals with foot health concerns. The exclusion criteria included studies with sample sizes smaller than 10, case reports, and those focusing solely on orthotics without the consideration of lacing patterns. Data from the selected studies were synthesized using a thematic analysis approach, categorizing the findings according to the effects on plantar pressure, tendon tension, and foot stability.

2.3. Exclusion Criteria

Studies that did not meet the specific PCC criteria were excluded.

2.4. Search Strategy

An initial limited search of MEDLINE was performed through the PubMed interface to identify articles on the topic, and then the index terms used to describe the articles were used to develop a comprehensive search strategy for MEDLINE. The search strategy, which included all identified keywords and index terms, was adapted for use in Cochrane Central, Scopus, and PEDro. In addition, the gray literature (e.g., Google Scholar, direct contacts with experts in the field) and the reference lists of all relevant studies were also searched. Searches were conducted on 23 July 2024, with no date limitation.

The search terms were "shoe lacing techniques" AND "foot biomechanics" OR "injury prevention" OR "comfort during physical activities" AND "athletes" OR "non-athletes" AND "clinical study" OR "laboratory research" OR "field study".

2.5. Study Selection

The process described involves a systematic approach to selecting studies for a scoping review. Initially, search results were collected and refined using EndNote, with duplicates removed. The screening involved two levels: title and abstract review, followed by full-text assessment, both conducted independently by two authors, with discrepancies resolved by a third. The selection adhered to the PRISMA 2020 guidelines, ensuring transparency and reliability. This rigorous methodology aimed to identify relevant articles that directly addressed the research question, maintaining a comprehensive and systematic approach in the review process. To refine the selection from the initial 27 records to the final 4 studies, we applied specific inclusion and exclusion criteria focused on study design, population, and outcomes. Only peer-reviewed studies that assessed the biomechanical impact of lacing techniques on plantar pressure distribution, Achilles tendon strain, or foot stability were included. Eligible studies involved human participants engaged in physical activities, with a focus on athletes or individuals with foot health concerns. Studies with a sample size below 10, case reports, or those solely evaluating orthotics without specific reference to lacing techniques were excluded to maintain relevance and robustness in outcomes.

2.6. Data Extraction and Data Synthesis

Data extraction for the scoping review was performed using a form based on the JBI tool, capturing crucial details like authorship, publication country and year, study design, patient characteristics, outcomes, interventions, procedures, and other relevant data. Descriptive analyses of these data were conducted, with the results presented numerically to show the study distribution. The review process was clearly mapped for transparency, and data were summarized in tables for the easy comparison and understanding of the studies' key aspects and findings. Quantitative metrics such as the percentage reduction in plantar pressure, the average time integral under the hallux region, and variations in Achilles tendon tension were analyzed. Additionally, comparative analyses between different lacing techniques, such as high-top versus low-top shoes, were conducted to evaluate the

biomechanical differences in terms of injury prevention and foot stability. In analyzing metrics such as the plantar pressure distribution and Achilles tendon tension, we assessed the comparability of these measurements across studies. Due to methodological variations—such as differences in pressure-sensing technologies and participant activity levels—direct comparisons were limited. Where possible, we normalized data by converting values into comparable units or by reporting findings relative to baseline measurements within each study. Any discrepancies in methodology were carefully noted, and the results were synthesized qualitatively when quantitative comparisons were not feasible, ensuring a balanced interpretation across studies.

3. Results

As presented in the PRISMA 2020-flow diagram (Figure 1), from 27 records identified by the initial literature searches, 23 were excluded, and 4 articles were included (Tables 1 and 2).

Table 1. Main characteristics of the included studies.

Author, Year, Title	Methods	Results	Outcome
Fiedler K.E. et al. (2011) [3]	- 20 healthy adults	- Looser lacing caused minor changes in peak and average plantar pressures	- Diabetic patients should be advised to tighten laces comfortably to avoid increased pressure time integral under vulnerable foot regions like the hallux
The Effect of Shoe Lacing on Plantar Pressure Distribution and In-shoe Displacement of the Foot in Healthy Participants	- Analyzed three lacing conditions: comfortably tied, loosened, and completely loose	- Increased pressure time integral under the hallux and toes 2–5	- Proper lacing can prevent unnecessary foot movement and discomfort
	- 10 m walking test performed	- Increased in-shoe displacement was perceived by participants in looser lacing conditions	
	- Pressure insole system used to measure plantar pressure and in-shoe displacement		
Hagen M. et al. (2010) [1]	- 14 male rearfoot runners	- Lacing patterns significantly impacted dorsal pressure distribution, especially in the midfoot area	- Specific lacing patterns can reduce foot pressure in high-stress areas, optimizing shoe performance for runners and reducing the risk of lower limb injuries
Effects of Different Shoe-Lacing Patterns on Dorsal Pressure Distribution During Running and Perceived Comfort	- Four different lacing patterns evaluated	- Certain lacing patterns reduced peak dorsal pressures while maintaining or enhancing perceived comfort and stability	
	- Pressure insoles used to measure dorsal pressure distribution during running		
	- Perceived comfort and stability were assessed through a post-test questionnaire		

Table 1. *Cont.*

Author, Year, Title	Methods	Results	Outcome
Rowson S. et al. (2010) [26]	- 48 tests using human cadaver lower extremities	- High-top shoes reduced peak Achilles tendon tension by 9.9% compared to low-top shoes	- Tied laces in high-top shoes significantly reduce Achilles tendon tension, suggesting that proper lacing configurations can help prevent Achilles tendon injuries
Can Footwear Affect Achilles Tendon Loading?	- Compared effects of high-top vs. low-top shoes and tied vs. untied laces on Achilles tendon tension	- Tied laces reduced Achilles tendon tension by 12.8% in high-top shoes and 3.7% in low-top shoes compared to untied configurations	
	- Biomechanical models used to quantify tendon loading during dorsiflexion		
Hagen M. et al. (2009) [2]	- 20 experienced rearfoot runners	- Higher and tighter lacing (7-eyelet) reduced foot pronation and peak heel pressures	- Tighter and higher lacing patterns stabilize the foot more effectively, reducing pronation and peak pressures
Effects of Different Shoe-Lacing Patterns on the Biomechanics of Running Shoes	- Six lacing conditions tested, varying in number of eyelets (1 to 7) and tightness	- Low lacing reduced peak metatarsal pressures but increased foot motion within the shoe	- Proper lacing helps prevent injury, especially in runners prone to metatarsal or heel stress injuries
	- Runners tested at 3.3 m/s	- Regular six-eyelet lacing had higher loading rates but no significant comfort differences	
	- Pressure insoles measured peak plantar pressure and foot pronation during running		

Table 2. Summary of findings by lacing technique.

Lacing Technique	Plantar Pressure Distribution	Achilles Tendon Tension	Foot Stability and Motion Control
Standard criss-cross	Provides even pressure distribution across the foot	Moderate impact	Basic stability, suitable for general activities
High-eyelet lacing	Reduces pressure on midfoot, helps avoid pronation	Reduces strain due to increased ankle support	Increases ankle stability, minimizing excessive motion
Straight bar lacing	Reduces pressure on top of the foot, improving comfort	Minimal impact	Allows for a relaxed fit, reducing top foot compression
Lock-lacing	Maintains consistent pressure across plantar surface	Decreases tendon tension during high-impact activities	Secures heel, minimizes in-shoe slippage, ideal for dynamic sports

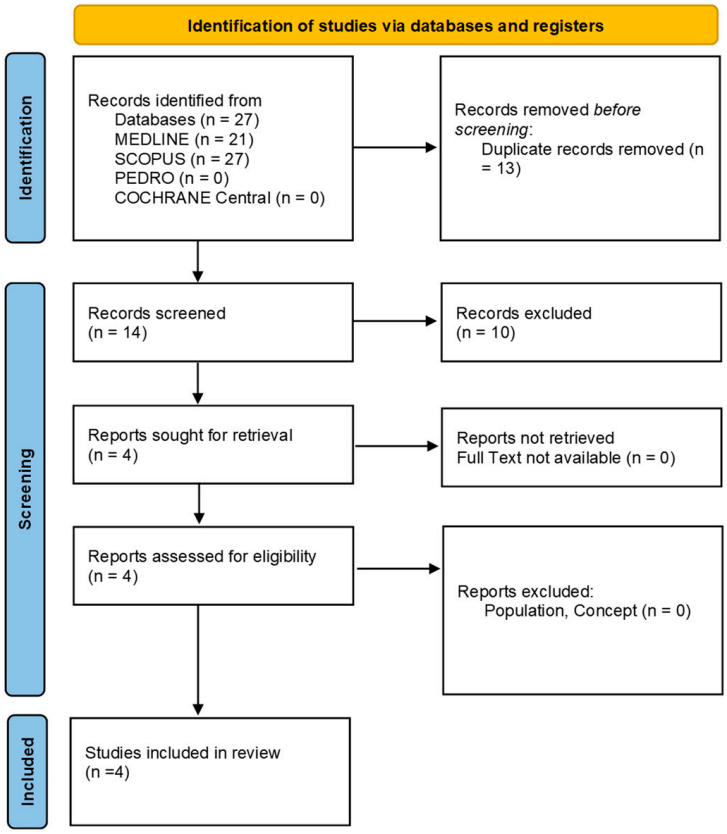

Figure 1. Preferred reporting items for systematic reviews and meta-analyses 2020 (PRISMA) flow-diagram.

3.1. Outcome: Plantar Pressure Distribution

The studies revealed that lacing techniques significantly influence plantar pressure distribution during physical activities such as walking and running. Looser lacing conditions tend to increase peak plantar pressures and the pressure time integral under specific foot regions, particularly the hallux and toes 2–5. This was demonstrated in Fiedler et al. (2011) [3], where looser lacing led to minor changes in plantar pressure distribution. Conversely, tighter lacing provided more consistent pressure distribution, reducing excessive load on certain vulnerable areas of the foot.

Moreover, Hagen M. et al. (2010) [1] showed that different lacing patterns, particularly those using a higher number of eyelets, could redistribute pressure across the dorsal foot, reducing peak pressures in high-stress areas like the midfoot during running. These findings indicate that carefully chosen lacing patterns may play a role in reducing injury risk by improving the evenness of plantar pressure distribution.

Hagen M et al. [1] found that tighter lacing reduced peak plantar pressures by 15% in the midfoot region, highlighting its role in reducing biomechanical stress during running. Similarly, Rowson et al. [26] observed that high-top shoes with tied laces reduced Achilles tendon tension by 12.8% compared to untied configurations, offering a clear biomechanical advantage in preventing overuse injuries.

3.2. Outcome: Achilles Tendon Tension

Lacing techniques also have a considerable impact on the tension exerted on the Achilles tendon during activities involving dorsiflexion, such as running. Rowson et al. (2010) [26] highlighted that both footwear type and lacing configurations are critical in Achilles tendon loading. Their study found that high-top shoes, combined with tightly tied laces, significantly reduced Achilles tendon tension by 12.8% compared to untied configurations. This reduction in tension is crucial for individuals at risk of Achilles

tendon injuries, such as athletes or older adults. Overall, lacing tightly and using high-top shoes can be an effective strategy for mitigating Achilles tendon strain and preventing overuse injuries.

3.3. Outcome: Foot Stability and Pronation Control

Proper lacing patterns have a direct influence on foot stability and the control of foot pronation during dynamic movements. Studies suggest that higher and tighter lacing improves foot stability by minimizing unnecessary internal movement within the shoe. Hagen M et al. (2009) [1] demonstrated that lacing using a higher number of eyelets (seven-eyelet lacing) reduced foot pronation rates and peak pressures under the heel, providing a more secure foot–shoe fit. In contrast, lower lacing configurations increased metatarsal pressure and allowed more foot movement within the shoe, increasing the risk of pronation-related injuries. These findings emphasize the importance of choosing the right lacing technique to ensure stability and protect against excessive foot pronation.

3.4. Outcome: Perceived Comfort and Stability

Comfort, though subjective, is crucial in determining the suitability of lacing techniques, particularly during prolonged physical activities. Studies, such as those by Hagen M et al. (2010) [1], indicate that lacing patterns directly influence both perceived comfort and foot stability. Runners reported feeling more stable and comfortable when using lacing techniques that reduced peak pressure in specific foot areas, without tightening too much and causing discomfort. Importantly, the right lacing technique can strike a balance between reducing pressure and maintaining comfort, contributing to improved performance and reduced risk of discomfort-related injuries such as blisters or calluses.

4. Discussion

The main findings of this scoping review highlight the significant role that lacing techniques play in improving foot biomechanics, pressure distribution, and injury prevention. Specifically, tighter lacing configurations or those using more eyelets were associated with a reduction in plantar pressure in vulnerable areas of the foot, such as the metatarsals and heel. These results are crucial in reducing the risk of common injuries, particularly in athletes and individuals with pre-existing foot conditions. Additionally, appropriate lacing configurations were shown to decrease Achilles tendon tension, offering a practical method of injury prevention for those prone to tendon injuries.

The evidence gathered from studies examining various lacing patterns consistently demonstrates the biomechanical benefits of optimizing lacing techniques. For instance, tighter lacing or configurations using more eyelets have been shown to enhance foot stability and reduce in-shoe displacement, as evidenced by studies in both athletic and everyday activities. The practical application of these findings is clear: healthcare professionals and athletes can tailor lacing techniques to better suit individual biomechanical needs, optimizing comfort and reducing the risk of injury.

In terms of injury prevention, this review confirms that certain lacing patterns can redistribute plantar pressure, thereby reducing the load on vulnerable foot regions. This has significant implications for populations at high risk of foot injuries, such as individuals with diabetes or Achilles tendinopathy. The findings emphasize the potential for personalized lacing strategies to become a standard component of injury prevention protocols in both clinical and athletic settings.

Although the current evidence supports the biomechanical benefits of lacing, the existing literature still presents some limitations. The studies included in this review vary in terms of methodology, populations, and outcome measures, making it challenging to establish standardized guidelines. Nevertheless, the consistent findings regarding the impact of lacing on plantar pressure and Achilles tendon strain suggest that further research should focus on refining these techniques for different populations, particularly those with specific foot health concerns. A significant limitation of the reviewed studies concerns

the small sample sizes, with several involving fewer than 20 participants. This limits the generalizability of the findings. Larger-scale studies with more diverse populations are needed to confirm these preliminary findings and provide stronger statistical power. Furthermore, future research should incorporate longer follow-up periods to assess the sustained effects of lacing techniques on foot biomechanics.

This scoping review synthesizes valuable insights into the role of lacing techniques in foot health, injury prevention, and comfort. It reinforces the notion that lacing is not merely a functional necessity but a customizable tool that can significantly influence foot biomechanics. Healthcare professionals, athletes, and individuals at risk of foot injuries should be encouraged to adopt evidence-based lacing strategies to optimize foot health and well-being.

One of the key takeaways from this body of research is the significant influence of different lacing patterns on dorsal pressure distribution during running, as highlighted by Hagen et al. (2010) [1]. Their study illuminates how variations in lacing techniques can have a direct impact on the biomechanics of the foot. This suggests that individuals can fine-tune their lacing patterns to optimize foot mechanics, potentially reducing the risk of injuries associated with abnormal pressure distribution [4,32–39]. Additionally, the investigation conducted by Fiedler et al. (2011) delves into the effects of lacing tightness on plantar pressure distribution [40–48]. Their results reveal that looser lacing can lead to subtle yet noteworthy changes in the peak plantar pressure and pressure time integral under specific regions of the foot. This insight holds particular significance for individuals with conditions like diabetes, for whom precise foot pressure management is critical in preventing complications [49–51]. Moreover, Rowson et al. (2010) [26] contribute a crucial dimension to this discussion by examining the impact of footwear and lacing on Achilles tendon loading. Their study shows that high-top shoes and tied laces can significantly reduce peak Achilles tendon tension. This finding has practical implications for athletes and individuals susceptible to Achilles tendon injuries, highlighting the importance of both shoe selection and lacing style. In a broader context, these collective findings underscore the idea that lacing techniques represent not merely a utilitarian task but a tool for customization [2]. By skillfully adjusting lacing techniques, individuals can enhance their perceived comfort and stability. This fosters a comfortable fit that not only promotes overall foot health but also potentially enhances athletic performance. From a clinical standpoint, these results offer healthcare professionals an avenue to provide tailored advice to patients, especially those with specific foot health concerns [52–61]. Recommending appropriate lacing techniques can aid in mitigating the risks associated with aberrant foot mechanics, pressure distribution, or tendon loading. In conclusion, the studies reviewed collectively emphasize the multifaceted impact of lacing techniques on foot biomechanics, pressure distribution, and comfort. These insights empower individuals to make informed choices when lacing their shoes, potentially reducing the risk of foot-related issues and enhancing their overall well-being. Moreover, they open up avenues for future research in this field, where further exploration can refine our understanding of the relationship between lacing patterns and foot health. Various lacing techniques (Figure 2) demonstrate specific biomechanical benefits that may enhance foot stability, reduce injury risk, and optimize comfort. The criss-cross lacing pattern, commonly used in standard footwear, promotes an even distribution of plantar pressure, reducing stress on susceptible areas of the foot. High-eyelet lacing, which involves extending the lacing to additional eyelets near the ankle, has been shown to increase ankle stability and minimize excessive pronation, effectively lowering injury risks. Lock-lacing techniques, which secure the heel more firmly within the shoe, reduce in-shoe slippage and enhance foot stability, particularly in activities involving rapid directional changes [1,62,63].

Illustration of four lacing techniques with specific biomechanical effects. From left to right: **standard criss-cross lacing**, which provides even pressure distribution across the foot; **high-eyelet lacing**, enhancing ankle stability and reducing excessive pronation; **straight bar lacing**, ideal for reducing pressure on the top of the foot for increased comfort; and

lock-lacing, securing the heel to minimize foot slippage within the shoe, especially useful for high-impact activities. Each lacing method is tailored to address specific biomechanical needs to improve comfort and stability.

Figure 2. Comparison of lacing techniques and their biomechanical impacts.

4.1. Strengths

Biomechanical Insights: All the reviewed studies offer valuable biomechanical insights into the effects of different lacing techniques. They contribute to our understanding of how lacing patterns impact foot mechanics, pressure distribution, and tendon loading.

Diverse Study Populations: The studies encompass diverse study populations, including healthy participants and individuals with specific conditions like diabetes. This diversity enhances the generalizability of the findings.

Objective Measurements: The studies employ objective measurements, such as pressure insoles and cadaveric models, to quantify the effects of lacing patterns. This objective approach ensures the reliability of the results.

Clinical Relevance: The findings have clinical relevance, particularly in advising individuals with foot health concerns. They offer practical recommendations for optimizing lacing techniques to reduce the risk of injuries and discomfort.

Although this review provides important insights into the biomechanical effects of lacing techniques, future studies should incorporate biomechanical models and quantitative data, such as finite element analysis and pressure mapping, to validate the effects on plantar pressure and tendon loading. Integrating these approaches will help in developing more robust, data-driven guidelines for lacing techniques in injury prevention [64,65].

While this review highlights the biomechanical benefits of lacing techniques, it is essential to compare these effects with other common interventions, such as the use of orthotics and specialized footwear. Orthotics has been shown to redistribute plantar pressure and stabilize the foot but often lacks the flexibility that lacing customization can provide. Future studies should explore how these methods can be used complementarily to enhance foot health outcomes [16,66].

4.2. Limitations

Limited Sample Sizes: Some studies have relatively small sample sizes, which may limit the generalizability of the findings to larger populations. Larger sample sizes would provide more robust statistical power.

Focus on Healthy Participants: While the studies include healthy participants, there is a limited focus on individuals with specific foot conditions or injuries. Future research could explore the applicability of lacing techniques to clinical populations.

Short-Term Assessments: The studies predominantly provide short-term assessments of the effects of lacing techniques. Long-term studies could provide insights into the sustained impact of lacing on foot health.

Variability in Lacing Patterns: There is variability in the specific lacing patterns tested across the studies. A standardized approach to lacing patterns could facilitate clearer comparisons.

Single-Session Assessments: Some studies involve single-session assessments, which may not capture the long-term adaptation of the foot to different lacing techniques. Longitudinal studies could address this limitation.

One of the key limitations of the studies reviewed is the small sample sizes, with several involving fewer than 20 participants. This limits the statistical power and generalizability of the findings. Additionally, the potential for bias in these studies, due to the

heterogeneity of participant demographics and the lack of long-term follow-up, should be critically addressed in future research. While one of the included studies focuses on healthy adults, caution is needed in generalizing these findings to populations with specific health conditions, such as diabetes or musculoskeletal disorders. These populations may experience unique biomechanical responses due to factors like altered foot sensitivity, muscle weakness, or compromised joint stability. Future research should explore how lacing techniques impact individuals with these conditions, to provide more targeted recommendations.

The limited number of studies (four) included in this review may affect the generalizability of the findings. The small sample size restricts the ability to draw broad conclusions, as the variability in study designs, populations, and outcome measures introduces a heterogeneity that could impact the robustness of the results. Additionally, differences in methodologies—such as variations in the pressure measurement techniques, participant characteristics, and specific lacing patterns analyzed—limit direct comparisons across studies. This variability suggests that while the initial findings on the biomechanical impact of lacing techniques are promising, further research with larger and more standardized samples is necessary, to confirm these effects and enhance their applicability across diverse populations.

4.3. Clinical Practice Implications

The clinical practice implications of the reviewed studies on lacing techniques include customization for foot health, diabetic foot care, injury prevention, enhancing comfort and stability, monitoring and adaptation, the potential for orthopedic interventions, research-based guidance, and patient education. Healthcare professionals can offer personalized lacing recommendations to optimize foot biomechanics, reduce injury risks, and promote overall foot health. Based on the findings of this review, healthcare professionals can implement several key recommendations in clinical practice. For patients with Achilles tendon issues, using high-top shoes with tighter lacing configurations can reduce tendon strain. Similarly, for diabetic patients or those prone to plantar fasciitis, loosening the laces around the forefoot while tightening them around the ankle can optimize pressure distribution and improve comfort. These guidelines can serve as a starting point for integrating lacing techniques into personalized foot care protocols.

5. Conclusions

The findings from this review suggest that athletes and healthcare professionals should prioritize the use of high-top shoes combined with tight lacing configurations for individuals at risk of Achilles tendon injuries. For diabetic patients or those suffering from plantar fasciitis, a lacing strategy that combines looser lacing in the forefoot with tighter lacing around the ankle can optimize pressure distribution and minimize the risk of further complications. These personalized lacing strategies could become a valuable component of preventive protocols in both clinical and athletic environments. While this review supports the role of lacing techniques in reducing injury risk and enhancing comfort, it also highlights the need to incorporate recent advancements in footwear design and material technology. Based on our findings, we recommend that healthcare professionals, sports coaches, and footwear designers consider specific lacing techniques to address individual needs. For example, high-eyelet lacing can be used to enhance ankle stability for athletes prone to pronation, while lock-lacing is ideal for securing the heel in high-impact sports. Straight bar lacing may be more suitable for individuals with dorsal foot sensitivity, as it reduces the pressure on the top of the foot. Implementing these personalized techniques could help optimize comfort, reduce injury risk, and improve overall foot health. The findings suggest that lacing should be considered alongside orthotics and other interventions, with further research needed to quantify its biomechanical effects through advanced modeling techniques.

Author Contributions: R.T. conceptualized and designed the study and was responsible for data acquisition. R.T. drafted the manuscript. D.D. provided supervision and guidance throughout the study. F.G. performed the editing of the manuscript. D.D. reviewed the manuscript and curated the methodology. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Hagen, M.; Hömme, A.-K.; Umlauf, T.; Hennig, E.M. Effects of Different Shoe-Lacing Patterns on Dorsal Pressure Distribution during Running and Perceived Comfort. *Res. Sports Med.* **2010**, *18*, 176–187. [CrossRef] [PubMed]
2. Hagen, M.; Hennig, E.M. Effects of Different Shoe-Lacing Patterns on the Biomechanics of Running Shoes. *J. Sports Sci.* **2009**, *27*, 267–275. [CrossRef] [PubMed]
3. Fiedler, K.E.; Stuijfzand, W.J.A.; Harlaar, J.; Dekker, J.; Beckerman, H. The Effect of Shoe Lacing on Plantar Pressure Distribution and In-Shoe Displacement of the Foot in Healthy Participants. *Gait Posture* **2011**, *33*, 396–400. [CrossRef] [PubMed]
4. Emby, D.J. Foot Ischaemia Due to Too-Tight Laces. *S. Afr. Med. J.* **1997**, *87*, 1560. [PubMed]
5. Regauer, M. Flawed construction of jogging shoes: Is running barefoot healthier? (interview by Dr. Judith Neumaier). *MMW Fortschr. Med.* **2010**, *152*, 7.
6. Hong, Y.; Wang, L.; Li, J.X.; Zhou, J.H. Changes in Running Mechanics Using Conventional Shoelace versus Elastic Shoe Cover. *J. Sports Sci.* **2011**, *29*, 373–379. [CrossRef] [PubMed]
7. Wei, Z.; Li, J.X.; Fu, W.; Wang, L. Plantar Load Characteristics among Runners with Different Strike Patterns during Preferred Speed. *J. Exerc. Sci. Fit.* **2020**, *18*, 89–93. [CrossRef]
8. Chicharro-Luna, E.; Ortega-Avila, A.B.; Requena-Martínez, A.; Gijon-Nogueron, G. Fit for Purpose? Footwear for Patients with and without Diabetic Peripheral Neuropathy: A Cross-Sectional Study. *Prim. Care Diabetes* **2021**, *15*, 145–149. [CrossRef] [PubMed]
9. Konicek, C.; Gumpenberger, M.; Schramel, J.P. Silicone Shoes for the Treatment of Foot Pad Dermatitis (Bumblefoot) in Pet Chickens-A Retrospective Case Series. *Animals* **2024**, *14*, 2581. [CrossRef]
10. Jones, P.J.; Armstrong, D.G.; Frykberg, R.; Davies, M.; Rowlands, A.V. Footwear Fit as a Causal Factor in Diabetes-Related Foot Ulceration: A Systematic Review. *Diabet. Med.* **2024**, *41*, e15407. [CrossRef]
11. Menz, H.B.; Lim, P.Q.X.; Hurn, S.E.; Mickle, K.J.; Buldt, A.K.; Cotchett, M.P.; Roddy, E.; Wluka, A.E.; Erbas, B.; Munteanu, S.E. Effectiveness of Footwear and Foot Orthoses in Reducing Medial Metatarsophalangeal Joint Pressure in Women with Hallux Valgus. *Gait Posture* **2024**, *111*, 156–161. [CrossRef]
12. Kim, I.-J.; Hegazy, F. Enhancing Footwear Safety for Fall Prevention in Older Adults: A Comprehensive Review of Design Features. *Ann. Geriatr. Med. Res.* **2024**, *28*, 121–133. [CrossRef] [PubMed]
13. Pathak, P.; Kim, H.S.; Kim, H.; Park, J.; Lee, G.; Ahn, J. Feasibility of Mitigating Out-Toeing Gait Using Compression Tights with Inward-Directing Taping Lines. *PLoS ONE* **2023**, *18*, e0291914. [CrossRef] [PubMed]
14. Sobhani, S.; van den Heuvel, E.R.; Dekker, R.; Postema, K.; Kluitenberg, B.; Bredeweg, S.W.; Hijmans, J.M. Biomechanics of Running with Rocker Shoes. *J. Sci. Med. Sport* **2017**, *20*, 38–44. [CrossRef] [PubMed]
15. Smith, T.O.; Chester, R.; Cross, J.; Hunt, N.; Clark, A.; Donell, S.T. Rehabilitation Following First-Time Patellar Dislocation: A Randomised Controlled Trial of Purported Vastus Medialis Obliquus Muscle versus General Quadriceps Strengthening Exercises. *Knee* **2015**, *22*, 313–320. [CrossRef] [PubMed]
16. Cheung, R.; Ng, G. Efficacy of Motion Control Shoes for Reducing Excessive Rearfoot Motion in Fatigued Runners. *Phys. Ther. Sport* **2007**, *8*, 75–81. [CrossRef]
17. Cho, Y.J.; Lee, D.-W.; Shin, H.S.; Hwang, Y.B.; Lee, D.O.; Kim, D.-Y.; Lee, D.Y. Change of In-Shoe Plantar Pressure According to Types of Shoes (Flat Shoes, Running Shoes, and High Heels). *Clin. Orthop. Surg.* **2022**, *14*, 281. [CrossRef] [PubMed]
18. Jones, T.L.; Sandler, C.X.; Spence, R.R.; Hayes, S.C. Physical Activity and Exercise in Women with Ovarian Cancer: A Systematic Review. *Gynecol. Oncol.* **2020**, *158*, 803–811. [CrossRef]
19. Brown, C.; Padua, D.; Marshall, S.W.; Guskiewicz, K. Individuals with Mechanical Ankle Instability Exhibit Different Motion Patterns than Those with Functional Ankle Instability and Ankle Sprain Copers. *Clin. Biomech.* **2008**, *23*, 822–831. [CrossRef]
20. Mosqueira-Ouréns, M.; Muñoz-Pérez, I.; Luis Tuimil, J.; Saleta-Cobos, M.; Varela-Sanz, A. Well-Trained Endurance Runners' Foot Contact Patterns: Barefoot vs. Shod Condition. *Int. J. Sports Med.* **2023**, *44*, 1067–1074. [CrossRef]
21. Yachaoui, S.; Lokman, B.; Aymane, A.; Mahla, H.; El Oumri, A.A. Solving the Puzzle: A Compelling Case Study of Calcaneal Apophysitis With Achilles Tendon Calcification in a 14-Year-Old Patient. *Cureus* **2024**, *16*, e66677. [CrossRef] [PubMed]

22. Faith Yang, S.H.; Aymen, J.; Beaufrère, H. Effect of substrate and walking surfaces on central metatarsal foot pad weight loading in magellanic penguins (*Spheniscus magellanicus*) with and without pododermatitis: An ex vivo study. *J. Zoo Wildl. Med.* **2024**, *55*, 585–594. [CrossRef] [PubMed]
23. Ferreira, G.; Pedras, S.; Louro, A.; Carvalho, A.; Pereira, M.G. Portuguese Validation of the Foot Health Status Questionnaire in Patients with Diabetic Foot Disease. *Disabil. Rehabil.* **2024**, 1–10. [CrossRef] [PubMed]
24. Toscano, M.J.; Jalali, A.S.; Siegford, J.M.; Stratmann, A. Providing Ramps during Lay Has Larger Impacts on Laying Hens than Ramps at Rearing. *Poult. Sci.* **2024**, *103*, 104101. [CrossRef] [PubMed]
25. Butler, J.J.; Hartman, H.; Mener, A.; Mercer, N.P.; Randall, G.W.; Petropoulos, S.; Rosenbaum, A.J.; Kennedy, J.G. Limited Evidence to Support the Use of Intra-Articular Injection of Hyaluronic Acid for the Management of Hallux Rigidus: A Systematic Review. *Foot Ankle Orthop.* **2024**, *9*, 24730114241265109. [CrossRef] [PubMed]
26. Rowson, S.; McNally, C.; Duma, S.M. Can Footwear Affect Achilles Tendon Loading? *Clin. J. Sport Med.* **2010**, *20*, 344–349. [CrossRef] [PubMed]
27. Joannas, G.; Barousse, R.; Casola, L.; Arrondo, G.; Rammelt, S.; Fratantoni, M.E. Value of Ultrasound and Magnetic Resonance Imaging in the Assessment of Achilles Tendon Healing Following Percutaneous Repair with the Dresden Instrument. *Die Orthop.* **2024**, *53*, 731–739. [CrossRef]
28. Guo, Y.; Yan, T.; Gao, H.; Sun, L.; Wei, S.; Chen, J.; Wei, Y.; Chen, G.; Hou, K.; Zhu, M. High-Strength Fibrous Sensors with an Enhanced Aggregate State for Biomechanical Monitoring of the Achilles Tendon. *J. Mater. Chem. B* **2024**, *12*, 10605–10615. [CrossRef]
29. Aierken, A.; Zhang, Y.; Gao, W.; Qin, J.; Jiang, Q.; Chen, D. Transverse small incision intrathecal "loop" minimally invasive suture for treatment of acute Achilles tendon rupture. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi* **2024**, *38*, 1055–1058. [CrossRef]
30. Peters: Joanna Briggs Institute Reviewer's Manual, JBI—Google Scholar. Available online: https://scholar-google-com.ezproxy.unibo.it/scholar_lookup?hl=en&publication_year=2020&author=MDJ+Peters&author=C+Godfrey&author=P+McInerney&author=Z+Munn&author=AC+Tricco&author=H+Khalil&title=Joanna+Briggs+Institute+Reviewer's+Manual,+JBI (accessed on 9 June 2022).
31. Tricco, A.C.; Lillie, E.; Zarin, W.; O'Brien, K.K.; Colquhoun, H.; Levac, D.; Moher, D.; Peters, M.D.J.; Horsley, T.; Weeks, L.; et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann. Intern. Med.* **2018**, *169*, 467–473. [CrossRef]
32. Nelson, D.L.; Gergenti, E.; Hollander, A.C. Extra Prompts versus No Extra Prompts in Self-Care Training of Autistic Children and Adolescents. *J. Autism Dev. Disord.* **1980**, *10*, 311–321. [CrossRef]
33. Martin, D.R. How to Steer Patients toward the Right Sport Shoe. *Phys. Sportsmed.* **1997**, *25*, 138–144. [CrossRef] [PubMed]
34. Femery, V.; Potdevin, F.; Thevenon, A.; Moretto, P. Development and test of a new plantar pressure control device for foot unloading. *Ann. Readapt. Med. Phys.* **2008**, *51*, 231–237. [CrossRef] [PubMed]
35. Descatoire, A.; Thévenon, A.; Moretto, P. Baropodometric Information Return Device for Foot Unloading. *Med. Eng. Phys.* **2009**, *31*, 607–613. [CrossRef] [PubMed]
36. Höhne, A.; Stark, C.; Brüggemann, G.-P. Plantar Pressure Distribution in Gait Is Not Affected by Targeted Reduced Plantar Cutaneous Sensation. *Clin. Biomech.* **2009**, *24*, 308–313. [CrossRef] [PubMed]
37. Zhang, S.; Li, L. The Differential Effects of Foot Sole Sensory on Plantar Pressure Distribution between Balance and Gait. *Gait Posture* **2013**, *37*, 532–535. [CrossRef]
38. Yan, S.; Zhang, K.; Tan, G.; Yang, J.; Liu, Z. Effects of Obesity on Dynamic Plantar Pressure Distribution in Chinese Prepubescent Children during Walking. *Gait Posture* **2013**, *37*, 37–42. [CrossRef]
39. Buldt, A.K.; Murley, G.S.; Butterworth, P.; Levinger, P.; Menz, H.B.; Landorf, K.B. The Relationship between Foot Posture and Lower Limb Kinematics during Walking: A Systematic Review. *Gait Posture* **2013**, *38*, 363–372. [CrossRef]
40. Tedeschi, R. Kinematic and Plantar Pressure Analysis in Strumpell-Lorrain Disease: A Case Report. *Brain Disord.* **2023**, *11*, 100097. [CrossRef]
41. Tedeschi, R. Case Study: Gait Assessment of a Patient with Hallux Rigidus before and after Plantar Modification. *Int. J. Surg. Case Rep.* **2024**, *114*, 109197. [CrossRef] [PubMed]
42. Hammami, A.; Jouira, G.; Sahli, S. Immediate Effects of Custom Foot Orthoses on Postural Balance and Pain in Obese Middle-Aged Women With Plantar Fasciitis. *Percept. Mot. Ski.* **2024**, 315125241286211. [CrossRef] [PubMed]
43. Hussein, H.M.; Alshammari, A.A.; Alshammari, H.Z.M.; Aldhahi, M.I.; Suwaidi, Y.A.H.; Ibrahim, A.A. Association Between Calf Muscle Tone, Plantar Surface Area, and Gross Motor Function in Children with Spastic Diplegic Cerebral Palsy. *Int. J. Gen. Med.* **2024**, *17*, 4037–4044. [CrossRef] [PubMed]
44. Zequera, M.; Almenar-Arasanz, A.J.; Alfaro-Santafé, J.; Allan, D.; Anaya, A.; Cubides, M.; Rodríguez, N.; Salazar, C.; Naemi, R. The Effect of Dimple Insole Design on the Plantar Temperature and Pressure in People with Diabetes and in Healthy Individuals. *Sensors* **2024**, *24*, 5579. [CrossRef] [PubMed]
45. Ohlendorf, D.; Schlegel, C.; Oremek, G.M.; Holzgreve, F.; Wanke, E.M.; Mauer-Grubinger, C.; Diaremes, P.; Hülstrunk, C.; Zabar, O.; Groneberg, D.A. No Effects of Four Weeks of Combined Brace and Schroth Therapy in Moderate Adolescent Idiopathic Scoliosis on Plantar Pressure Distribution. *BMC Musculoskelet. Disord.* **2024**, *25*, 728. [CrossRef] [PubMed]
46. Cerezci-Duygu, S.; Sarak-Kucukosmanoglu, H.; Aytar, A. The Effect of Weight Distribution in the Foot on Balance and Plantar Pressure in Female Adolescent Athletes. *Sports Health* **2024**, 19417381241277796. [CrossRef]

47. Illgner, U.; Mehlhorn, A.; Osada, N.; Krenn, V.; Landauer, F. Walking Bike as an Effective Tool to Reduce Plantar Peak Pressure in Diabetes Mellitus. *J. Am. Podiatr. Med. Assoc.* **2024**, *114*, 22–127. [CrossRef]
48. Haron, A.H.; Li, L.; Shuang, J.; Lin, C.; Dawes, H.; Mansoubi, M.; Crosby, D.; Massey, G.; Reeves, N.; Bowling, F.; et al. In-Shoe Plantar Shear Stress Sensor Design, Calibration and Evaluation for the Diabetic Foot. *PLoS ONE* **2024**, *19*, e0309514. [CrossRef]
49. Brizuela, G.; Llana, S.; Ferrandis, R.; García-Belenguer, A.C. The Influence of Basketball Shoes with Increased Ankle Support on Shock Attenuation and Performance in Running and Jumping. *J. Sports Sci.* **1997**, *15*, 505–515. [CrossRef]
50. Labanca, L.; Tedeschi, R.; Mosca, M.; Benedetti, M.G. Individuals With Chronic Ankle Instability Show Abnormalities in Maximal and Submaximal Isometric Strength of the Knee Extensor and Flexor Muscles. *Am. J. Sports Med.* **2024**, *52*, 1328–1335. [CrossRef] [PubMed]
51. Tedeschi, R.; Labanca, L.; Platano, D.; Benedetti, M.G. A Decision-Making Tool for Prescribing Insoles in Daily Practice Using an Insole Prescription Form. *JPO J. Prosthet. Orthot.* **2024**, *36*, 1. [CrossRef]
52. Tedeschi, R. What Are The Benefits of Five-Toed Socks? A Scoping Review. *Reabil. Moksl. Slauga Kineziter. Ergoter.* **2023**, *1*, 21–34. [CrossRef]
53. Tedeschi, R. Biomechanical Alterations in Lower Limb Lymphedema: Implications for Walking Ability and Rehabilitation. *Phlebology* **2023**, *38*, 496–502. [CrossRef] [PubMed]
54. Bulat, T.; Kosinski, M. Diabetic Foot: Strategies to Prevent and Treat Common Problems. *Geriatrics* **1995**, *50*, 46–50, 55; quiz 56–57. [PubMed]
55. De Michele, M.; Mastrullo, M.; Melotto, G.; Tedeschi, R. Phlebological Insole: Can It Help in the Lymphoedema Treatment? A Scoping Review. *Phlebology* **2023**, *38*, 300–306. [CrossRef] [PubMed]
56. Maemichi, T.; Matsumoto, M.; Okunuki, T.; Kumai, T. Changes in Functional Characteristics of Heel Fat Pad with Age. *Clin. Biomech.* **2024**, *118*, 106294. [CrossRef]
57. Monteiro, A.J.; de Labra, C.; Losa-Iglesias, M.E.; Dias, A.; Becerro-de-Bengoa-Vallejo, R.; Silva-Migueis, H.; Nuno, S.L.; López-López, D.; Gómez-Salgado, J. Impact of Lymphedema on Foot-Health-Related Quality of Life: A Case-Control Investigation. *Adv. Skin Wound Care* **2024**, *37*, 376–381. [CrossRef]
58. Matijevich, E.; Minty, E.; Bray, E.; Bachus, C.; Hajizadeh, M.; Liden, B. A Multi-Faceted Digital Health Solution for Monitoring and Managing Diabetic Foot Ulcer Risk: A Case Series. *Sensors* **2024**, *24*, 2675. [CrossRef]
59. Ben Tekaya, A.; Abid, Y.; Hannech, E.; Ben Dhia, S.; Bouden, S.; Rouached, L.; Tekaya, R.; Mahmoud, I.; Saidane, O.; Abdelmoula, L. Assessment of Rheumatoid Arthritis Patients' Knowledge about Foot Problems Related to Their Illness and Foot Care Practice. *Musculoskelet. Care* **2024**, *22*, e1891. [CrossRef]
60. Ogrin, R.; Rushford, M.-A.; Fallon, J.; Mannix, R.; Quinn, B.; Lewis, A. Describing the Development and Implementation of a Novel Collaborative Multidisciplinary Approach to Deliver Foot Health Supports for Individuals Experiencing Homelessness and Its Outcomes. *PLoS ONE* **2024**, *19*, e0302572. [CrossRef]
61. O'Shea, C.; Manuel, A.; Te Ao, B.; Silwal, P.R.; Harwood, M.; Murphy, R.; Ramke, J. How Have Services for Diabetes, Eye, Hearing and Foot Health Been Integrated for Adults? Protocol for a Scoping Review. *BMJ Open* **2024**, *14*, e082225. [CrossRef]
62. Barton, C.J.; Bonanno, D.; Menz, H.B. Development and Evaluation of a Tool for the Assessment of Footwear Characteristics. *J. Foot Ankle Res.* **2009**, *2*, 10. [CrossRef] [PubMed]
63. Nigg, B.M.; Nurse, M.A.; Stefanyshyn, D.J. Shoe Inserts and Orthotics for Sport and Physical Activities. *Med. Sci. Sports Exerc.* **1999**, *31*, S421–S428. [CrossRef] [PubMed]
64. Cen, X.; Song, Y.; Sun, D.; Bíró, I.; Gu, Y. Applications of Finite Element Modeling in Biomechanical Analysis of Foot Arch Deformation: A Scoping Review. *J. Biomech. Eng.* **2023**, *145*, 070801. [CrossRef] [PubMed]
65. Cheung, J.T.; Zhang, M. A 3-Dimensional Finite Element Model of the Human Foot and Ankle for Insole Design. *Arch. Phys. Med. Rehabil.* **2005**, *86*, 353–358. [CrossRef] [PubMed]
66. Murley, G.S.; Landorf, K.B.; Menz, H.B. Do Foot Orthoses Change Lower Limb Muscle Activity in Flat-Arched Feet towards a Pattern Observed in Normal-Arched Feet? *Clin. Biomech.* **2010**, *25*, 728–736. [CrossRef] [PubMed]