

A Comparative Study of Socket-Type Breathable Mesh Cast Versus Synthetic Cast in Conservative Management of Foot Fractures: Influence of Heel Integrity and Patient Compliance

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Abstract

Introduction: Conservative management of foot fractures commonly involves immobilization using synthetic (fiberglass) casts; however, these are frequently associated with structural failure at high-stress points, particularly the heel, due to repetitive weight-bearing. Although patients are routinely advised to use a plaster shoe to offload pressure, compliance is often inconsistent in real-world settings. This study evaluates whether a socket-type breathable mesh cast offers superior resistance to heel breakdown, even in the presence of variable patient compliance.

Methodology: A prospective comparative study was conducted on 220 patients with foot fractures managed conservatively using below-knee immobilization. Patients were equally divided into two groups:

- Group I: Conventional synthetic cast (n=110)
- Group II: Socket-type breathable mesh cast (n=110)

Patients were categorized as compliant or non-compliant with plaster shoe usage and followed for 4–5 weeks. Outcome measures included heel integrity, cast breakage, need for reinforcement or reapplication, and patient comfort.

Results: Heel breakage in the synthetic cast group was observed in 13% of compliant patients and 50% of non-compliant patients. In contrast, the mesh cast group demonstrated only 2 cases of below-knee cast breakage overall. Overall failure rates were significantly lower in the mesh cast group compared to the synthetic cast group. The breathable mesh cast also demonstrated superior patient comfort and reduced dependence on patient compliance.

Conclusion: Socket-type breathable mesh casts provide a more reliable and durable alternative to conventional synthetic casts in the conservative management of foot fractures. Their ability to maintain structural integrity even in non-compliant patients highlights their potential to reduce complications, improve patient comfort, and enhance overall orthopaedic care outcomes.

Keywords: Foot fractures; Breathable mesh cast; Synthetic cast; Fiberglass cast; Conservative management; Heel breakage; Patient compliance; Below-knee cast; Fracture immobilization; Orthopaedic casting.

Introduction

Foot fractures are commonly treated with conservative immobilization techniques aimed at maintaining alignment and promoting healing. Synthetic (fiberglass) casts are widely used due to their favorable weight and handling characteristics

compared to plaster of Paris [3, 4]. However, despite these advantages, complications such as cast breakage, pressure sores, and skin irritation remain prevalent, particularly at the heel, which is the principal load-bearing region during ambulation [1, 2].

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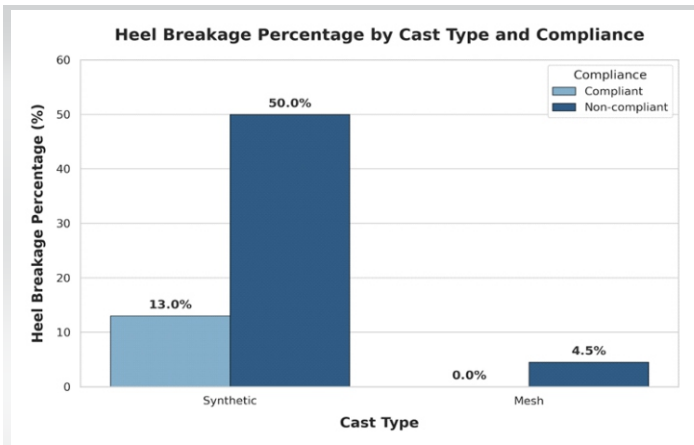


Figure 1: Bar graph comparing heel breakage percentages across groups demonstrates a dramatic increase in failure among non-compliant synthetic cast patients, while only isolated failures are observed in the mesh cast group. The visualization highlights a significant surge in failures within the non-compliant synthetic cast group (50.0%), whereas the mesh cast demonstrates remarkable structural resilience, maintaining exceptionally low breakage rates regardless of patient compliance.

To mitigate these issues, patients are advised to use a plaster shoe to offload heel pressure. However, compliance with this recommendation is often inconsistent, especially in outpatient settings, contributing significantly to cast failure and treatment interruption. Studies have shown that improper load distribution and material limitations can predispose synthetic casts to structural compromise under repetitive stress [5, 6]. Socket-type breathable mesh casts represent an advancement in immobilization technology, combining structural ventilation with improved load distribution. These features aim to enhance both durability and patient comfort. The present study was

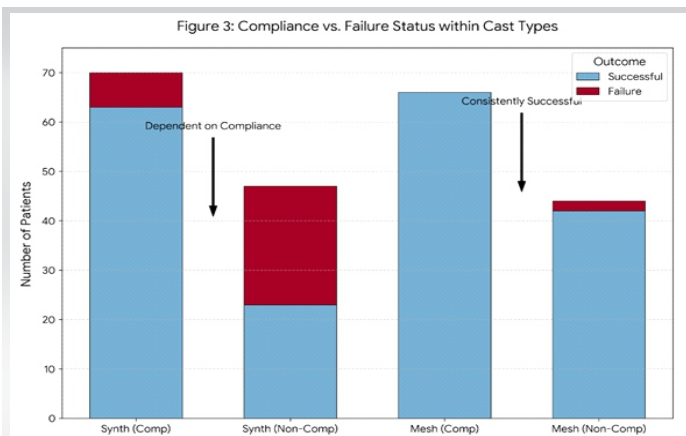


Figure 3: Stacked bar chart illustrating compliance versus failure highlights that synthetic cast performance is highly dependent on compliance, whereas mesh cast performance remains consistently successful regardless of compliance. This visualization highlights how the success rate of Synthetic Casts is strictly dependent on patient compliance (showing a significant rise in failures when patients are non-compliant), whereas Mesh Casts remain consistently successful regardless of compliance levels.

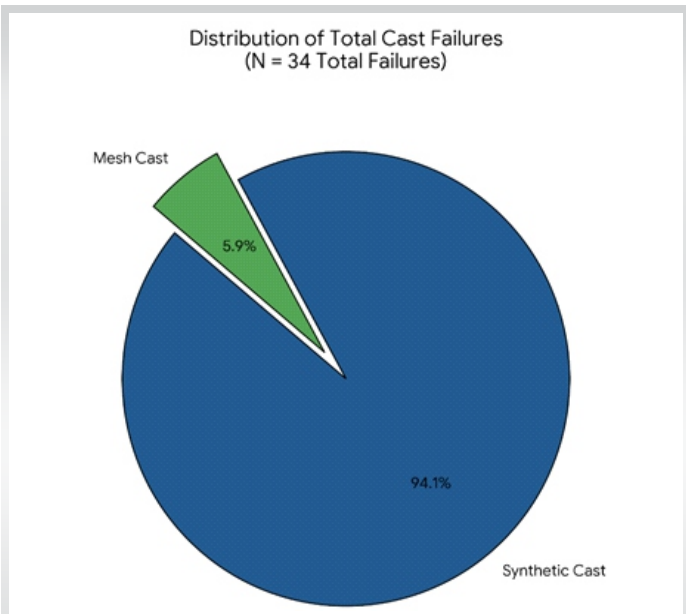


Figure 2: Pie chart showing distribution of total failures indicates that the overwhelming majority of failures occurred in the synthetic cast group. The chart clearly highlights that the overwhelming majority of total clinical failures—94.1% (32 out of 34 instances)—occurred within the synthetic cast group, while the mesh cast group accounts for just a minimal 5.9% (2 instances) of the overall failure pool.

undertaken to compare the performance of synthetic casts and breathable mesh casts, with a specific focus on heel integrity and the influence of patient compliance, including evaluation under real-world conditions where compliance may be suboptimal.

Methods

This prospective comparative study included 220 patients with foot fractures requiring conservative management using below-knee immobilization. Patients were divided into two groups of equal size: Group I (synthetic cast, n=110) and Group II (breathable mesh cast, n=110).

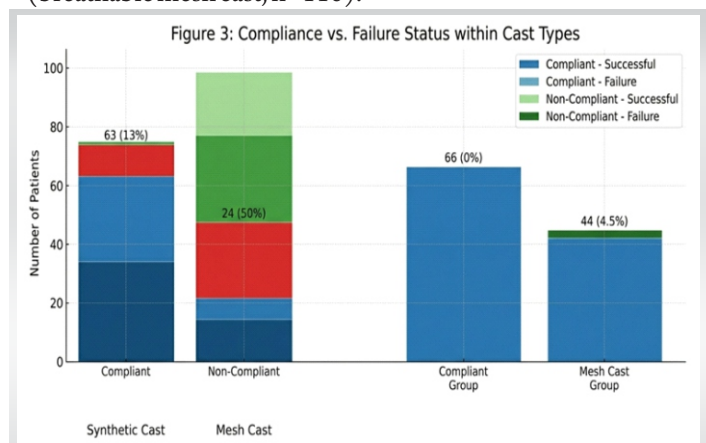


Figure 3: • Synthetic Cast: High dependency. Failure rate jumps from minimal to substantial when patients switch to non-compliant status.
• Mesh Cast: Robust performance. Very few failures are recorded across both Compliant and Non-Compliant cohorts, demonstrating independent structural integrity.



Figure 4: Clinical photograph comparing broken conventional fiberglass cast and broken VENTICAST™ following weight-bearing stress. The fiberglass cast demonstrates significant structural failure and heel collapse, whereas VENTICAST™ maintains superior structural integrity with minimal breakdown under similar conditions.

All patients were instructed to use a plaster shoe during ambulation. Compliance was monitored and patients were categorized into compliant and non-compliant groups. Patients were followed for 4–5 weeks and evaluated for heel breakage, need for reinforcement or reapplication, and patient-reported outcomes such as comfort, sweating, and itching.

Results

Heel Integrity and Breakage

A marked difference in heel integrity was observed between the two groups (Table 1). In the synthetic cast group, heel breakage

occurred in 13% of compliant patients and increased sharply to 50% among non-compliant patients. In contrast, the mesh cast group demonstrated no heel breakage in compliant patients and only 2 cases of breakage among non-compliant patients, indicating substantially superior structural integrity overall (Fig. 1).

Overall Failure Rates

The total failure rate was significantly higher in the synthetic cast group (29.1%) compared to the mesh cast group (1.8%), as shown in Table 2 and Figure 2.

Need for Reinforcement and Reapplication

Synthetic casts frequently required reinforcement or reapplication, particularly in non-compliant patients, whereas the mesh cast group required minimal reinforcement and only occasional reapplication, demonstrating superior durability (Table 3).

- Synthetic Cast: High dependency. Failure rate jumps from minimal to substantial when patients switch to non-compliant status.
- Mesh Cast: Robust performance. Very few failures are recorded across both Compliant and Non-Compliant cohorts, demonstrating independent structural integrity.

Discussion

A key finding of this study is that mesh cast performance remains far less dependent on patient compliance compared to synthetic casts (Fig. 1 and 3). While synthetic casts showed a dramatic increase in failure rates with non-compliance, the mesh cast maintained structural integrity in the overwhelming majority of patients, with only two failures occurring among non-compliant individuals. This suggests that the mesh cast not only improves outcomes but also reduces dependence on patient behavior, which is often unpredictable in real-world settings.

Practical Clinical Relevance

The findings of this study have significant implications for routine orthopaedic practice. The use of socket-type breathable mesh casts can substantially reduce the risk of heel breakage, thereby minimizing the need for reinforcement or reapplication (Tables 1 and 3). This results in fewer follow-up visits, reduced clinical workload, and improved patient satisfaction. The ability to maintain consistent performance irrespective of compliance makes this approach particularly valuable in real-world clinical scenarios.

Table 1: Heel Breakage Comparison Based on Compliance				
Cast Type	Compliance	Total Patients	Heel Breakage (n)	Percentage (%)
Synthetic	Compliant	63	8	13%
Synthetic	Non-compliant	47	24	50%
Mesh	Compliant	66	0	0%
Mesh	Non-compliant	44	2	4.50%

Table 2: Overall Cast Failure Rates

Cast Type	Total Patients	Failures (n)	Failure Rate (%)
Synthetic	110	32	29.10%
Mesh	110	2	1.80%

Strengths and Limitations

This study benefits from a robust sample size and a real-world comparative design incorporating patient compliance as a critical variable. The use of objective endpoints such as heel integrity enhances the reliability of the findings.

However, limitations include a relatively short follow-up period, lack of blinding due to visible differences between casting materials, and partial reliance on patient-reported compliance. Additionally, long-term functional outcomes and fracture healing parameters were not extensively evaluated.

Table 3: Reinforcement and Reapplication Requirements

Cast Type	Reinforcement Needed	Reapplication
Synthetic	High	Frequent
Mesh	Minimal	Rare

Conclusion

The socket-type breathable mesh cast offers a significantly more durable and clinically reliable alternative to synthetic casts in the conservative management of foot fractures. Its ability to markedly reduce heel breakdown, even in non-compliant patients, represents a substantial advancement in casting technology. Adoption of this method has the potential to improve patient outcomes, reduce complications, and enhance efficiency in orthopaedic care delivery.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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