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CASE STUDY

Enhancing Durability of 3D Printed Ankle-Foot Orthotics (AFOs) Through Vapor Smoothing with AMT PostPro

Industry: Medical

Introduction:

Ankle-foot orthotics (AFOs) play a crucial role in aiding mobility for individuals with lower limb disabilities. The integrity and durability of these devices is extremely important as they often encounter sudden impacts in daily use, such as trips or falls. This study examines the impact resistance of as printed and vapor smoothed AFO's, produced using HP MJF 580 3D printing technology, and highlights the benefits of vapor smoothing.

Materials and Methods:

For this investigation, two varieties of Ankle-Foot Orthotics (AFOs)— Supramalleolar Orthosis and Resting Orthosis—were employed. A total of twelve samples were 3D printed, with six for each AFO type. Half of these were left in their as-printed condition, while the remaining six were treated with AMT PostPro SF 100 vapor smoothing machine. This setup was designed to evaluate and compare the impact resistance of raw versus vapor-smoothed samples.

Each AFO was exposed to impacts from a blunt metal edge with a 70-degree blade angle, mimicking a typical trip or fall impact scenario. The impacts were systematically increased in height, measuring the force at the point of failure, until the AFOs showed signs of cracking. The table below summarizes the distribution of samples across the two types of devices:

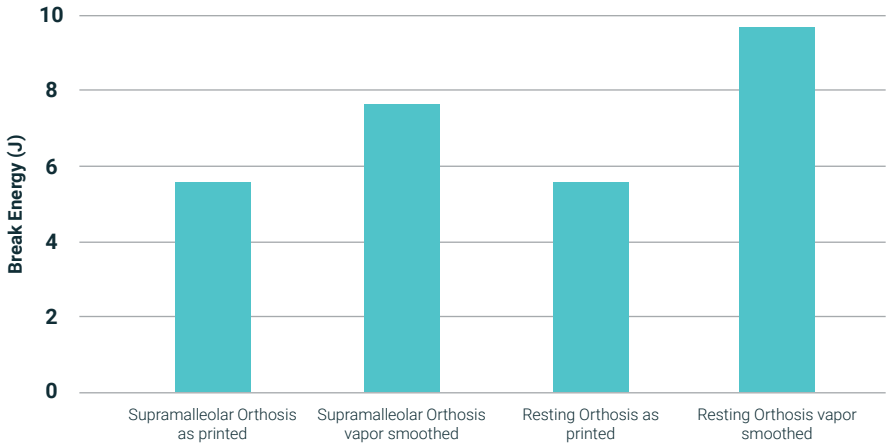
Device Type	Total Samples	As-Printed	Vapor Smoothed
Supramalleolar Orthosis	6	3	3
Resting Orthosis	6	3	3

Results:

The study revealed a significant improvement in the durability of vapor smoothed versus as printed AFOs:

- **Vapor Smoothed AFOs:** Demonstrated enhanced resistance to impact, withstanding greater forces before cracking. The average force required to induce failure was 60-80% higher compared to unpolished samples.
- **Unpolished AFOs:** Showed lower resistance to impact, cracking at around 5 J. It was also noted that unpolished AFO's showed significantly more damage i.e. the crack length after impact was larger vs the vapour smoothed counterparts.

Average Break Energy of Sample Orthosis



Conclusion:

Vapor smoothing is a critical post-processing step for 3D printed AFO's in the orthotics and prosthetics market. By employing AMT PostPro technology, manufacturers can significantly enhance the durability and reliability of these devices, ensuring better patient outcomes and extending the usable life of the orthotics.

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