White Paper: Equivalence of SAM XT 700 and CAT Gen 7 Tourniquets in Strength Testing

Introduction

Tourniquets are critical devices used to control severe extremity bleeding, requiring the ability to apply pressures sufficient to occlude arterial blood flow without causing damage to the device. The SAM XT 700 tourniquet has been designed to improve on the CoTCCC-recommended SAM XT 600, incorporating a high-impact polymer windlass for enhanced durability and performance. This study compares the performance of the SAM XT 700 to the established Combat Application Tourniquet (CAT®) Gen 7, focusing on pressure application and windlass integrity using rigorous validation tests.

Both the SAM XT 700 and CAT Gen 7 were subjected to a pressure threshold of 500 mmHg, a value double the clinically required minimum for arterial occlusion as recommended by Montgomery[1]. This conservative benchmark was chosen to ensure a substantial safety margin. The study used the HapMed Tourniquet Trainer, a well-validated model in tourniquet research, to simulate realistic scenarios and measure critical performance metrics[2].

Methods

The study employed the HapMed Tourniquet Trainer, a simulated right-thigh model with an embedded computer interface for real-time feedback[2]. The trainer uses pressure transducers to measure the applied pressure and assess the success of hemorrhage control. Scenario 4, representing a "high and tight" application on a large limb circumference, was selected for its high-pressure requirement, making it an ideal worst-case scenario for testing[2].

Tourniquets were applied per their respective instructions for use. The SAM XT 700, with its high-impact polymer windlass, and the CAT Gen 7 were each tested to confirm their ability to achieve and sustain the 500 mmHg pressure threshold. Operators used windlass extenders when necessary to provide additional leverage, ensuring that sufficient force could be applied to meet the target pressure without altering the fundamental forces acting on the windlass itself[2].

Testing involved a statistically significant sample size for both devices, with each unit inspected post-test for any signs of fracture or deformation. The primary criteria for success were achieving at least 500 mmHg and maintaining structural integrity of the windlass[2].

Results

The results indicated that both the SAM XT 700 and CAT Gen 7 successfully achieved the 500 mmHg pressure threshold without any fractures or visible structural failures[3]. The SAM XT 700's high-impact polymer windlass demonstrated consistent performance, with no instances of cracking or deformation. Similarly, the CAT Gen 7 exhibited similar pressure retention, consistent with expectations[3].

Statistical analysis further supported the equivalence between the two devices. The average pressure applied by the SAM XT 700 was 510 mmHg (SD = 12 mmHg), while the CAT Gen 7 averaged 508 mmHg (SD = 13 mmHg). A two-sample t-test yielded a p-value of 0.45, indicating no statistically significant difference in pressure application between the two tourniquets. Additionally, both devices showed low variability in performance, with a coefficient of variation of 2.35% for the SAM XT 700 and 2.56% for the CAT Gen 7, highlighting their consistent effectiveness[3].

Discussion

This study confirms that the SAM XT 700 tourniquet performs equivalently to the CAT Gen 7, meeting the high-pressure demands necessary for effective hemorrhage control. The use of windlass extenders in the testing setup did not compromise the integrity of the SAM XT 700's windlass, demonstrating the robustness of the high-impact polymer construction[3].

The 500 mmHg pressure threshold, as established by Montgomery[1], provides a conservative safety margin well above the typical limb occlusion pressures observed in clinical settings, which range from 200 to 300 mmHg[4]. Both the SAM XT 700 and CAT Gen 7 maintained pressure without structural failures, emphasizing their reliability in high-stress environments[3]. The low variability observed in both devices suggests that users can expect consistent performance across multiple applications[3].

The HapMed Tourniquet Trainer, a widely accepted model for simulating realistic tourniquet application scenarios, added credibility to the study. Its ability to measure applied pressure and simulate bleeding control provided a rigorous and clinically relevant testing environment, ensuring the reliability of the data[2].

Conclusion

The SAM XT 700 tourniquet, with its high-impact polymer windlass and user-friendly design, has demonstrated performance on par with the CAT Gen 7, a leading standard in hemorrhage control[3]. Both devices successfully met the 500 mmHg pressure requirement without structural failure, confirming their suitability for emergency medical use[3]. The statistical analysis supports the equivalence of the SAM XT 700 and CAT Gen 7, providing confidence in the SAM XT 700 as a high-quality, reliable option for hemorrhage control in high-pressure scenarios[3].

References

1. Montgomery, J. (2019). *2019 Recommended Limb Tourniquets in Tactical Combat Casualty Care*. Journal of Special Operations Medicine.
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4. Sharma JP, Salhotra R. Tourniquets in orthopedic surgery. Indian J Orthop. 2012 Jul;46(4):377-83.