NIT: A modular innovation advancing large volume subcutaneous autoinjectors

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Introduction

Large-volume subcutaneous (LVSC) therapies continue to increase in volume and viscosity, creating growing pressure on delivery systems to achieve acceptable injection times without increasing device size, spring force, or patient burden. Platform technologies that improve fluid-path efficiency provide an opportunity to expand delivery capability while preserving established device architectures.

SHL Medical's Magnitude platform (Figure 1) incorporates Needle Isolation Technology (NIT), a modular fluid-path architecture (Figure 2) that separates flow-control elements from the primary container. NIT integrates an optimized flow path (Figure 3) designed to increase delivery performance while maintaining compatibility with existing Magnitude platform designs.

Methods

Analytical modelling was performed across multiple viscosities, fill volumes, and cannula configurations to predict delivery performance. As a simplified illustration of the influence of cannula radius, the Hagen–Poiseuille relation (Equation 1) shows that flow resistance scales with the inverse fourth power of radius.

$$Q = \frac{\pi r^4 \Delta P}{8 \mu L}$$

Equation 1: Hagen-Poiseuille showing relation of cannula inner diameter

Technology Overview

NIT decouples fluid path design from the primary container, enabling optimization of flow characteristics without fundamental changes to the autoinjector powerpack or cartridge architecture. Key benefits include:

- Enhanced flow performance
- Improved robustness and manufacturability
- Increased configuration flexibility
- Compatibility with existing Magnitude platform architecture



Figure 1: Next generation large volume autoinjectors – Magnitude 3.0 and 5.0



Figure 2: NIT subassembly with modular fluid path

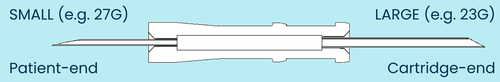


Figure 3: The innovative split-cannula enables adjustable patient- and cartridge-end gauges

Predicted performance was compared with empirical testing of representative 5.0 mL injections using the Magnitude platform configurations. Performance between NIT generations was assessed by metrics of injection time using different viscosities.

Results

Injection time simulations predicted a consistent increase in flow performance across the operating conditions evaluated (Figure 4).

Empirical test data (Figure 5) was consistent with the injection time (IJT) simulations, demonstrating measurable reductions in injection time between single- and split-cannula. By increasing flow area, the split-cannula decreases the fluidic resistance, enabling >50% faster delivery across all tested viscosities.

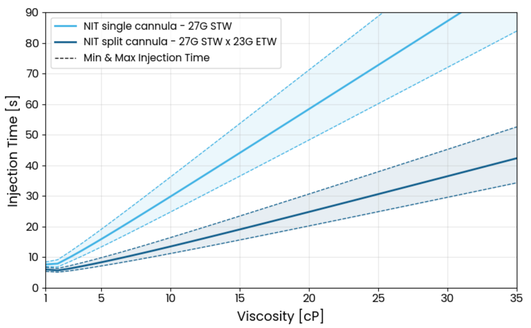


Figure 4: Injection time simulation comparison (5.0 mL)

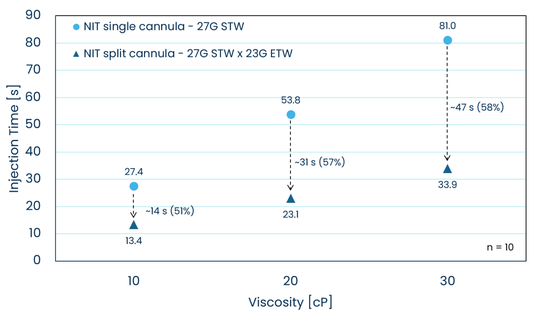


Figure 5: Empirical injection time test results (5.0 mL)

Conclusions

The innovative split cannula design (Figure 3) demonstrated substantial improvement in delivery performance while maintaining compatibility with the Magnitude platform architecture.

Key findings include:

- >50% reduction in injection time across tested viscosity range (10, 20, 30 cP) at 5.0 mL.
- Strong alignment between empirical results and mathematical modelling.
- Predictive modelling enables assessment of additional viscosities and design configurations beyond tested conditions.
- NIT remains a scalable solution for future large-volume, high-viscosity drug delivery applications.

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