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Development of a Looped UHMWPE-Polyester Braided Construct with Integrated Identification Features

Executive Summary

A medical device OEM required the development of a looped braided construct combining high-strength UHMWPE reinforcement with polyester braid elements and integrated coloured identification strands.

The objective extended beyond producing a braided assembly. The construct needed to achieve repeatable loop geometry, maintain dimensional and mechanical consistency, and incorporate visual identification features directly into the textile architecture without introducing additional assembly complexity.

Through controlled braid construction, material configuration, and process optimisation, a repeatable manufacturing approach was established that delivered consistent loop formation, reliable mechanical behaviour, and integrated visual functionality suitable for further medical device development.

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The Challenge

Introducing loop geometry into a hybrid UHMWPE-polyester structure created multiple interacting design constraints.

The development required the team to:

- Maintain dimensional stability through loop transition regions
- Control differential behaviour between UHMWPE and polyester during braiding
- Preserve tensile performance despite introducing coloured identification carriers
- Achieve repeatable loop dimensions across production runs
- Maintain target diameter and picks-per-inch (PPI) requirements

Because looped geometries create localised structural complexity, maintaining braid consistency and process stability became critical to successful development.

Engineering Objectives

The programme focused on delivering a braided construct that could:

- Produce stable, repeatable loop geometry
- Integrate colour-coded identification directly into the braid architecture
- Maintain target dimensional characteristics
- Preserve tensile performance and extension behaviour

- Establish a repeatable process suitable for future customised construct development

Development Approach

The development strategy combined the mechanical advantages of UHMWPE with polyester braid architecture to create a functional composite structure.

The selected design incorporated:

- UHMWPE core elements to provide tensile performance
- Polyester cover elements to support handling and braid stability
- Integrated dyed carrier strands for visual identification
- Controlled braid geometry to support loop formation and dimensional control
- Rather than treating identification as a secondary feature, colour integration was designed directly into the braid construction.
- This approach enabled functional and visual requirements to be delivered within a single engineered structure.

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Process Optimisation

Development focused on optimising braid architecture and material configuration to achieve loop formation while integrating visual identification features.

Key optimisation activities included:

- Balancing UHMWPE core and polyester cover elements
- Defining placement of coloured identification strands within the braid architecture
- Optimising braid geometry to support loop formation and dimensional control
- Monitoring braid density through PPI verification
- Refining loop forming techniques to improve geometric consistency
- These activities established a stable braid architecture capable of delivering both mechanical performance and integrated visual functionality.

Validation & Performance Assessment

Performance was evaluated using standard textile and mechanical assessment methods.

Validation activities included:

- Runnage assessment
- Tensile testing
- Extension measurement

- Dimensional verification
- Visual inspection of loop consistency and colour placement

Results confirmed that the developed construction met the defined structural and manufacturing requirements while maintaining across production samples.

Process Control & Repeatability

Repeatable production was achieved through defined control of both braid construction and loop assembly.

Key process controls included:

- Standardised UHMWPE core preparation
- Controlled carrier loading and placement of coloured identification strands
- Fixed braid configuration and yarn tension management
- Monitoring of diameter, PPI, and loop geometry
- Final inspection of colour placement and construct uniformity

These controls established a robust manufacturing process capable of producing consistent looped constructs with integrated functionality while minimising batch-to-batch variation.

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Engineering Outcome

The programme demonstrated that functional features can be engineered directly into braided textile architectures without compromising structural or mechanical performance.

Key engineering outcomes included:

- Repeatable loop formation with controlled geometry
- Stable hybrid UHMWPE-polyester braid construction
- Integrated visual identification within the braid architecture
- Consistent dimensional and mechanical performance
- A scalable manufacturing platform for customised braided medical components

The project demonstrated how braid engineering can integrate mechanical performance, geometric control, and product functionality into a single manufacturable textile component.

Application Relevance

Orthopaedics & Sports Medicine

Looped fixation systems, ligament reconstruction constructs, rotator cuff repair assemblies, tendon repair devices.

Soft Tissue Repair & General Surgery

High-strength repair constructs, loop-based fixation systems, ligation assemblies.

Surgical Sutures & Closure Systems

Specialised braided structures requiring tensile performance, controlled geometry, and enhanced visual identification.

Minimally Invasive & Robotic Surgery

Pre-formed textile loops supporting simplified deployment and reduced intraoperative handling.

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Key Takeaways

- Looped braid performance depends on controlling geometry, material interaction, and process simultaneously.
- Visual identification features can be integrated directly into braid architecture without compromising performance.
- Hybrid UHMWPE-polyester constructions enable balancing of strength, handling, and usability.
- Precision textile engineering enables conversion of braided materials into functional device-ready components.

“By integrating loop geometry and identification features directly into the braid architecture, the construct became more than a textile; it became a functional medical device component.”



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