

WHITE PAPER

SURGICAL POWERED HAND TOOLS IN MOTION: LEARN HOW PORTESCAP MINI MOTORS HELPED POWER A SMART SURGICAL TOOL SYSTEM

by Nicole Ashton

Along with an aging population comes a host of medical diseases. One of those is osteoarthritis, the most common type of knee arthritis. It is a very slow progressing degenerative disease where the joint cartilage gradually wears away. Other types of arthritis in the knee that can occur are rheumatoid arthritis and post-traumatic arthritis. When the arthritis does not respond to non-surgical treatment, patients may need to turn to arthroscopic surgery. Researchers from the Centers for Disease Control and Prevention in Atlanta and the University of North Carolina at Chapel Hill have estimated that the risk of having symptoms of osteoarthritis in at least one knee by age 85 was 45.5 percent. Nearly 1 in 2 people will develop osteoarthritis of the knee before they reach the age of 85.

Blue Belt Technologies has introduced a revolutionary “smart-drill” surgical system or orthopedic procedure that provides a less invasive solution for partial-knee replacement procedures.

Currently, anywhere from 2 to 5 percent of partial-knee replacements have to be redone within a year, possibly because the alignment is wrong, or the implant has shifted, or simply because the patient is still in pain.

Orthopedic surgeon Brian Hamlin, who practices at the bone and joint center at Magee-Womens Hospital of UPMC and is on Blue Belt's scientific advisory board, said the ability to correctly place the implant "will allow for durability and long-term success for your patients."

The NavioPFS™ is a surgical system that combines a powerful image-free intraoperative planning and navigation system, with the next evolution in surgical robotics represented by the handheld NavioPFS handpiece. This intelligent tool is tracked in real-time via the surgical navigation system built into NavioPFS, which is also tracking in real-time the patient's bones during a knee procedure.

The hand piece only allows the surgeon to cut where s/he has planned to cut in the 3D reconstruction of the patient's joint. A Portescap motor adjusts the exposure of a spinning bur beyond a static guard dozens of times per second while the hand piece is moving in free-space. The technology (PFS) stands for Precision Freehand Sculpting because the hand piece is free to move around in space under the surgeon's control in order to access the patient's anatomy, but the multiple intelligent algorithms in the software are constantly adjusting the tool's ability to resurface away bone. One can think of it like a virtual boundary the surgeon constructs using the planning software, ensuring that the tool will never cut outside the boundary regardless of what the surgeon does. This provides the precision of robotics into the clinically skilled hands of the surgeon, making the NavioPFS the most empowering orthopedic robotic technology on the market.



One of the challenges in developing the NavioPFS orthopedic surgical system was finding a high performance miniature motion control solution that could meet demanding requirements for accurate position control (0.01mm) in a compact envelope (12.7mm). Furthermore, the motor needed to be autoclavable. A design engineer suggested Portescap's sterilizable brushless slotted motors, which are designed with medical wash-down conditions in mind, tested to well over 1,000 autoclave cycles, providing field-proven class-leading longevity.

Motion solution that move life forward

Portescap engineers collaborated with the Blue Belt Technologies team to develop a custom solution. The most challenging requirement was selecting a motor that could fulfill all of Blue Belt Technologies needs. Because their technology exists in the operating surgical suite, it was imperative to provide a motor that would allow their hand piece to be sterilized and reused. A B0512 brushless slotted DC autoclavable motor was proposed. "This motor combination was chosen because system inertia and acceleration rate are critical to ensure a short retraction time" says Louis Mongin, Portescap Medical Project Manager. Portescap was able to ship prototypes within 48 hours and assist with guidance for additional electronics, including gearheads.

"All in all, Portescap was very responsive in helping us find the perfect solution for our needs."

"We fully expect that miniature motors and controls will serve an increasingly critical function in this market" says Loic Lachenal, Portescap Medical Market Director. "All in all, Portescap was very responsive in helping us find the perfect solution for our needs. They worked extensively with us through

multiple design iterations to determine the optimal motor that worked in our NavioPFS system. No other motors we looked at were able to address all of our requirements" adds Adam Hahn, Blue Belt Technologies Mechanical Engineer.

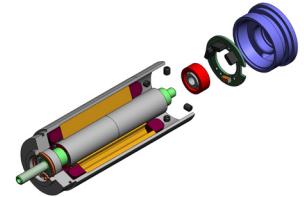
"Portescap is continually striving to serve the future needs of the surgical hand tool market by designing new motors that deliver utmost quality and performances, and we will be introducing additional innovate motor solutions to this market during the coming new year," says Loic Lachenal. Companies interested in learning more about Portescap's solutions for the medical market, including products optimized for a particular application, should contact a Portescap sales engineer.



Brushless Slotted Motor Advantages:

Brushless Slotted Motors use a stator that consists of stacked steel lamination with winding placed in the slots that are axially cut along the inner periphery. They provide improved heat dissipation and high torque density, along with high acceleration.

- High efficiency and power density
- Ability to withstand harsh environments
- Increased motor lifetime due to no mechanical commutation
- Autoclavable options



Motor Technologies and Characteristics

With so many different requirements when looking for miniature motion solutions for medical equipment, you can see that it can be a challenge. Many times, a tradeoff must be made between parameters, in order to satisfy the end customer requirements. Engineers can benefit from the education of the features and benefits by technology, which can help making a motion solution selection more efficient.

	Brushless DC Slotted	Brushless DC Slotless	Brush DC Coreless	Stepper Can Stack	Stepper Disc Magnet	Stepper Linear Actuator
Efficiency	✓	✓	✓			
Increased battery life		✓	✓			
Motor lifetime	✓	✓			✓	✓
Autoclavability	✓					
Ability to withstand harsh environments	✓		✓			
High power/weight ratio	✓	✓	✓			
High acceleration	✓	✓	✓		✓	
Open loop positioning				✓	✓	✓
Simple control			✓	✓	✓	✓
Low noise		✓	✓			
Reduced the number of mechanical components						✓

About Portescap

Portescap is a leader in miniature motion solutions for medical technologies, including autoclavable brushless dc slotted motors. Our success stems from the highly collaborative environment we create between customers and our Sales and Application Engineering teams. Our micro motors put the power in motion-critical applications such as surgical hand tools, infusion pumps, ventilation equipment and more. Complete assemblies can include encoders, gearheads, customized shafts and modified design configurations to reduce assembly costs

About Blue Belt Technologies

Based out of Pittsburgh, Pennsylvania, Blue Belt Technologies is an innovative medical technology company commercializing the NavioPFS orthopedic surgical system for initial use in Unicompartmental Knee Replacement (UKR). NavioPFS provides a less invasive solution for partial knee replacements, bringing to the OR advanced robotic technology coupled with intuitive and powerful intra-operative planning and navigation software. The NavioPFS intelligent handheld instrumentation provides robotic enhancement in accuracy and repeatability for the technically challenging UKR procedures. NavioPFS has not yet been evaluated by the US FDA and is only commercially available in Europe. **P**

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