Cutting the Size and Weight of Surgical Devices

The Project: Replace the previously used alkaline battery packs to power a surgical bone drill with a more efficient alternative.

The Solution: Utilize high power lithium batteries to make cordless bone drills lighter, more powerful, and more ergonomically designed.

By Sol Jacobs

Orthopedic surgeons are continually looking to increase productivity and improve efficiency by choosing medical devices that are lightweight and ergonomically designed.

This fact was clearly on the minds of the product development engineers at BioAccess as they began designing their latest generation of cordless, single-use surgical bone drills. Teaming up with Tadiran, a leading manufacturer of long-life lithium batteries, they recently unveiled a new higher power device that is significantly lighter and more ergonomically beneficial than previous models, yet capable of delivering high energy density and capacity required to produce greater torque and faster drilling speeds, which saves valuable OR time and cost.

Formerly powered by alkaline packs, BioAccess bone drills now use TLM-1550-HP lithium packs to produce greater torque and faster drilling speeds while reducing weight by 36%.

After carefully reviewing available battery chemistries, BioAccess specified a custom battery pack made from six TLM-1550-HP AA-size high power lithium batteries from Tadiran. Introduced to the market approximately two years ago, these high power lithium batteries enable BioAccess portable bone drills to deliver excellent performance characteristics, that have been quickly validated based upon positive feedback from OR surgeons and through input received by BioAccess' field sales representatives. BioAccess is currently ramping up production of its newest generation bone drills based on strong demand from surgeons who appreciate the drill's increased power and better ergonomic comfort during surgical procedures, which minimizes fatigue and leads to more efficient drilling cycles.

BioAccess powered earlier generations of its portable small bone drills with alkaline battery packs. While these products performed well and offered excellent reliability, BioAccess' goal of continuous improvement called for ongoing refinements that would ultimately reduce overall weight and extend the power ceiling of the device.

"With the Tadiran cells, we get much more power than a standard alkaline pack, while trimming 36% off the weight," says Bob Chapolini, MD, president of BioAcess. "This noticeable weight reduction makes the product more ergonomic by reducing user fatigue. If we had used a AA alkaline pack giving the same power as the Tadiran pack, the drill would have been three times heavier and twice the volume (requiring 15 AA-size alkaline batteries versus six AA-size TLM-1550-HP batteries). That would have turned a compact, lightweight design into a heavy, bulky instrument. That is not what the surgeon wants."

TLM-1550-HP cells feature an open circuit voltage of 4.1 V along with the ability to handle pulses of up to 15 A, with 5 A maximum continuous load. The battery also operates across a wide temperature range (-40°C to 85°C) and can withstand pre-surgical sterilization temperatures as high as 125°C. While the BioAccess bone drill is specifically designed for single use, the extended temperature range of the cell makes it extremely well-suited

	Previous Alkaline Pack	TLM-1550-HP Pack	Alkaline Equivalent to TLM-1550-HP Pack
Weight (Oz)	6.3	4.0	12.4
Volume (Cu. In.)	3.3	3.3	7.13
# of Batteries	15 AAA	6 AA	15 AA

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for autoclave cycles.

"We're seeing a remarkable efficiency gain from these new batteries," Chapolini adds. "TLM-1550-HP battery packs enable more active drill time and a much longer shelf life, as well as more instantaneous power when the device is activated. Surgeons also do not want to experience power delays when utilizing our device in the OR. Use of a TLM-1550-HP battery pack ensures a more positive and reliable experience, as our latest generation of cordless drills are capable of delivering more power compared to alkaline cells, along with more stall torque, 30 to 40 seconds at a time, with 20 to 30 cycles."

A former surgeon himself, Chapolini speaks from experience, which helps establish credibility with surgeons as he demonstrates the newer drill model in physician offices, and at medical conferences and symposiums. "Any time we go to a symposium or conference, we've usually kept our demo units in storage for weeks or months at a time without testing system reliability." he says. "Fortunately, every time that we have pulled a bone drill out of the box it has operated powerfully and reliably, which provides greater reassurance to the prospective customer. What's more, the power provided for these small bone procedures is such that it may give us an opportunity to sell the drills into other classes of surgery that involve larger or heavier power tool classifications, which opens additional doors of opportunity for our product," Chapolini adds.

Recognizing that extended storage life coupled with high reliability would be important product attributes for BioAccess, Tadiran's quality assurance department conducted extensive testing on the TLM-1550-HP to ensure that the cell could offer an extremely long service life of up to 20 years, as certain emergency medical devices can go unused for extended periods of time yet must work reliably in life threatening situations. To accomplish this, the batteries feature very low annual self-discharge, resulting in a potential service life of up to 20 years.

"Simply put, the TLM-1550-HP battery is an optimum power source for a great many single-use devices," says Sol Jacobs, VP and general manager of Tadiran. "With unique attributes such as extraordinarily high capacity and energy density, extremely long life, and extended temperature range, TLM-1550-HP cells are particularly well-suited for a wide range of medical applications," Jacobs says. "This includes automatic external defibrillators (AED), cauterizers, CPR resuscitation equipment, and other handheld power devices used in hospitals, clinics, or by field responders. The positive results achieved as a result of our partnership with BioAccess demonstrate the importance of OEM design engineers working in close partnership with the right battery manufacturer to achieve the optimum power management solution."

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- www.bioaccess.com
- www.tadiranbat.com