The Fine Art of Machining

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While machining may not be specified as much as it once was in the medical device industry (outside of the orthopedic realm, that is), it is still very much a necessary component fabrication process for this industry. In fact, machining is being utilized across an array of device sectors, from surgical tools, fixation devices, and dental implants to components for medical pumps, instrumentation, and implantables.

“Until science can produce products that can exactly fit together as a functional bio-structure replacing Mother Nature’s version, machining of some level is necessary,” explains Ted Driggs, program management principal engineer at Okuma [1].

Machining is still a valuable process for the medical device designer and can be used in a number of instances where it offers a lower cost alternative to other component fabrication methods.

Challenges

Since medical devices are so critical, ensuring their proper function is paramount to the designers developing them. As such, when tasked with specifying machined components, setting higher tolerances must be better…right? Unfortunately, ensuring that a part meets such exacting requirements can add additional, yet unnecessary, costs to a project. The reality is that a machining specialist can determine the right course of action when it comes to specifying a machined component for a particular device better than most design engineers.

Dan Grosberger, tooling supervisor at Crescent Industries [2], explains, “Design

engineers may have a tendency to call out more dimensional requirements and tighter tolerances than is actually necessary for required functionality. The way to avoid this type of mistake is partnering with your vendor in the early stages of product development and design phase for manufacturability."

Greg Thompson, VP of engineering at Sanmina Medical Division [3], highlights a second challenge that his company is mindful of. "Two areas that Sanmina focuses on to avoid errors are ensuring that we consider part resonances to avoid failures and stresses induced by machining resonance, and ensuring that tolerancing is appropriately specified to avoid unnecessarily increasing the machining cost."

Both make a good argument for partnering with a reliable machining expert early in the development process to avoid these or other oversights.

Micro Machining

The trend toward miniaturization in the medical device realm impacts all areas, from molded parts to electronic components to machined pieces. Micro machining addresses this need while still maintaining the ability to offer high quality results and exacting tolerances.

"Micro parts with precision of better than 0.01 microns are currently practical. This enables smaller manufactured products, opening up new possibilities for implantable devices or replacements for certain anatomical structures," states Thompson.

Driggs looks ahead at the next step for micro machining and in what direction it could go. "Micromachining and the intricate shapes and features required from the

macro scale are a challenge moving forward. The trend is to move toward 'nano' in the medical world. There may come a point where conventional machine tools of today will morph into something yet imagined when the time arrives."

Looking Ahead

The machining of components has a place in medical device manufacturing, and will continue to do so looking ahead. It may have lost a little ground in terms of how much it is specified, but it is certainly not going anywhere. And as such, the roundtable contributors are enthusiastic about machining's future with some unique ideas on what could be on the horizon.

"I predict that by using the cloud combined with MRI and CT scan technologies, there may be a time when medical devices will be partially created to fit the human patient prior to surgery and the final fitting will come next door to the hospital OR after the surgeon makes his/her incisions. Laser scanning of the body replacement area will be fed directly to an OR CAD operator and delivered to the waiting machine tool. End result is the best ergo fit to the patient instead of machining the patient to fit the device," offers Driggs.

Thompson shares his own view, "Further advances are expected in the precision of the machining equipment along with wider deployment of more compact and lower cost machining equipment. As the cost and the size of the machining equipment are reduced, we expect to see more product assembly lines that include in-line or co-located machining operations as an integral part of the medical device manufacturing and assembly process."

Conclusion

While the world of healthcare today appears to be built with molded plastic, other component fabrication techniques still have a place in the process. Machining for medical device components offers an array of advantages that are still not achievable using other methods. And until the time when there is a suitable alternative, it is critical for medical device designers to identify machining experts with whom they can partner to develop the very best device they can while being mindful of controlling costs and waste—a consideration that a quality machining specialist will be able to accommodate.

Full Responses

To see the full responses of the participants, view these links:

- Fitting Devices to the Patient with Machining [4]- Ted Driggs, Program Management Principal Engineer, Okuma
- Machining for Medical Device Components [5]- Dan Grosberger, Tooling Supervisor, Crescent Industries
- Freedom in Material Selection with Machining [6]- Greg Thompson, VP of Engineering, Sanmina Medical Division

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[1] http://www.okuma.com/
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[3] http://www.sanmina.com/
[4] http://www.mdtmag.com/blogs/2013/11/fitting-devices-patient-machining#.Uo-3MZzAaQw
[5] http://www.mdtmag.com/blogs/2013/11/machining-medical-device-components#.UpTZlpzAaQw
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