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Special Focus: Medical Components

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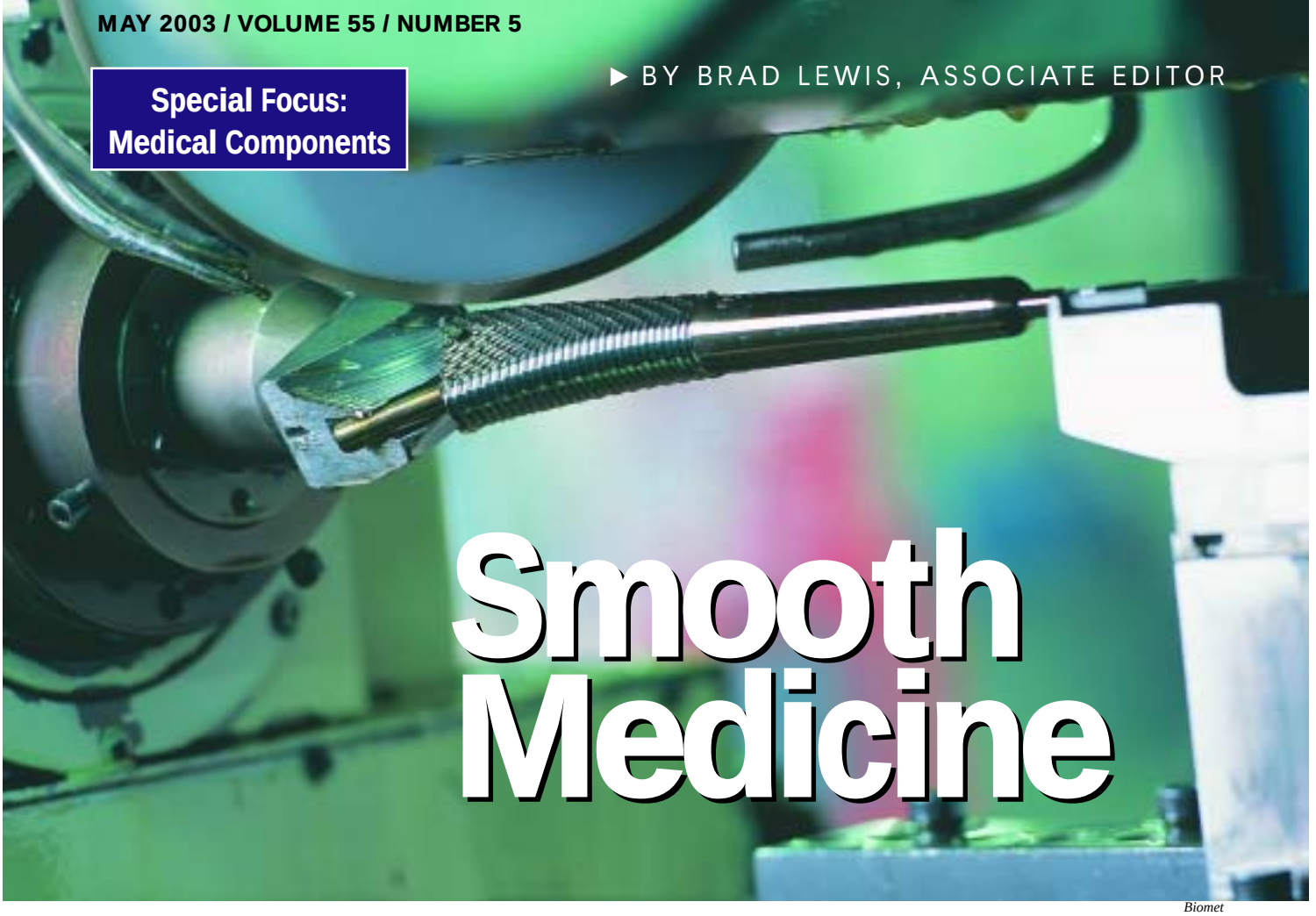
Smooth Medicine



Biomet

Medical-part makers share their secrets for holding the line on costs.

Machining medical parts has brought about some of the most advanced technological strides in metalworking. While manufacturers are optimizing part technology, they're also striving to maximize production efficiency. Technology is aiding them in their efforts.

As in any other field, once technical hurdles have been overcome, the question becomes, "How can the same process be performed more efficiently for a lower cost?" According to Dave Hayes, product manager for Haas Automation Inc., Oxnard, Calif., "For years, [the medical-parts sector] wasn't too affected by cost crunching, but now they are. There is pressure to lower the costs of parts."

As this article shows, Hayes' assertions are borne out in the field. In and around Warsaw, Ind., dubbed the "capital of orthopedic manufacturing," and elsewhere, end users discussed how they are holding the line on parts-production costs.

Software

Software, specifically, CAD/CAM packages, are playing an important role in boosting productivity and lowering costs. Machining Concepts Inc. (MCI), for example, uses software extensively at its Warsaw shop, where it manufactures implants and surgical instruments and performs a wide range of operations. The company focuses on milling, turning and the wire electrical discharge machining of stainless steels and titanium.

CNC Software Inc.'s Mastercam Mill Level 3 with Solids has improved shop efficiency, according to MCI's president, Tom Knisely. Using the software, MCI receives orders via e-mail and plots and verifies a part's toolpaths within minutes. "There's no need to draw the part from a print," he said. "There are fewer errors that way."

A key benefit of Mastercam is its associative capability, said Ernie Rice, MCI's plant manager. According to Mastercam, the Mill Level 3 version allows for full-associative machining of unlimited complex surfaces and solids together as a single model. Level 1 only allows for full-associative, 2-D machining directly from a solid and Level 2 allows for full-associative machining of single solid faces and single surfaces.

This means the software allows him to make a quick change to the model and receive an updated toolpath with one mouse click.

"Shortening turnaround time is one of our biggest concerns here," Knisely

Above: Cellular manufacturing allows for efficient production of Biomet's femoral broaches.

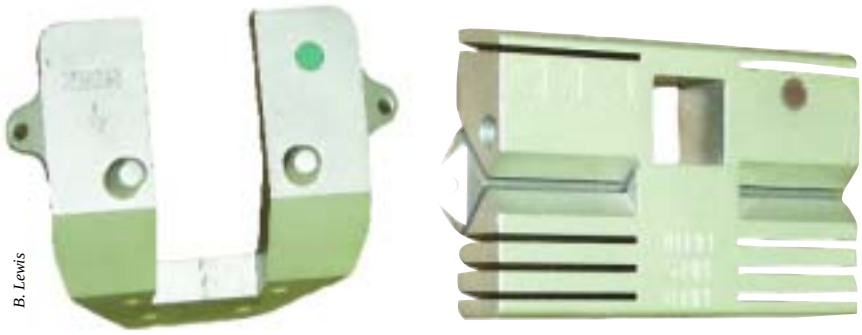
said. The software has allowed MCI to reduce turnaround time by up to 50 percent.

The software also allows libraries of tools and part sizes to be set up in advance. Pointing to a titanium femoral cap that MCI machines, Rice said, "There are six sizes of that part. Using Mastercam, we can generate toolpaths for all six from one file."

The software also aids in fixture planning. With Mastercam, Rice said the shop quickly realized that it could machine two femur caps per slug of titanium bar stock. "We're constantly looking for ways to get more parts per fixture," said Rice.

In addition, the company leverages the multi-axial capability of its machining centers to squeeze cycle times. By machining a part in its Okuma 4-axis vertical machining center, Rice said he performs several operations with one machine.

Swiss-style turning centers have also speeded processes by combining operations. With an automatic bar-stock feeder, the company can drill cross-holes, mill flats and do 3-D milling on the lathe. Rice attributed this multifunctionality to its live-tooling capability.



B. Lewis

In addition to implants, Machining Concepts also makes instrumentation for knee-replacement surgery.

Robotics, Cells

Automation is also helping producers improve efficiency. Jim Nicholas, vice president of another Warsaw company, NG Instruments Inc. (NGI), has seen firsthand how foreign competition and market saturation have reduced product prices and squeezed profit margins for part makers in the industry. His company, a producer of surgical drills and taps, is using robotics as a means of trimming production costs.

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WEDMing plays a crucial role in efficient machining at Machining Concepts.

Today's robotic systems have greater versatility than their predecessors, a quality that initially attracted Nicholas. NGI has integrated robotic arms into its grinding operations. From a pallet of blanks, the arm grabs each one and places it into the tool and cutter grinder. Once the tool has been ground, the arm removes it and repeats the process. Nicholas said this allows the grinders to run virtually unattended.

The company's investment in technology reflects market needs. "Our customers want us to grow with them," Nicholas said, adding that major investments in technology instill confidence in customers.

The company does not use robotics for lights-out machining, however. Nicholas said the risk of a fire starting is too high, particularly given the plant's rural location and delayed emergency response times.

Companies are also using cellular manufacturing concepts, and some are bringing more work in-house. That's true at the Biomet Inc. facility in Warsaw. It houses more than 100 CNCs, yet "we maintain a job shop atmosphere," said Terry Martin, director of manufacturing engineering. From producing its own forgings down to polishing each finished part, Biomet does most of its work in-house.

Although orders are plentiful, the quantities per order, like those at most medical-part makers, are small. According to Martin, orders are generally fewer than 10 pieces. For some, this quantity-to-order ratio would sound like a recipe for financial ruin. However, Biomet has met this logistical challenge with cellular manufacturing.

The cells are formed around families of parts, with each cell specializing in similar manufacturing processes. For example, Martin said the mills within one cell have a common vise indexer. "Generally, we organize our cells with one, two or three machining centers," said Martin.

To machine tool builder Mori Seiki USA Inc., Irvine, Texas, a typical machining cell consists of a lathe and a machining center or two. Included in the cell is a machine for secondary operations, such as broaching or polishing, said Fred Puzon, Mori's national strategic accounts manager. "Takt time (the dividend of available daily production time and required daily output) is very important, because you've got to split that time up amongst the machines to have a nice even flow" and eliminate bottlenecks where parts stack up outside a machine.

Manufacturing speed and flexibility also extend to the choice of workpiece fixtures. "How long a fixture lasts is not important. What's important is that it's flexible," Biomet's Martin said.

Biomet doesn't use robotics systems, except for polishing parts. Martin said the machinists the company seeks to hire simply aren't interested in getting into machining via this type of repetitive, low-skill work. "Kids today, they want to work on computers."

Smart managers, he added, recognize this and adapt themselves by embracing technological innovation and focusing

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One of Biomet's Exact bone reamers being machined.

on the programming end of machining.

Nevertheless, automation by itself is not a panacea. It doesn't make sense to automate processes when a customer orders 900 parts and takes delivery of just 100 to 300 per year, said Clive Scott, vice president of technology for Paragon Medical Inc., Pierceton, Ind. "Our buyers want to hold less inventory," he said. "They only want 24 parts at a time, spread over eight different sizes."

For its manufacturing cells, Paragon's rule of thumb is to have, on average, 1.8 machines per operator. Any time that ratio slips, Scott immediately starts looking for ways to bring it up.

One way to do this is to move machinery around, according to the parts orders that come in. Given the number of orders that Paragon processes, this means the company moves machines frequently, sometimes on a weekly basis. How does the company process its orders less expensively and on time if it's constantly rearranging the furniture? Simple. Paragon calculates the time it takes for an operator to move from machine to machine to produce a given part, said Scott.

If the machines are not placed so that they are easily accessible, or if the operator has to walk too far between them, time is wasted. By arranging machines so the operators didn't have to walk more than one or two steps and everything is at hand, the company has saved a significant amount of time. So much, in fact, that Paragon easily justifies the time spent moving the machines for each job.

Scott said Paragon's cells are organized to be cost centers in and of themselves. Each cell is given an "allowance" of time and money to finish a job. Workers in that cell then determine the best way to spend that time and money.

Moreover, flextime is fine for the operators, as long as they get their jobs done on time, Scott said. And, there are incentives for employees to complete jobs significantly under the cell's allowance.

Randy Sible, principal manufacturing engineer for Paragon, said the company has not yet codified the incentive system, so it relies on the "gut feeling" of the cell's team leader. The incentives themselves can range from free coffee mugs to dinner at a local restaurant.

Multitask Machines

More suppliers are adopting computer-integrated manufacturing into their operations. MedSource Technologies, Minneapolis, for example, has invested in such technologies, including the purchase of six 6-axis Mazak Integrex 200 machining centers.

Director of strategic development, Don Wagner, contrasted the machines' performance with traditional machining practices. Traditionally, he said, medical-part makers start jobs on a 2-, 3- or 4-axis lathe and then go to a mill. Alternately, some use lathes that also have milling and turning capabilities. Such machine tools, however, don't have 40-tool toolchangers and a rotating milling head, which the Integrex has, he said.

Wagner said the head resembles a machining center head, except that it can swivel on the 6th axis 244°. "That allows you to work about the part in a true multiaxis fashion," he said.

The machine also reduces parts handling for the company. "For secondary operations, it transfers the part to the secondary chuck," he said. "We don't open the door for anything."

Previously, the company had to perform three or four setups, and parts were queued up for the machines. "If one of the machines' cycles is faster or slower, then you can only go through the process as fast as the slowest piece of equipment," said Wagner.

The Integrex eliminated that. It allows the company to turn IDs and ODs automatically, which saves time. "You can virtually finish a part in one setup," he said. "They're all operating in the same axis and at the same surface speeds and spindle speeds, so you can define your manufacturing cycle much

The following machine tool builders contributed to this article:

Haas Automation Inc.
(800) 331-6746
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Mori Seki USA Inc.
(972) 929-8321
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The following companies also contributed to this article:

Biomet Inc.
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Machining Concepts Inc.
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MedSource Technologies Inc.
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NG Instruments Inc.
(574) 268-2112

Paragon Medical Inc.
(800) 225-6975
www.paragonmedical.com

B. Lewis

At Paragon, machines are constantly being rearranged for maximum efficiency. Proper machine placement can cut time wasted by walking too far.

closer than you could in the past. It takes out a lot of variables."

Workpiece reinspection time is also reduced. In the past, he said, "each time you did something to the part, it had to be rechecked by a supervisor and quality control. If there were four processes, we had to go through four setups."

By having all the work done in one setup in a single machine, Wagner said, "nine times out of 10 we're measuring a finished part."

The Integrex also reduces the number of secondary operations, such as grinding, and allows the part to go straight to polishing. The machine, he said, imparts 8- to 16-rms finishes for bearing surfaces. "If you go into a polishing operation with an 8- to 16-rms finish, getting to a 4-rms finish is fairly easy."

Producing medical parts today is more difficult than it was in the past. Previously, the work was technically challenging, but there was relatively little competition. Today, as competition intensifies, technology is dramatically relieving pricing pressures.