



## Technical Report for Dental Industries !



Many end mills from various manufactures were rigorously tested. OSG's tools were clear winners in all accounts.

## TOOLS LIKE YOUR TEETH: SMOOTH, DEFINED AND DURABLE.

**There are still many challenges in dental applications as zirconium-oxide and chrome-cobalt do not rank as your friendliest materials to machine. Sauer, a subsidiary of Gildemeister Group based in Stipshausen, conducted series of tests with different tools from various manufacturers. OSG's end mills clearly out-dueled others.**

Until recently, the dental industry suffered from having only one supply chain with no room to improve productivity. As dental material suppliers not only provided materials, but also the entire machining procedures, dentists and part manufactures had no choice but to rely on their only supplier. The introduction of chrome-cobalt and zirconium oxide, however, shifted the casting vote from the integrated dental suppliers to the dentists and part manufactures. Suddenly, the dental industry was an open market.

Now that dentists and part manufactures are free to be innovative, many are opting for industry leading technologies and require a disclosure of the entire machining process. The new technologies that are purchased from different partners must be seamlessly connected and offer more possibilities than those in the past. With the current lineup of two 5 axis machines in Ultrasonic 10 and Ultrasonic 20, DMG offers the dental industry today's leading machining technologies in all dental materials with proven

test results in numerous applications.

### Integrated Support

In order to provide the best integrated support, DMG was specifically searching for the best performing ball nose and corner radius end mills ranging from 1 mm to 3 mm in diameter. "Due to the high cobalt and chromium contents, one must consider numerous factors in machining this difficult material" told Andreas Schwarz, the Director of Applica-

tion Engineering at Sauer. "This material is especially challenging for the tools. Technical literatures are no help to you as there is none describing how best to handle this material. It must come from machine and tool manufacturers to enlighten customers with the best approach."

Different end mills from various manufacturers were tested at the DMG testing facility in Stipshausen to break the current threshold of 30 work pieces. A dramatic increase in tool life was (and still is) expected from those involved in the dental industry as the demand for automation is ever increasing. The tests were conducted to find reliable end mills to pair up with the machines that ensured a continuous unmanned operation milling the problematic, yet often used material. So, the race of who can increase tool life was on.

In order to obtain objective results, Sauer carefully controlled standard work piece materials for different applications with each end mills. For roughing operations, Sauer tested 3mm corner radius end mills at cutting speed of 75m/min and RPM of 8000. For finishing operations, 1mm ball end mills were tested at 150m/min and RPM of 25000 to 30000.

## Doubled Tool Life

The cutting conditions were all the same for each end mills tested. The result: an end mill from OSG achieved 55 to 60 pieces for the roughing operation, doubling the previous output of 30 pieces. A similar result for finishing operation was witnessed. OSG tool again finished 60 to 80 pieces, a drastic improvement from the conventional tool.

The research for optimal tool life for the responsible parties is far from complete. The team of engineers at Stipshausen will continuously test different tools at various cutting conditions in search for bettered tool life. There are still many more unresolved X factors in the process of machining chrome-cobalt and zirconium oxide. For example, the enormous variation of material properties can cause havoc in

machining these materials. "We have experienced that by changing the material supplier, but ordering the exact same material properties, the tool life and the surface finish were vastly compromised", said Andreas Schwartz. "Whether extruded, poured, or compounded, the cutting parameters of chrome-cobalt will be affected." Thus, different tests result in different outcomes. The cause of the loud cutting noise is directly related to tool vibrations caused while cutting the material. It is a known fact that the greater the noise, the more the vibrations.

Vibrations do horrid things not only to surface finish of a work piece, but also to tool life. On the other hand, we have learned through various tests that these vibrations can be controlled with the geometry of cutting tools, the number of cutting edges, and angle of cutting edges.

## Machining strategy is the key

According to those responsible for the test, it is confirmed that OSG's end mills were designed, grounded, and coated to best match the rigorous cutting conditions of chrome-cobalt and zirconium-oxide. In comparison with other end mills, OSG's tools cut much quieter and resulted in smoother surface finish. It is also noteworthy that the internal cavities were machined by using five axes simultaneously in order to increase productivity. This, of course, was only possible with the quality of Sauer machining centers equipped with OSG's highly precise end mills.

In the time of printing this article, the engineers were at work testing OSG's newly developed 5 flute corner radius end mill at Sauer's Dental Excellence Center in Stipshausen. The concrete results of which were not ready in time for the press. One thing, however, is for sure. The engineers at Stipshausen are working today for tomorrow's technologies.



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(Original report made by Manfred Lerc)  
Courtesy of "Trends & Innovationen"

## Profile



SAUER | ULTRASONIC is standing for the economical way to machine Advanced Materials. Beside the typical hard and brittle advanced materials like ceramics, glass, corundum, composites and silicon, also materials like tungsten carbide and hardened steel that are hard to machine can be machined with several advantages and in excellent quality. This innovative product line, successfully serves the sectors die & mold, optical and automotive industry as well as manufacturers of wear resistant ceramic components for pump and fitting industry. Further on, watchmakers, customers from the fine mechanics and medical industry are more and more increasing their productivity by using ULTRASONIC. The new DENTAL product line successfully transfers the ULTRASONIC-concept and serves the growing future market of the DENTAL industry with exactly for the branch's requirements developed machine features. So positioned, SAUER offers an open system to machine all DENTAL applications in all materials. Customers are small dental labs as well as large dental milling centers. Additional to the machine production, SAUER offers the required know how for economical machining and supports the customer with feasibility studies, process optimization and technology developments by it's application department. In close contact to our customers, SAUER develops individual solutions that enable a customer specific operation of the SAUER machines in various application areas.

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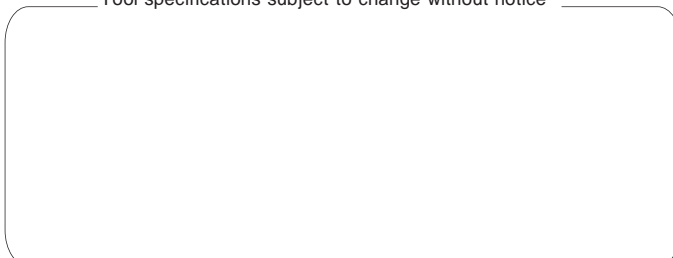
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