Testing the cutting properties of milling tools

Our new milling test setup enables us to quantify the wear resistance of side-cutting tools. The test is important, not only for manufacturing technology, but also for analyzing the wear and cutting properties of surgical instruments. It allows the performance of milling tools designs to be compared and optimized.

With the experience gained from many different wear tests on drills (see Newsletter 33), we have developed a test setup to analyze the cutting properties of milling tools. This setup allows for the comparison of different designs. It employs a block of well-defined material, which is pressed laterally against the tool with a defined force by a low-friction wire mechanism. A laser

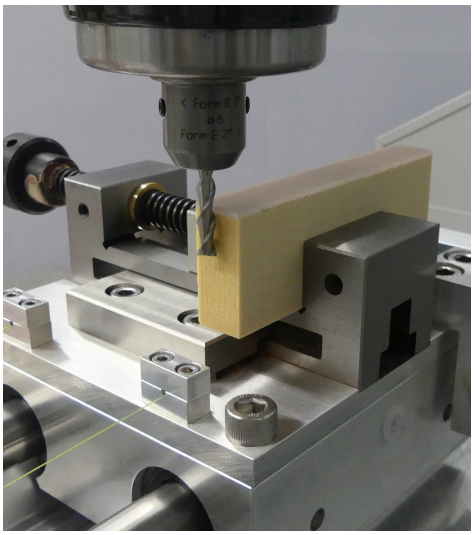

Figure 1: Milling test setup with clamped artificial bone made of a polyurethane foam-epoxy composite, as typically used in medical technology.

displacement sensor records the exact distance travelled, allowing for accurate calculation of the tool's cutting speed. This highly reproducible measurement enables us to compare different cutting tools in terms of performance and tool life.

Our stable base tooling machine is a reliable aid for accurate testing on a wide range of materials. Milling tests can be carried out on steel, cast iron and aluminum alloys, as well as plastics. In medical technology, for example, we use polyurethane foam blocks covered with an epoxy plate as a model for bone with a cortical layer (see Figure 1).

A well-established method in our testing practice is the repeated performance of linear cutting tasks, where we measure the change in time required for each run (see Figure 2).

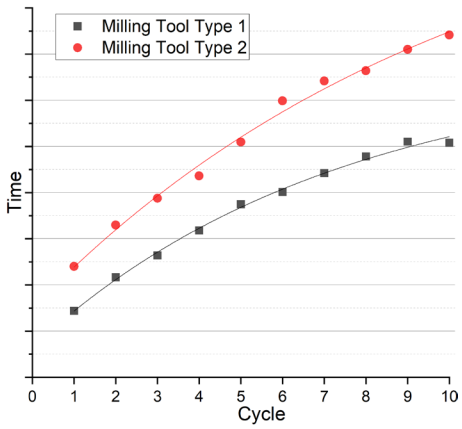

Figure 2: Typical development of the time for milling a defined distance with two different designs of milling tools. The time increase is substantially lower for type 1, i.e. the tool wears more slowly.

We also often use the test method specified in the Chinese standard YY 91064 for dental drills. This involves first milling in a PMMA plate, followed by milling in an abrasive material and then milling in a PMMA plate again. The increase in milling time observed provides important insights into the durability and efficiency of the milling cutter designs. As a result, decisions can be made based on reliable data.

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Info about the machine:

- Tooling machine «Fehlmann Picomax 21-M» with maximum speed of 6300 min^{-1} (infinitely variable)
- Tool holders via Drill chuck or collet chuck possible
- Maximum width of the Test block: 50 mm

Info about the measurment:

- Laser distance sensor OptoNCDT-ILD 1402 from Micro-Epsilon (max. measuring distance: 45 mm)
- Amplifiers & Software from HBM

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The RMS Foundation has been certified according to ISO 9001 and is an ISO/IEC 17025 (type C) accredited laboratory.

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