On the Machining of Joint Implant UHMWPE Inserts

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Abstract. The modern orthopaedic implants for applications in hips, knees, shoulders, and spines are composed of hard metal alloys or ceramics. The tribo-logical sub-component is composed of soft materials with good tribological properties – e.g. UHMWPE (Ultra High Molecule Weight Polyethylene). The UHMWPE implants need to be machined into their final shape after the polymerization and consolidation into a blank profile or near-net shaped implant.
So machining is a crucial technology that can generate an accurate and precise shape of the implant that should comply with the joints' function. However, the machining technology can affect the topography and integrity of the surface, and its resistance to wear. The technology, cutting tools, and cutting conditions can impact the physical and mechanical properties of the entire implant, limiting its life span and creating a need to be replaced.
The basic machining technologies are turning and milling (each can be used as roughing or finishing). There are many ways to machine these surfaces. Many problems such as low rigidity of the product, poor thermal properties of the mate-rial, high melt viscosities, and sticking of the material to the cutting edge (production of built-up edges) have been solved. UHMWPE can be damaged by excessive heat, feed rate, cutting force, and tool micro-geometry. The shapes and dimensions for the customized implants vary broadly for the humans this complicates the machining technology. No standard programs can be used repeatedly so each joint must be designed and produced individually. However, it results in the longer implant life and a better comfort of patients.

Keywords: machining, UHMWPE, implant, surface integrity, tribology

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