MASS FINISHING

History of the process

Nothing lasts forever – at least not in endoprosthetics. Even the very best quality of implant has only a limited life. One of the main factors in this is the quality of the surface finish.

Different types of implant place vastly differing requirements on the surface finish. Depending on the field of application, there are a number of criteria which determine the quality of the product: a highly accurate fit, a homogeneous surface, pronounced or minimal edge rounding. Combined with the complexity of the shapes normally involved, these factors have hitherto made reliable automated processing virtually impossible.

The process

From consultation to series production

In order to best fulfill the requirements of each individual application, it is essential to determine the ideal combination of all relevant process parameters. This includes amongst other things the choice of process, the composition of the processing media, the speed of rotation, the processing time and (in the case of drag finishing) the clamping angle.

Machines are available in a variety of sizes, from bench top units to fully-automatic plants. As for the choice of the right medium, potential customers are invited to have a sample of their product processed at the research laboratory. Such service is available all over the world. Systems for sepa-

rating the finished workpieces from the processing medium and for reprocessing the water used complete the range of products.

FIGURE 1: The right mixture for precision: disc finishing machine.

Example of Mass finishing of joint implants

The contact surfaces of hip and knee implants must be homogeneous, precise and very smooth. In order to achieve this, special mass finishing processes for drag finishing were developed.

In this process, the workpieces are clamped in specially designed holders and drawn through a series of grinding and polishing media in a number of processing stages. Clamping the workpieces eliminates any danger of damage caused by the workpieces colliding with each other. Especially when treating the complex surface geometry of a knee joint, it is important for the material to be removed evenly during grinding and polishing, in order to ensure a perfect fit. For this purpose, numerous trials have been carried out, workpiece holders were developed, which

guarantee precisely this. As a rule, items such as knee joints are processed in two stages as follows:

Wet grinding

During wet grinding the knee joints are dragged through a special plastic abrasive media. A water/compound mixture is added to the media in a continuous flow process; this mixture carries away the material removed and is discharged into an external process water treatment system (such as a microfiltration unit). This flow through process ensures that the workpiece remains clean at all times. The water/compound concentration can be preset by means of the Siemens S 7 control unit, considerably improving the consistency and reliability of the process.

By varying the depth to which the workpiece is immersed in the media and the speed of rotation, and thereby controlling the contact pressure of the abrasive on the workpiece, this process can achieve Ra values of up to 0.08 µm. The processing time for this is about 2 – 3 hours.

After wet grinding, the workpieces are in such a perfect condition that they can be polished immediately.

Dry polishing

During dry polishing, the knee joints are dragged through specially treated (impregnated) natural abrasive media such as walnut shell granulate. During impregnation, the granules receive a coating which basically consists of a special oil and aluminium oxide. The motion of the workpiece through the granulate and the resulting friction smoothes and polishes the workpiece. This process enables surfaces with Ra values of up to 0.01 µm to be achieved. This corresponds to the surface quality attained by manual polishing. The oil/aluminium oxide powder mixture has to be replenished at regular intervals in the form of a polishing cream in order to maintain a consistent polishing performance. The processing time is normally 1 – 2 hours.

Drag finishing machines can also be equipped to carry out both process stages automatically. This eliminates the time-consuming procedure of removing and reclamping the workpieces. In the OTEC DF-10 Tools drag finishing machine, for example, 20 knee joints can be clamped at one time and processed in about 3 – 5 hours.

Applications in the medical field

Such machines have numerous applications in the medical and dental sectors. Whether for joint implants, bone plates and screws, dental implants, dentures, orthopaedic products, ear inserts or stents - for products in stainless steel, titanium, plastic or ceramic.

Joint replacements

In the case of hip or knee joints, a homogeneous, very smooth and highly polished surface is demanded of the contact areas. For this purpose a special dry process for drag finishing was developed. In this process the workpieces are clamped in

suitable holders and dragged through the appropriate grinding and polishing media in a number of stages. Clamping the workpieces prevents them from damaging each other. The processing results depend on determining the ideal clamping angle. This enables Ra values of 0.03 µm to be achieved.

Bone screws and dental implants

Bone screws and dental implants are made of special stainless steel or titanium alloys. In order to obtain a good fit, unrounded but bur-free edges are required as far as possible. A smooth, polished surface is conducive to easy insertion and removal. Furthermore, the smooth surface simplifies the process of disinfection immediately before use. A way to fulfill all three requirements in a single process was developed. By using a disc finishing machine it is possible to create a smooth, highly polished surface without any significant edge rounding. After this single-stage process the workpieces are light in colour, have a pristine finish and exhibit a much higher quality. In this process Ra values of 0.03 µm can be attained.

Bone plates

In contrast to this, bone plates usually require a considerable degree of edge rounding and the surface should be as smooth and homogeneous as possible. Here, too, a disc finishing machine is used, albeit with different process parameters. This enables all traces of stamping and chip removal operations to be removed in a very short time and produces a smooth, high-quality surface.

Guarantees of quality

As a result of several years' work, past experience and know-how have helped developed special parameters for the drag finishing and disc finishing processes to meet the particular requirements of implant manufacturing. This makes it possible to achieve fast and economical surface finishing combined with consistent quality. Workpieces of any shape and weight can be deburred, ground, smoothed or polished in a very short time. This is performed by moving the workpieces through a customised composition of abrasive media, whereby the workpieces themselves are either loose or fixed in a rotating holder.

Partner

OTEC GmbH supplies precision engineering solutions for creating perfect surfaces with deburring, grinding, burnishing and polishing machines. With a network of over 60 agencies, OTEC is present all over the world to provide a local service to international customers from many different industries. Customers can benefit from OTEC's comprehensive expertise as the technology leader experienced in developing the perfect interplay of machine and processing medium.

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