



Polyethylene - The Miracle Plastic

One of the questions that I am most frequently asked as a joint replacement surgeon is "***What are the parts made of?***". The portion of the total joint which keeps the metal surfaces apart and acts as the spacer or shock absorber is a material called polyethylene. This is a plastic formed by pressurizing and polymerizing ethylene gas into a solid (usually powder). Polyethylene certainly is not something used only in medicine, but is a substance found in many common things that we use in every day life. After the dry powder is produced, it is stabilized and packaged.

The polyethylene powder is then manufactured by different processes which form rods or occasionally other shapes of polyethylene. The portion of the total joint implant such as a spacer in the center of a total knee replacement or a cup in a total hip replacement, is produced by a machining process.

After it is produced, orthopaedic grade polyethylene is usually referred to as ultra high molecular weight polyethylene. It is believed that ultra high molecular weight polyethylene will have much greater wear rates and less debris production than other types of polyethylene. In the very early years of joint replacement in the 1960's, a type of polyethylene was used that demonstrated poor wear characteristics and lead to failure in only two or three years.

As if all of this were not enough of a problem, attempting to sterilize the polyethylene material for use in surgery has presented its own set of problems. Attempts have been made to perfect different types of sterilization of the material to enhance its wear properties and increase its structural integrity. Gamma radiation was used for sterilization extensively until about five years ago when evidence began to mount that this type of sterilization caused oxidation of the polyethylene changing, in part, its structural integrity.

Gamma radiation in an inert environment such as Argon or a complete vacuum is the sterilization of choice today.



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