Ultra-high molecular weight polyethylene (UHMWPE) is a gold standard material for use in total joint replacements because of its good biocompatibility, high mechanical toughness, and low friction coefficient. Gel-spun high strength UHMWPE fibers have also been widely used as the suture in bone repairs. However, the gel-spun UHMWPE fibers cannot be used directly on soft tissue and skin for wound healing or tissue connection because of its high stiffness, which will cause lacerations and tissue cutting upon application. In this study, we have developed a new hybrid UHMWPE fiber with low tensile stiffness but high strength, which can be explored for use as sutures in wound healing applications.

In order to provide better utilization of UHMWPE in the medical application, UHMWPE coated with Polydimethylsiloxane (PDMS) was invented. The study was divided by two parts, the first part involved the production of isotropic polymer sol-gel by swelling 3wt% of UHMWPE in petrolatum and hot draw the produced isotropic polymer sol-gel to obtain the high tensile and elasticity UHMWPE with high oriented Extended Chain Crystal (ECC) fibers. The second part involved the PDMS coating on UHMWPE fibers by modified dip coating. The PDMS coating on UHMWPE enhanced the ultimate strain significantly with retaining tensile strength. The soften surface provided by PDMS reduce the damage to prevent lacerations of tissue during suturing. By controlled dip coating, the uniform dimension suture fiber with stripping-free is produced. Furthermore, the special porous structure on the fibers surface discovered that provided a potential of loading drugs, anti-infection or anti-inflammatory agent for advance medical operations.