

IMAGING FIBER ORIENTATION IN ARTICULAR CARTILAGE USING OPTICAL
POLARIZATION TRACTOGRAPHY

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ABSTRACT

Articular cartilage plays a vital role in providing a low-friction surface between the bones of joints. This mechanical function is highly related to the special collagen organization in cartilage, especially in the superficial zone. The “split-line” method has been previously used to examine the fiber orientation in superficial zone of the cartilage. Because the “split-lines” are created by pricking the cartilage surface using a needle, this method is destructive and cannot be used for diagnosis purpose.

In this thesis research, I applied optical polarization tractography (OPT) to visualize fiber orientation in cartilage. OPT is a recently developed high resolution imaging technology based on polarization-sensitive optical coherence tomography. OPT has been previously applied to visualize fiber structures in muscles. We showed that OPT can non-destructively image the fiber orientation in cartilage. The orientation information obtained in OPT agreed very well with the split-line results. In addition, the thickness of cartilage and the thickness of superficial zone can be obtained in OPT results. These findings show that OPT has a great potential in clinical orthopedic applications.