

Projekttitel: Hybrid – Development of a synthetic cruciate ligament prosthesis from a linear hybrid braid

Partner: Institut für Textiltechnik der RWTH Aachen (ITA)
Feinmechanik Mehr GmbH & Co. KG

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Mission Statement

As a load-bearing joint, the knee joint is subject to permanent stress, whose loss of function can lead to restrictions in mobility and thus to a loss of quality of life and an increased probability of new cases of concomitant diseases. Every 6.5 minutes a cruciate ligament tears. Worldwide, the number is estimated at one million cruciate ligament ruptures per year, in Germany at about 100k. 90 % of the defects are tears of the anterior cruciate ligament. In the western world the anterior cruciate ligament rupture is therefore one of the most common sports injuries.

The current gold standard in the surgical treatment of anterior cruciate ligament ruptures is still autologous ligament plastic surgery. After initial enthusiasm, the synthetic cruciate ligament prostheses developed since the 1980s are no longer used today due to rapid material fatigue and the resulting limited fatigue strength. The majority of synthetic cruciate ligaments are woven or braided. The disadvantage of a woven cruciate ligament is its force-elongation behaviour. The load is only absorbed by the threads perpendicular to the direction of production (warp threads). The force-elongation behaviour of a woven fabric differs significantly from that of a natural cruciate ligament due to the insufficient stretchability of the warp threads. The aim of the research project is the development of a linear hybrid braid of elastic and non-elastic fibres as a functional pre-distant cruciate ligament replacement with adequate fatigue strength as the new gold standard for cruciate ligament replacement.

In a first step, a novel linear production braiding machine for the manufacture of the hybrid linear braids as a synthetic cruciate ligament replacement with respect to ISO 13485 will be developed based on a prototype available at Kettler (patent application DE 10 2012 000 076 A1). For the production of the hybrid structure, carriers with a self-regulating yarn tension for processing the elastic fibres in the linear braiding process are conceived, designed and manufactured.

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