Ten pan-European centre collaboration to improve joint surgery awarded 3.7 million Euros

Under the Framework Programme 7 (FP7) the European Commission has granted 3.7 million Euros over the next three years to a consortium of 10 partners collaborating in the research and development aimed to improve the safety of joint surgery. Within the project the MXL consortium aims to develop a unique computing environment to allow all surgeons, irrespective of their surgical experience, to plan procedures using patient specific biomechanical analyses in order to ensure the optimum reconstruction of replacement knee, shoulder and hip joints. This environment will enable the surgeon to "virtually" implant and manipulate prostheses of different sizes, and at varying orientations, to fully understand the loading conditions and the mechanical stresses induced by these changes and their relation to the patient specific musculoskeletal competence. Currently, failure of joint replacement is often a consequence of inadequate restoration of the joint mechanics resulting in joint overload and instability, or their combination. To prevent failures and improve the outcome of joint replacement operations, MXL will make key facts on the mechanical conditions of the joint available to surgeons. By integrating the anatomical information regarding bones and soft tissues gained from standard clinical imaging techniques, such as x-ray and MRI, with biomechanical know-how MXL will make the joint loading and stability information accessible for joint surgery.

Patient-specific

MXL will implement an ICT framework that helps to identify a safe route to optimal functional outcome in which clinically available X-rays form the basis to derive multilevel biomechanical models. These models will be enhanced using musculoskeletal data derived from explicit clinical tests, thus providing patient-specific models for identifying a safe surgical strategy to minimize the risk of failure of joint surgery, as well as deliver optimal joint function and joint longevity.

Work packages

The overall project is divided into a series of distinct phases. The initial phase will involve collection and data management of the necessary medical image data. The second phase, to occur in parallel with the first, will be research intensive and aimed at developing a variety of technologies (including statistical shape modelling, rapid biomechanical model generation, rapid biomechanical solution methods) to a useable status. The third phase will see their application during the verification phase, through in vitro testing as well as clinical trials. The fourth phase will see the development of the end applications, including a pre-operative planning tool, surgeon training tool and a patient recruitment tool. In parallel, additional work plans have been designed to monitor and control the project and to demonstrate the project results to the wider end-user community.

Commercial uses

The MXL project team has a passionate belief that the field of orthopaedics and the subsequent clinical practice of joint replacement will be enhanced by the introduction of both ICT methods and a

patient centric approach. Our aim is to develop the MXL technology into three commercial applications:

1. MXL surgeon training module – a training tool to allow trainee surgeons to experiment and learn in a virtual clinical setting and hence understand the impact of decisions and surgical technique with direct feedback on the results;

2. Virtual clinical CAD tools and expertise – using ICT tools and expert knowledge within the consortium, we intend to provide a service to the implant product development community. The performance of existing and new implant design can be modelled in a virtual environment with real world data to comprehensively validate the device design.

3. Surgical planning/execution software – Ultimately MXL will reach its greatest potential in the clinical setting where it will be used as a surgical planning and decision support tool during the initial consultation phase with the patient and hence complement current PACs systems and also provide a complementary suite of software tools for guided surgical systems.

We have arranged our consortium and management structure to provide the optimal network for communication and working relationships. The consortium is composed of 10 participants. Their affiliations are: 6 leading European research/clinical centres, 2 ICT focused SMEs, 1 large world leading European software company specializing in numerical simulation for safety assessment, 1 professional project management company and a Project Advisory Board that is formed by representatives of key stake holders benefiting from MXL technology for improving patient safety in the management of degenerative joint disease, including committed commercial partners for the MXL technology.
The participants in the MXL consortium are: Charité – Universitätsmedizin Berlin (Germany), University of Southampton (United Kingdom), Academisch Ziekenhuis Leiden – Leids Universitair Medisch Centrum (Netherlands), Euram Ltd (United Kingdom), ESI Group S.A. (France), Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany), Technische Universiteit Delft (Netherlands), Istituto Ortopedico Rizzoli (Italy), SCS SRL (Italy) and Medis Specials b.v. (Netherlands).

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