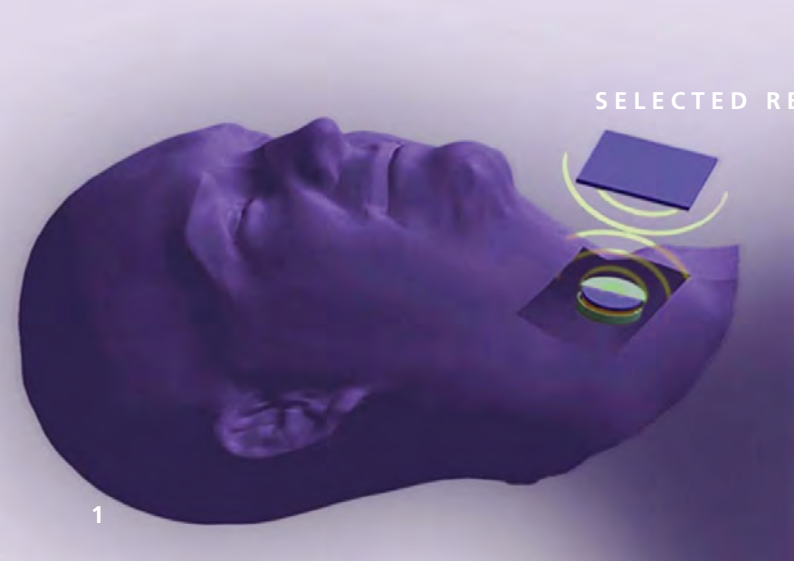

PROJECT EXAMPLE: "UTE" – ULTRASOUND-BASED ENERGY SUPPLY AND SIGNAL TRANSMISSION FOR HERMETICALLY ENCAPSULATED MINIATURE IMPLANTS

Starting situation

Active implants require a constant energy supply which is currently provided on a wireless basis transcutaneously and/or by implant batteries. The wireless transcutaneous energy supply and communication in active implants is currently provided exclusively by electromagnetic-inductive means. This technology reaches its limits, however, as soon as the implant is very small or when the implantation location has to be further away from the surface of the body. In particular, a hermetic metal encapsulation such as is used for almost all currently available active implants to achieve reliable, long-term functionality and biocompatibility screens off the high-frequency electromagnetic waves and restricts the possibilities and efficiency of this method. The only option then is signal transmission via cumbersome and defect-prone electric leads and cable connections to a coil arranged outside of the housing. If the energy is supplied from a battery, this takes up most of the size of the implant and has to be replaced at regular intervals with an expensive and patient-stressing surgical intervention.

Solution

The aim of the project "UTE" – Ultrasound-based transcutaneous energy supply and signal transmission for hermetically encapsulated miniature implants – is the development of a new technology platform as an alternative to implanted batteries or inductive approaches. It extends the possibilities of the hermetic metallic encapsulation of active implants by using ultrasound technology as a basis for the transcutaneous energy supply and communication. Unlike the electromagnetic-inductive approach, here the recipient of the ultrasound waves lies within the hermetic implant housing, directly on the wall of the housing. Implant wall and transducer are connected in such a way that ultrasound waves can be sent and received. The platform is completed with an extra-corporeal unit which can send energy and data by ultrasound waves and receive data sent by the implant. The exposure to ultrasound waves falls well below the specified limit values for ultrasound therapy on the human body.

Potential

The platform developed is aimed at the whole market for active implantable medical devices (AIMD), but particularly at highly miniaturized implants or implants with high energy requirements whose long-term energy supply cannot be secured due to the limited space available for energy storage. It is also an advantageous alternative for systems which currently supply energy via a subcutaneous receiver coil through a cable to an implant lying deeper in the body. Another important potential of the platform lies in the nature of ultrasound technology. The restricted public availability of ultrasound systems as well as the highly material-dependent propagation of ultrasound waves offers protection against cyber attacks.

Contact

Dipl.-Ing. Andreas Schneider
Telephone: +49 (0) 6897/9071-456
andreas.schneider@ibmt.fraunhofer.de

1 *Basic structure of ultrasound-based energy supply and communication.*