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UK-India Education and Research Initiative

Effect of cation substitution on the structure and biocompatibility of ionomer glasses and glass ceramics

Osteoporosis is one of the most common health risk faced by vast majority of the ageing population across the globe, especially by post-menopausal women. The occurrence of this systemic skeletal disease will eventually make the bone weak, porous and fragile. The survival of implants in such patients is very low, as osteoporosis affects the process of osseointegration and such patients otherwise have to undergo revision surgery. Considering the growing need to develop bone substitute materials that can improve bone formation as well as reduce bone resorption, a joint venture was initiated between Dr. Bikramjit Basu (Indian principal investigator) and Dr. Artemis Stomboulis (UK principal investigator) to fabricate ionomer substituted glass-ceramic based implant to enhance faster bone healing. This DST-UKIERI sponsored project resulted in several exchange visits among PI's group, knowledge dissemination through seminars and talks, utilizing the scientific concepts and technological ideas in the emerging area of biomaterials in order to develop clinically relevant materials for the purpose of the enhancement of public health.

One of the most **groundbreaking research outcomes of this UKIERI** collaboration was the study on the *in vivo* biocompatibility and faster Osseo integration of strontium containing glass ceramic implants in rabbit model, which was later published in the most prestigious journal, ***Biomaterials***[1]. **The uniqueness of this work was the comprehensive integration of Materials Science and Biological Science concepts towards** the development of novel glass ceramic implants for hard tissue replacement. Overall, the collaboration between Prof. Bikramjit Basu's group from India and Dr. Artemis Stomboulis's group from UK led to the creation and evaluation of novel glass ceramic implants that was found to be biocompatible *in vivo*, with regard to the local effects after implantation. The study of the structure of cation substituted glasses will improve the fundamental knowledge on the chemical structure and properties of glass networks and glass ceramics. It is only recently, that the structure of amorphous glasses can be fully studied by using advanced techniques such as high field MAS-NMR spectroscopy. Such a detailed analysis of structure and crystallisation mechanisms will help to predict the properties and biocompatibility related to cation charge and size. This information will have significant impact on the glass science and technology community (academia and industry).The summary and details of all the research activities carried out under the UKIERI project, can be viewed at the weblink - **http://www.iitk.ac.in/UKIERI_biomaterials**

Prof. Bikramjit Basu, Principal Investigator on the project received the prestigious Shanti Swarup Bhatnagar award-2013, for his outstanding contributions to Engineering Sciences discipline. He has been bestowed by this nation's most coveted honor for his work on "understanding the theoretical and experimental basis of in vitro cell functionality modulation on engineered biomaterials using electric field stimulation approach". Prof. Basu has also been elected as a Fellow of National Academy of Sciences, India in 2013.

In vivo implantation and biocompatibility evaluation of Sr-substituted glass ceramic implant in rabbit animal model *[adopted and modified from Sabareeswaran et. al[1]]*

Participants

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References

[1]A. Sabareeswaran, B. Basu, S. J. Shenoy, Z. Jaffer, N. Saha and A. Stamboulis; Early osseointegration of a strontium containing glass ceramic in a rabbit model, Biomaterials 34 (2013) 9278-9286