A hydrogel material developed at the University of Oxford promises better treatment for cleft palates – a birth defect that affects 1 in 700 babies in the UK – and for routine dental procedures.

The hydrogel breakthrough comes from Dr Jan Czernuszka and his team, including Dr Jinhyun Hannah Lee and Mr Zamri Radzi from the University’s Department of Materials, in collaboration with the John Radcliffe Hospital and the Georgia Institute of Technology. The hydrogel can be used for a wide range of surgical applications, including restorative and general dentistry, treatment of congenital disorders and surgical reconstruction.

One application of the technology is the development of a new treatment for cleft palates which involves inserting an anisotropic hydrogel under the mucosa of the root of the mouth. Once inserted, the hydrogel gradually expands as fluid is absorbed, encouraging skin growth over and around the plate. After sufficient skin has been generated to repair the palatal cleft, the plate is removed and the cleft is repaired using this additional tissue. This technology will provide a reliable method for expansion of the soft tissue, thereby improving the outcome for cleft palate patients.

Another key field of use is in dental treatments, including restorative dentistry, implant surgery and treatment of periodontal disease. Here again, the expansion of soft tissue in procedures such as dental implant surgery, where bone augmentation is required, will improve the outlook for patients and make it easier to predict the result. In the UK alone 80,000 implants are fitted, with an estimated 50% of cases requiring bone augmentation.

The success of the preliminary studies of the self-inflating anisotropic hydrogel has led to the first clinical trials in a range of surgical reconstructive procedures planned for 2011 and the team hopes that the improved treatment will become common clinical practice in the near future.

This new type of hydrogel material was recently investigated by the group using the Science and Technology Facilities Council’s ISIS Neutron Source facility to investigate the structure of hydrogel materials and how they might be used as part of a simplified surgical treatment.

“This study shows how fundamental knowledge about the structure of materials can be used to develop new technology.”

Andrew Taylor, Director of the Science and Technology Facilities Council ISIS Neutron Source

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