A soft touch for mending broken bones

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Silk is an unlikely substitute for steel in any context, but for bone fractures, it may just be the perfect thing.

A Swinburne researcher has developed a mix of cocoon silk fibres and biodegradable polymers that may one day hold bones together and help

heal them from the inside out.

Steel plates and bolts are often a surgeon's only tools for fixing fractured bones. The problem is that steel can block new bone cells from repairing the fracture. Removing the steel through further surgery can leave bones brittle.

Materials scientist, Professor Alan Lau, said this impediment was a real problem and that a replacement for steel was needed.

For 10 years, researchers have investigated a biodegradable polymer called PLA, already used in some food packaging, for medical implants. If PLA could pin bones together and then be gently resorbed by the body over time, bone cells could enter the fracture and heal the bone and eliminate the need for further surgery. But so far, PLA has proved too weak to reinforce bone.

Professor Lau came across part of the solution in 2007. Avian flu had broken out in his native Hong Kong and more than a million chickens were killed to stop the spread. He wondered why the chicken feathers weren't used for something. The idea of mixing animal fibres with other materials was the genesis of his breakthrough, but the fibres from feathers were difficult to purify. Lau's team found an alternative that was easier to work with: the silk from a silkworm's cocoon.

In 2008 Professor Lau's team at Hong Kong Polytechnic University combined cocoon silk fibres with PLA and found the polymer became harder. Adding around six per cent silk fibre made the biodegradable polymer as strong as bone.

The scientists also found cells can grow around the material as it degrades, showing potential for use in patients.

"At this stage we have a great accomplishment," says Professor Lau. "But there's still a long way to go."

Professor Lau is now tackling the design of the right pins and screws, speculating that the material could one day be tailored for individual patients by scanning their fracture and 3-D printing a shape that fits perfectly.

He is looking for collaborators in Australia to start animal trials and eventually progress the material to patients. He is optimistic: "If we can find a partner here to continue, this material will progress very fast."

Provided by Swinburne University of Technology