Scientists re-grow dental enamel from cultured cells

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Dental enamel is the hardest tissue produced by the body. It cannot regenerate itself, because it is formed by a layer of cells that is lost by the time the tooth appears in the mouth. The enamel spends the remainder of its lifetime vulnerable to wear, damage, and decay. For this reason, it is exciting to consider the prospect of artificially growing enamel, or even whole teeth, using culturing and transplantation techniques. In the emergent field of tooth-tissue engineering, several groups have developed their own approaches. Although there has been some success in producing enamel-like and tooth-like tissues, problems remain to be solved before the technology comes close to being tested in humans. One of the issues has been how to produce, in culture, sufficient numbers of enamel-forming cells.

Today, during the 85thth General Session of the International Association for Dental Research, a team of researchers from the Institute of Medical Science, the University of Tokyo (Japan), reports on a new technique for culturing cells that have the capacity to produce enamel. This group has recently shown that epithelial cells extracted from the developing teeth of 6- month-old pigs continue to proliferate when they are cultured on top of a special feeder layer of cells (the feeder-layer cells are known as the 3T3-J2 cell line). This crucial step boosts the number of dental epithelial cells available for enamel production. In the study being reported today, the researchers seeded the cultured dental epithelial cells onto collagen sponge scaffolds, along with cells from the middle of the tooth (dental mesenchymal cells). The scaffolds were then transferred into the abdominal cavities of rats, where conditions were favorable for the cells in the scaffolds to interact and develop. When removed after 4 weeks, the remnants of the scaffolds were found to contain enamel-like tissue. The key finding of this study was that even after the multiple divisions that occurred during propagation of the cells in culture, the dental epithelial cells retained the ability to produce enamel, as long as they were later provided with an appropriate environment.

The idea for the culturing technique originates from 1975, when Dr. J.G. Rheinwald and Dr. H. Green of Harvard Medical School reported the use of feeder layers for culturing epithelial cells from the skin (the 3T3-J2 cells used in the current study were gifted by Dr. Green). The cell-scaffold approach is based on tissue-engineering technology developed at the Forsyth Institute (MA) and was applied by one of the Tokyo researchers to produce enamel-like tissues in 2002. Now that dental epithelial cells can be propagated in culture, the next step will be to achieve the same success with their partners in tooth formation, the dental mesenchymal cells. Further development of this technique will be aimed toward production of tissue to replace damaged or missing enamel, and ultimately, regeneration of whole teeth.