Medical Xpress

Bio-hybrid dental implant that restores the physiological tooth functions

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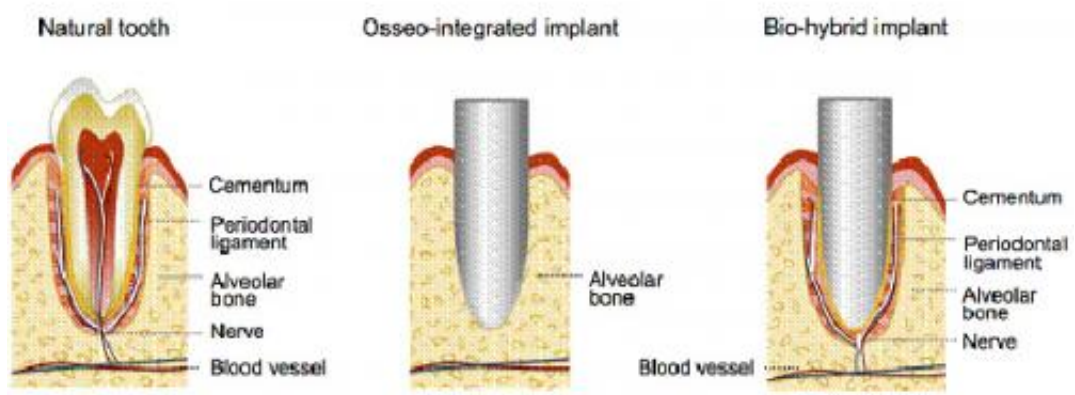

A model of the connection of a bio-hybrid implant to the periodontal tissues. The schematic representation of the natural tooth shows the osseo-integrated implant and bio-hybrid implant. The bio-hybrid implant restored physiological functions, including bone remodelling, regeneration of severe bone defect and responsiveness to noxious stimulations, through the periodontal tissue regeneration.

Our bodies function thanks to the smooth integration of different organs within the surrounding tissues. One challenge of creating artificial organs is to mimic the comprehensive organ function. Bio-hybrid implants are the way to go, but so far they have not been able to fully integrate into

the living tissue and perform the same functions as real biological organs. Now Takashi Tsuji and collaborators at several institutions in Japan have developed a bio-hybrid dental implant that restores the physiological tooth functions by using a conventional dental implant and dental follicle stem cells as a bio-hybrid organ.

The team used a hydroxyapatite-coated titanium implant and dental follicle stem cells extracted from embryonic tooth germs. They then studied the integration of this bio-hybrid implant into the tooth loss region with different microscopy techniques and demonstrated the regeneration of periodontal tissues comprising cementum, periodontal ligament and alveolar bone.

Tsuji and his colleagues found that the bio-hybrid implant essentially acts as a fully functional organ in vivo. The implant can respond to mechanical stress and perceive noxious stimuli. It also restores other physiological functions such as bone remodelling and regeneration of critical bone-defects.

There is still a way to go to clinical applications, but the new bio-hybrid implant represents a significant advance in the development of the next-generation therapeutic treatments for tooth loss.

More information: "Functional tooth restoration by next-generation bio-hybrid implant as a bio-hybrid artificial organ replacement therapy." *Scientific Reports* 4, Article number: 6044 DOI: 10.1038/srep06044

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