

Saving teeth by using periodontal ligament regeneration

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Teeth may fall out as a result of inflammation and subsequent destruction of the tissues supporting the teeth. Dutch researcher Agnes Berendsen has investigated a possible solution to this problem. At the Academic Centre for Dentistry Amsterdam (ACTA), she has studied the regeneration of the periodontal ligament by use of tissue engineering. The 3D in vitro model she has developed appears to be promising for regenerating periodontal ligament and may also prove valuable for restoring tendons and ligaments elsewhere in the body.

The periodontal ligament forms a flexible connection between the tooth root and the surrounding jaw bone. Trauma or inflammation can cause destruction of the periodontal ligament. Berendsen chose tissue engineering to tackle this problem.

Research in tissue engineering uses cells placed in a 3D model, after which signals are applied to activate the cells. Berendsen developed a new 3D model in which cells isolated from periodontal ligament were implanted in a collagen network suspended between an artificial root and artificial bone. She wanted to see if viable periodontal ligament could be generated in this way.

The composition of the collagen network in which the cells are located has a considerable influence on the contractile properties of the cells. Contraction of the cells creates internal tension in the network which keeps the cells active. The network must be well attached to the surrounding solid surfaces to prevent its detachment.

Berendsen managed to attach the network to these artificial root and bone surfaces present in the model by creating an enzyme-mediated mineral deposition on the surfaces. By subsequently applying loading to the tooth root (mimicking the process of chewing) in the 3D model, she was able to deform the mineral-anchored network containing the cells. The subsequent response of the cells was dependent on the magnitude of the loading.

Follow-up research will investigate whether the cell-culture results can be translated to an animal model to obtain more accurate insights concerning the potential use of this method in humans.

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