Professor Min-Huey Chen

Honorary Professor, Graduate Institute of Clinical Dentistry,

School of Dentistry,

National Taiwan University, Taiwan

Topic of Presentation:

Application of stem cells and exosomes for regenerative Medicine in Dentistry

Abstract

Stem cells and exosomes have significant potential in regenerative medicine,
Stem Cells in Dentistry

1. Regeneration of Dental Tissues: Stem cells, particularly those derived from dental tissues (like dental pulp stem cells), have the ability to differentiate into various cell types, such as odontoblasts (which form dentin) and cementoblasts (which form cementum). These cells are crucial in regenerating damaged or lost tooth structures.
2. Bone Regeneration: Stem cells from the periodontal ligament, bone marrow, or even induced pluripotent stem cells can be used to regenerate bone tissue lost due to periodontal disease or trauma. This can help rebuild the jawbone in cases where tooth loss or bone damage has occurred.
3. Periodontal Tissue Repair: Stem cells are being used to regenerate tissues affected by periodontal disease. Mesenchymal stem cells (MSCs) can promote the healing of the periodontal ligament and alveolar bone, improving the integrity and function of the periodontal apparatus.
4. Tooth Regeneration: Research is exploring the use of stem cells to regenerate whole teeth. By combining stem cells with scaffold materials, it′s possible to grow teeth in the lab or even stimulate tooth regeneration in vivo.
5. Neural regeneration: Stem cells have potential for neural differentiation and can promote the pulp regeneration and neural regeneration.

Exosomes in Dentistry

Exosomes are small vesicles secreted by cells that play a role in intercellular communication. They carry proteins, lipids, and genetic material, and are emerging as key players in regenerative medicine due to their ability to modulate inflammation, promote tissue repair, and enhance stem cell function. In dentistry, exosomes are applied in the following ways:

1. Enhancing Stem Cell Function: Exosomes derived from stem cells can be used to promote the healing and regeneration of dental tissues. They help in the

recruitment of endogenous stem cells to the site of injury and also enhance tissue repair by modulating immune responses.

2. Tissue Regeneration and Healing: Exosomes have been shown to aid in the regeneration of bone and soft tissues by promoting angiogenesis (the formation of new blood vessels) and collagen synthesis. This is particularly important in periodontal regeneration and bone healing after oral surgery.

3. Anti-inflammatory Effects: Exosomes have potential in reducing inflammation and promoting tissue healing, which can be crucial in cases of periodontitis or post-surgical healing. They help by modulating the immune response at the site of injury, reducing scar formation and accelerating tissue regeneration.

4. Potential for Guided Tissue Regeneration: Exosomes derived from specific cell types (like periodontal ligament stem cells) could be used to guide the regeneration of specific tissues, offering a more targeted and effective regenerative approach in dental treatments.

In summary, stem cells and exosomes hold tremendous promise in regenerative dentistry by promoting tissue healing, enhancing the regeneration of dental and periodontal tissues, and offering potential solutions for tooth regeneration and jawbone repair. Ongoing research and clinical trials will further solidify their application in everyday dental practices.