STEM CELL-ENHANCED DENTAL IMPLANT FOR IMPROVED OSSEOINTEGRATION AND REGENERATIVE TISSUE INTEGRATION

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Background: Dental implants are a widely used therapeutic option for the replacement of missing teeth and the restoration of oral function. Despite high success rates, implant failure may occur due to insufficient osseointegration, inflammatory reactions, or inadequate bone regeneration around the implant site. Conventional implantology primarily relies on mechanical stability and passive biological integration with surrounding tissues. Recent advances in regenerative medicine and tissue engineering have introduced new approaches aimed at improving implant performance through the use of biologically active materials and stem cells.
Aim of the Study: The aim of this study is to describe the concept and potential biological advantages of a stem cell-enhanced dental implant that integrates a biocompatible scaffold with osteogenic stem cells in order to improve osseointegration, stimulate bone regeneration, and enhance the long-term stability of dental implants.
Results: The proposed implant design includes a ring-shaped structure positioned at the upper part of the implant body. This component is manufactured from synthetic bone or another biocompatible bone-like material and functions as a scaffold capable of hosting osteogenic stem cells. After implantation, stem cells may be introduced into this ring-shaped reservoir, where they interact with surrounding tissues. Through osteogenic differentiation and the secretion of growth factors, these cells may stimulate new bone formation around the implant and enhance the regenerative capacity of the alveolar bone. This biological activity may strengthen the interface between the implant surface and the jawbone, improving the stability of the implant over time. In addition, stem cells may contribute to the regeneration of surrounding soft tissues, including gingival structures, thereby improving the attachment between the implant and the oral mucosa. The presence of regenerative cells may also reduce inflammatory responses at the bone–implant interface, which represents a common cause of implant failure in conventional systems.
Conclusion: The stem cell-enhanced dental implant represents an innovative concept that combines implant engineering with regenerative medicine. By integrating osteogenic stem cells into a biocompatible scaffold within the implant structure, this approach may enhance osseointegration, stimulate bone regeneration, reduce inflammation, and accelerate healing after implantation. The proposed strategy may contribute to improved long-term stability and higher success rates in dental implantology.