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A FEASIBILITY STUDY OF DEVELOPING CONDUCTIVE, ADHESIVE, REMODELLABLE AND ELASTIC GUMS (CAREGUMS) FOR MENDING BONE FRACTURES

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Bone glues may be the greatest alternative for bonding fractured bone segments compared to metal implants, which require screws, makes the treatment longer, have more adverse-effects for large fracture fragments, and are not suitable for small fracture fragments. The main purpose of this research is to investigate whether a Conductive, Adhesive, Reconfigurable, and Elastomeric material (called CareGum) is applicable as the basis material for bone glue applications. The CareGum material was infused with variable percentages of two different nanoceramic powders to enhance the mechanical behavior, biocompatibility and bioactivity. Several characterization approaches, such as impedance analysis, mechanical, adhesion, self-healing tests, and biocompatibility investigations, were used to evaluate the properties of the CareGum. CareGum samples were immersed in simulated body fluid (SBF), which mimicked the physiological conditions inside a body, to assess the bone bioactivity of the material (ability to stimulate hydroxyapatite (Hap) mineralization). The progression of the CareGum properties after immersion in the SBF was also analyzed. This enabled data collection on the behavior of the material under simulated body physiological conditions. Given the importance of achieving a material that is capable of inducing biomineralization, the optimization of the CareGum formulation and the bioactivity test has been carried out. Overall, the hybrid formulation containing nanoceramic powders can efficiently enhance the mechanical properties of the CareGum more than 100% after immersing in SBF. Moreover, the conductivity of the composite was around 10-3 S/cm, which decreased during the formation of HAp and this can be use to detect the bone formation stage.

keywords: Bone formation monitoring, bone glue, conductive polymer