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BIOMECHANICS AND BIOMATERIALS ADVANCES IN MEDICAL APPLICATION

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SUMMARY

Biomechanical analyses, especially in the areas of orthopaedics, dentistry and cardiovascular, has evolved from purely experimental to a more numerical and computational approach. These numerical methods have been successfully used for predicting the outcome of various surgical procedures. More intricate anatomical models can now be constructed, with time taken to solve the numerical analysis no longer becoming an issue. Short term and long term predictions of surgical outcomes in complex joints such as the spine and the wrist can be done with greater efficiency. Comminuted bone fracture healing can also be simulated with greater accuracy. Other than biomechanics and related analysis, biomaterials also play a crucial role with research areas focusing on enhanced properties to promote better integration with human tissues for faster healing and recovery. Magnesium has been the center of attention for its high specific stiffness as well as its degradation behavior inside human body. Enhancement of magnesium alloys includes the addition of calcium and bismuth as well as coating of its surface with silicon biopolymer, fluorine, hydroxyapatite and polycarbonate. Nanocomposites of Mg/HA/MgO and Mg/HA/TiO2 were also developed. Other biometals under investigation are silver nanoneedles and cobalt-chromium-based alloys. Research on the enhancement of HA includes the addition of barium-fluoride and erbium, as well as developing bioglass using rice husk. Quinone-rich polydopamine functionalization of yttria-stabilized-zirconia has also been found to enhance the growth of apatite biomineralization.