In the present study, bioactive glass-zirconia core-shell spherical nanoparticles were synthesized using a combination of sol-gel and sonochemical methods. The results revealed that the nanoparticles possess a ~ ١٦±٤ nm rough tetragonal zirconia shell that surrounded the bioactive glass core. The optimized structure was coated on Ti٦Al٤V substrate through electrophoretic deposition technique. In order to obtain a stable suspension of nanoparticles in ethanol, dopamine was used as a surface treatment agent and cathodic electrophoretic deposition was successfully achieved on the Ti٦Al٤V substrate. Also, the utilization of polyethyleneimine improved the adhesion between the coating and substrate. Due to the differences in surface charge of zirconia and bioactive glass nanoparticles, a high voltage and surfactant concentration are necessary for the simultaneous deposition of the particles. However, in the presence of core-shell nanoparticles, this issue was overcome. Microscopic examination of the coatings confirmed the elimination of cracks in core-shell constituted coatings. The adhesion between the coating and substrate increased significantly due to the rough surface of the core-shell nanoparticles. The appropriate cohesion due to the core-shell particles, lower coating thickness, and the reduced cathodic voltage resulted in higher barrier performance of the coatings compared to the bioactive glass coating group as tested in a phosphate-buffered saline solution (impedance (|Z|) was ٧٫٦ times higher). In addition, despite the presence of a $ZrO_{٢}$ shell around the bioactive glass particles, the bioactivity was not greatly affected. Furthermore, the cell viability study on the core-shell coating, following exposure to MG٦٣ cells, confirmed the non-cytotoxic nature of the coatings. According to the SEM images, cell proliferation improved significantly on the core-shell coatings compared to a bioactive glass group, perhaps due to the excellent pH control owing to the presence of a zirconia shell. These results confirmed the positive effects of using core-shell coating on the