and Smad1/5/8 phosphorylation. This proves the potential of bioglass-releasing dexamethasone to actively stimulate odontogenic differentiation of the dentin-pulp complex.

Borate bioglass has been under trial in the promotion of angiogenesis. In rat subcutaneous implantation model, borate bioglass scaffolds improved angiogenesis (Lin et al., 2014).

Studies done to quantify vascularity have also thrown light on the fact that the concentration of bioactive glasses is equally important in the promotion or inhibition of angiogenesis. The foam replica technique was used to fabricate 3D scaffolds with angiogenic cobalt on"1393"melt-driven glass (53 wt% SiO_2, 6 wt% Na_2O, 12 wt% K_2O, 5 wt% Mg, 20 wt% CaO, and 4 wt% P_2O_5). Structural and biological functions were evaluated. The characteristics of cobalt varied with its concentration. It formed as well as modified the network. CoO substituted the Si−O bonds as Co−O bonds at 5 wt% concentration exhibiting compressive strengths of >2 MPa which was equivalent to human spongy bone. After a time span of 21 days, maximum Co concentrations of around 12 ppm was noted in the simulated body fluid, which was well within the optimum therapeutic range (Hoppe et al., 2014).

Nanoscaled 45S5 bioglass particles were incorporated on bovine type I collagen and composite films were made. The CAM model was used for assessing the angiogenic status. After 24 h, 10 wt% n-BG promoted angiogenesis by 41%, whereas 20 wt% of n-BG inhibited angiogenesis (Vargas et al., 2013). This revelation will be significant in using bioglass in regenerative and tissue engineering.

12.9 DRUG DELIVERY UTILIZATION

Biomaterials possess the most favorable bioactive property, yet modifying them to be effective in easy production and adapting them to the function of proangiogenic or antiangiogenic is equally important. The various methods of drug delivery are as follows (Bhise et al., 2011).

Drug-agent conjugates—The direct combination of the drug and delivering agent.

Implanted drug-loaded materials—Implanted natural or synthetic polymers with loaded drugs.

Micro/nano-particles to deliver drugs—Micro/nano-particles to deliver proteins, genes, drug, etc.

Cell-based delivery systems—Cells like endothelial cells, human mesenchymal stem cells, adipose-derived stromal cells, etc. are used on scaffolds for delivery.

Nondegradable particles—Examples are mesoporous silicon microparticles, metal nanoparticles, iron oxide nanoparticles, gold nanoparticles, etc.

Tissue engineering has witnessed the advancement of biomaterials scaffolds with a combination of natural and synthetic polymers and bioglass. As per the