



FIG. 5.1 Structural diagram of bone (McNamara, 2011). (A) Nanostructure, (B) microstructure, (C) macrostructure, and (D) organ level.

bone transplantation is increasing. Tissue engineering thus helps to solve the problem of shortage of donors, and eliminates the waiting time usually required for a transplant. The main objective of bone tissue engineering is to assemble a bone substitution that is based on the combination of engineering principles and cell biology. Tissue engineering materials have the ability to repair the damaged bones as well as to stimulate the natural regeneration of bone tissue. Implanting bone scaffolds into the damaged bones allows for the growth and adhesion of osteocytes to the bone scaffolds. After the implantation, the osteocytes grow over the damaged site and eventually fill it, while the bone scaffolds degrade over time (Guarino et al., 2008; Lou et al., 2012; Mohammadkhah et al., 2015). The damaged area thus shrinks as a result of the newly formed and fully regenerated tissue, whereas the bone scaffold completely decomposes over time. The phenomenon of tissue engineering is depicted in Fig. 5.2.

5.4 SCAFFOLDS

Depending on the best application, varied matrix materials are used to support three-dimensional (3D) cell culture. These embody artificial polymers, natural polymers, natural-synthetic hybrids, metals, ceramics, glass, and carbon nanotubes. Artificial polymer area units are most well liked due to the power to manage their physical and chemical properties. However, they lack the biological activity of natural polymers. The format and producing techniques for various types of scaffolds vary according to the final application of the scaffold. Some scaffold formats embody chemical compound gels, solid porous scaffolds, fibrous scaffolds, and noncellular scaffolds (Lluch et al., 2014; Dhandayuthapani et al., 2011).

5.4.1 Hydrogels

Hydrogels are typically used for tissue engineering because their hydrated and soft form resembles the natural living tissues. 3D hydrated hydrogel polymer