

periodate shows faster degradation rate, as it is susceptible to hydrolysis. Oxidized alginate hydrogels showed faster degradation there by enhancing new bone formation, when compared to unoxidized alginate hydrogel (Kong et al. 2004).

Consideration of Hydrogel Design for Bone Applications

In TERM applications, it is essential to mimic the ECM for regenerating the damaged tissue. As hydrogels are capable of forming three-dimensional network with high porosity and absorbs considerable amount of water, they serve as a delivery vehicle for tissue engineering. It is important to understand the properties of natural tissue while designing the hydrogels as every tissue in our body has specific properties. The following key parameters need to be considered while designing injectable hydrogels.

Stiffness and strength

The stiffness and strength of the hydrogels varies based on the application and mimic the native tissue. Usually the strength of the hydrogels is measured in terms of elastic modulus and yield stress. For example, the hydrogels should have considerable strength for bone applications where as for skin this requirement is less demanding. The cellular processes such as adhesion and differentiation (Cukierman et al. 2011), motility (Lo et al. 2000) and phagocytosis (Beningo and Wang 2002) are depending on stiffness of the gel. The stiffness of the hydrogels depends on various parameters such as polymer concentration (West et al. 2007), preparation method (Drury et al. 2003) and degree of crosslinking (Nicodemus et al. 2008; Dadsetan et al. 2007). Shear thinning is a property shown by certain class of hydrogels where they start flow when external shear is applied. In the absence of shear, hydrogels behave like a solid and retain their original shape. Many researchers are developing this type of gels for ease of handling and minimal invasiveness to use in tissue regeneration (Van Vlierberghes et al. 2011).

Porosity/permeability

Another important parameter to be considered in tissue regeneration is porosity of the hydrogel, which helps cell migration and nutrient supply. These interconnected porous networks create a platform for faster cell growth and proliferation (Kretlow et al. 2007; Hunt et al. 2010). The pore size plays important role in controlled release of drugs and growth factors. The appropriate pore size is however still a topic of debate. Some studies shown that smaller pore size hydrogels are better since natural tissues are in nanometer scale. However, some researchers have demonstrated that better cell proliferation and matrix content production when hydrogels have large interconnected pores (Griffon et al. 2006). Brauker et al. showed the importance of pore size for cell growth. The average pore size (0.8–8 μm) enhanced the cell growth in the gels (Brauker et al. 1995). It is important to design a hydrogel with appropriate pore size and strength for controlled delivery of drugs or growth factors. At the same time size of the molecules should be smaller than size of the pores to enable free movement inside the pores and controlled release. Such release also depends on the