

of teeth and bone (Blaschko et al., 2013). Zinc (Zn^{+2}) (Lynch et al., 2012) and silver (Ag^{+1}) (Gargiulo et al., 2013) have been reported to possess antibacterial properties and their incorporation in bioactive glass is another potentially useful area to synthesize novel glasses with bactericidal properties and utilize them in implant coatings. Novel bioactive glasses containing borate (BO_3^{-3}) in their compositions have recently shown better bone regenerating properties as compared to the conventional silicate bioactive glasses (Fu et al., 2010). BO_3^{-3} -based bioactive glasses can also act as a center for therapeutic ion discharge in cases of infections (Liu et al., 2010) which can occur after placement of a dental implant. Recently, it has been demonstrated that the degradation rate of bioactive glasses can be controlled by manipulating its composition, for example, replacement of silica with BO_3^{-3} in silicate bioactive glasses gives a wide-ranging period over which the degradation can be varied (Yao et al., 2007). This better control of degradation rate could prove advantageous in matching the rate of degradation of BO_3^{-3} based bioactive glass with the rate of new bone regeneration (Rahaman et al., 2011). Therefore, although silicate based bioactive glasses have been researched extensively in the past few years, BO_3^{-3} -based bioactive glasses have opened new doors of tissue engineering and their use in dental implant coatings could yield promising results.

Although dental implants have a high success rate, infection and ineffective tissue integration poses a serious threat to their success; thus, an ideal implant surface should be osseointegrative and antibacterial (Kulkarni Aranya et al., 2017). To avoid these two concerns, implant surface modifications/coatings were introduced (Liu et al., 2004). Bioactive glass remains a gold standard material with a marked evidence of bioactivity (Granito et al., 2011). Therefore, it can be an ideal material for dental implant coatings as it forms HAP on the glass surface (which bears resemblance to the inorganic phase of the bone) and can significantly accelerate healing times (Torricelli et al., 2001).

11.4 KEY PROPERTIES OF BIOACTIVE COATINGS

11.4.1 Bioactivity and Osseointegration

Bioactivity is a key property that promotes osseointegration for bonding and better stability of dental implants. Bioglass coatings represent high surface area and reactivity leading to an effective interaction of the coating material and surrounding bone tissues (Cao and Hench, 1996; Hench, 2006). In the biological environment, the formation of a layer of carbonated hydroxyapatite (CHA) initiates bonding to the bone tissues (Jones, 2013). The bioglass surface coating undergoes leaching/exchange of ions, dissolution of glass, and formation of the HA layer that promotes cellular response of tissues. The high specific surface area of bioactive glasses is likely to induce quicker solubility of the material, availability of ions in the surrounding area, and enhanced protein adsorption ability. These factors altogether contribute toward the bioactivity of bioglass coatings (Mačković et al., 2012). In addition, tissue mineralization (bone, teeth)