

have important roles in faster healing of wounds (Table 8.2) (Zhai et al., 2012; Li and Chang, 2013; Dzondo-Gadet et al., 2002; Grzesiak and Pierschbacher, 1995; Lansdown, 2002; Kornblatt et al., 2016; Wild et al., 2010; Lansdown et al., 2007). Its deficiencies or imbalances in ionic concentration are potential causes of chronic or nonhealing wounds.

Several studies have shown that borate glass, when subcutaneously implanted to interact with the surrounding tissue, stimulates angiogenesis and that it is nontoxic (Zhou et al., 2016; Yang et al., 2015). The borate glass (13-93B3) nano-/microfibers stimulated the skin fibroblast cells proliferation and migration ability (Yang et al., 2015). Zhou et al. (Zhou et al., 2016) reported that 13-93B3 microfibers showed a thinner fiber diameter (1 μm) and better biodegradation and bioactivity than the 45S5 Bioglass microfibers. In vivo, the BG microfiber accelerated the wound healing rate and enhanced the formation of blood vessels, resulting in a much faster wound size reduction than the 45S5-fibers, or than the control groups, after 9 days application (Fig. 8.7).

Copper ions have a very important role in wound healing, enhancing angiogenesis and showing antimicrobial activity (Kornblatt et al., 2016; Chen et al., 2017). Zhao et al. (2015) reported that the ionic dissolution product such as Ca, B,

TABLE 8.2 Role of Elements in Wound Healing

Element	Role	Ref.
Silicon	Stimulates the secretion of pro-angiogenic growth factors; stimulates the proliferation of endothelial cells and angiogenesis	Zhai et al. (2012), Li and Chang (2013)
Boron	stimulates $\text{TNF}\alpha$, VEGF, and $\text{TGF}\beta$ secretion	Dzondo-Gadet et al. (2002)
Calcium	Extracellular regulator and intracellular modulator of cell proliferation and differentiation in the epidermis	Grzesiak and Pierschbacher (1995), Lansdown (2002)
Copper	Promotes angiogenesis, stimulates VEGF secretion and antimicrobial activity	Kornblatt et al. (2016)
Zinc	A cofactor for both RNA and DNA polymerase, essential for all proliferation cells and antimicrobial activity	Wild et al. (2010), Lansdown et al. (2007)
Magnesium	A cofactor for many enzymes involved in protein and collagen synthesis	Grzesiak and Pierschbacher (1995)
Iron	A cofactor of prolyl and lysyl hydrolysis enzymes, which are essential for the synthesis of collagen	Wild et al. (2010)