



FIG. 9.1 Commercial products for periodontology based on Bioglass. (Reproduced with permission from Fermin, A., Carranza, J., 1996. *Classification of diseases of the periodontium*. In: Carranza, F.A., Newman, M.G. (Eds.), *Clinical Periodontology*, eighth ed. W.B. Saunders, Philadelphia, p. 58.)

anchorage is capable of successfully maintaining support for the implants for long periods of time (Norton and Wilson, 2002).

9.5 BONE-BONDING BY BIOACTIVE GLASS

Bioactive glass is appropriate for use in the treatment of periodontal diseases because of its ability to stimulate the growth of new bone. This is able to replace the bone destroyed by the progression of the periodontal disease. In this way, the teeth cease to be loose, and they are no longer in danger of being lost. The mechanism of this bone-bonding will now be considered in detail.

Not surprisingly, given its biological complexity, the full details of the processes underlying bone regeneration and bone bonding are not fully understood (Jones, 2013). However, some aspects are well known, particularly those associated with the early part of the process.

The strong bond formed between bone and bioactive glass is attributed to the formation of an HCA layer, a layer that is able to interact with collagen fibrils of the diseased bone to form a bonded structure (Hench and Paschall, 1973). Following the formation of this HCA layer, bone bonding occurs. The latter process is thought to involve protein adsorption, followed by incorporation of collagen fibrils. After this, bone progenitor cells become attached, cell differentiation occurs, and this leads to excretion of bone extracellular matrix and subsequent mineralization (Hench and Polak, 2002). Although the details of these later steps are not clear, it is apparent that the HCA layer that forms initially is able to act as an appropriate surface for the attachment and subsequent proliferation of osteogenic cells.

The formation of HCA itself is a multistep process, and appears to involve five distinct steps, which apply in both natural body fluids *in vivo* and in