Oral Diseases (2008) 14, 204–205. doi:10.1111/j.1601-0825.2008.01443.x

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COMMENTARY

Periodontal disease and diabetes

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Gingivitis and chronic inflammatory periodontal disease are among the most common chronic infections worldwide. In the United States, half the population has evidence of gingival inflammation (Albandar and Kingman, 1999) and nearly 45 million people have moderate or severe periodontal disease (Albandar *et al*, 1999; Burt, 2005). Diabetes is also highly prevalent, affecting over 217 million people worldwide and 21 million people in the United States, and the prevalence is expected to increase rapidly in the coming decades (Smyth and Heron, 2006). Given the high prevalence of periodontal disease and diabetes, it is not surprising that the two diseases are present concurrently in many people.

The relationship between these diseases, however, is more complex than simply the intersection of two common diseases. The emergence of periodontitis may signal the onset of diabetes. Moreover, diabetes increases the risk and hastens the progression of periodontal disease, and periodontal disease hinders glycemic control, ultimately creating a vicious cycle that may worsen both diseases (Mealeyand and Oates, 2006). Accordingly, treatment of periodontal infection takes on added importance in the setting of diabetes, not only for maintenance of oral health but also for its possible effect on improving glycemic control and breaking this vicious cycle—a current topic of research interest among investigators.

Recent studies suggest even greater complexity in the relationship between periodontal disease and diabetes. These studies report striking relationships between periodontal disease and the development of the macro- and microvascular complications of diabetes—in particular cardiovascular and kidney disease (Saremi *et al*, 2005; Shultis *et al*, 2007). Whether these relationships are due primarily to the hyperglycemia that typically accompanies periodontal disease or to other mechanisms remains to be determined. Some proposed mechanisms for the link between periodontitis and the complications of diabetes include chronic systemic inflammation associated with increased circulating cytokines and inflammatory mediators, direct infection of the vasculature extending beyond the oral cavity, an autoimmune response to the chronic periodontal infection that leads to endothelial dysfunction, or common susceptibility factors that lead to increased susceptibility to periodontal disease and to vascular diseases simultaneously (Seymour *et al*, 2007). Perhaps several or all of these mechanisms are involved.

Once vascular complications of diabetes develop they may, in turn, adversely affect periodontal health. Increased levels of plaque, calculus, and gingival inflammation, for example, are often reported in patients with end-stage renal disease (Craig, 2008). Given the high rate of cardiovascular disease in these patients and the possible contribution of periodontal disease to cardiovascular disease, preservation of periodontal health in patients with end-stage renal disease may be of great importance.

The review by Taylor and Borgnakke in this issue of *Oral Diseases* (Taylor and Borgnakke, 2008) provides strong evidence for the bidirectional links between periodontal disease and diabetes and documents the emergence of evidence linking periodontal disease and the vascular complications of diabetes. This review also illustrates the shift in research focus in recent years from studies in type 1 diabetes to a greater emphasis on studies in type 2 diabetes. Such a change in focus is prudent, since type 2 diabetes is also strongly associated with periodontal disease and accounts for more than 90% of the diabetes worldwide. Furthermore, the prevalence of this type of diabetes is increasing rapidly in response to an increasing prevalence of obesity. With obesity increasingly affecting young people, the onset of type 2 diabetes is also shifting to younger ages (Pavkov *et al*, 2007), leading to the earlier appearance of diabetic complications (Krakoff *et al*, 2003; Pavkov *et al*, 2006). All of these factors emphasize the importance of identifying the underlying mechanisms that link periodontal disease with diabetes and its complications and finding effective treatments to disrupt these links.

As illustrated in the review, the relationship between oral health and general health is indisputable. This

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Received 17 January 2008; revised 17 January 2008; accepted 18 January 2008

observation suggests that a multifactorial approach to the care of diabetic patients that incorporates aggressive treatment of periodontal disease may be beneficial in reducing the complications of diabetes. A study of multifactorial interventions in type 2 diabetes, that did not include periodontal disease management, but did combine dietary modification, increased exercise, and smoking cessation with aggressive pharmacologic management, reported a reduction in the rate of cardiovascular disease and kidney disease progression in people with type 2 diabetes relative to standard care (Gaede *et al*, 2003). The additional contribution of periodontal disease management in this setting deserves careful scrutiny.

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