

There are several reasons for sialolithiasis being observed most commonly in the submandibular system. First, the submandibular gland lies inferior to Wharton's duct such that the flow of saliva must travel against the forces of gravity. The physical characteristics of Wharton's duct, specifically its length and two acute bends, also theoretically predispose the ductal system to the development of sialolithiasis. The relatively long duct increases the transit time of saliva in the ductal system. The first bend occurs as the gland courses posterior to the mylohyoid muscle, and the second occurs just proximal to the exit of the duct superiorly into the anterior floor of the mouth. While the anatomic nature of Wharton's duct has been considered to be etiologic in the genesis of sialoliths in this system, the angle of the genu of the duct has been investigated as to whether it represents a significant contributory factor (Drage, Wilson, and McGurk 2002). Specifically, these researchers retrospectively studied this issue using sialograms in 23 patients with sialadenitis, 61 patients with sialolithiasis, and a control group of 18 patients. There were no statistical differences in the angle of the genu in the three groups, suggesting that the difference in the angle of the genu of the submandibular duct in the sagittal plane is not of etiologic significance in the formation of sialoliths. The authors indicated that the *length* of the duct might be of significance in the formation of stones; however, that parameter was not investigated in their study. One final issue related to submandibular sialolithiasis is the alkaline nature of the saliva, its viscosity, and its relatively high content of calcium salts, specifically phosphates, carbonates, and oxalates that make the submandibular saliva more prone to sialolithiasis than the other major glands (see Table 5.1). All of these features contribute to salivary stasis, crystallization of precipitated calcium salts with calculus formation, obstruction to salivary flow, and infection. Interestingly, *partial* obstruction appears to be of great importance in the development of sialoliths. A completely obstructed gland, although possessing salivary stagnation, does not result in an increase in stone formation (Williams 1999). In completely obstructed glands, the calcium secretory granules in the acini become depleted and the saliva is less likely to produce stones. Baurmash has stated that salivary stasis and salivary viscosity, rather than the calcium content of the salivary secretion, determine the development of sialoliths (Baurmash 2004).

Table 5.1. Composition of normal adult saliva.

	Submandibular Gland	Parotid Gland
Calcium	3.6 mEq/L	2.0 mEq/L
Phosphate	4.5 mEq/L	6.0 mEq/L
Bicarbonate	18 mEq/L	20 mEq/L
Sodium	21 mEq/L	23 mEq/L
Potassium	17 mEq/L	20 mEq/L
Chloride	20 mEq/L	23 mEq/L
Magnesium	0.3 mEq/L	0.2 mEq/L
Urea	7.0 mEq/L	15 mEq/L
Proteins	150 mg/dL	250 mg/dL
Amino acids	<1 mg/dL	1.5 mg/dL
Fatty acids	<1 mg/dL	1 mg/dL
Glucose	<1 mg/dL	<1 mg/dL

Clinical Features of Sialolithiasis

Approximately 85% of sialoliths occur in the submandibular gland, 10% in the parotid gland, 5% in the sublingual gland, and the incidence of this pathology is extremely rare in the minor salivary glands (Milor 1998). When involved, minor salivary gland sialoliths occur in the buccal mucosa or upper lip, forming an indurated nodule that may mimic a neoplastic process. Sialolithiasis occurs more often in males, with a peak occurrence between 20 and 50 years of age (Lustmann, Regev, and Melamed 1990). The left submandibular gland is more often affected than the right gland, and bilateral involvement in the absence of another systemic disorder is rare. In fact, stone formation is not highly associated with systemic abnormalities of calcium metabolism (King, Ridgley, and Kabasela 1990). Gout is the only systemic disease known to predispose to salivary stone formation. These stones are primarily made up of uric acid. Multiple occurrences of sialolith formation independent of systemic illness in the same gland, however, are common. While salivary stones are single in 70–80% of cases (Figure 5.1), two calculi occur in 20% of cases, and more than two calculi occur in 5% of cases (Milor and Goldberg 2002; Williams 1999) (Figure 5.2). Sialolithiasis of the parotid gland is rare. When stones occur in the parotid gland, they are smaller than submandibular gland stones, and more often multiple (Figure 5.3). With regard to location, submandibular stones are located in the duct 75–85% of the time, while