Introduction

The preceding report showed the dissolution rate and amount (DR/AM) at pH 5.2/5.7/6.5 in the initial phase of dental enamel demineralization in a 5–10-min time period. Dietary carbohydrate fermentation by oral microflora frequently induces a pH drop, causing tooth demineralization below a critical pH\(^2\). Accordingly, the critical pH may vary over 5.1–6.5, primarily depending on concentrations of Ca\(^{2+}\) and phosphate species in saliva and dental plaque\(^5\).

Dynamic imbalance of demineralization/remineralization cycles, accumulative under regular daily conditions, brings about net mineral loss/gain for caries, or to keep a tooth intact over time\(^6\)-\(^8\). DR/AM is thus critical in dental enamel/tooth demineralization in the temporal and chronological accrual.

To date, eight theoretical models have been proposed to explain the mechanism of enamel mineral dissolution or biological apatite/calcium phosphate solubility\(^9,10\). Substantial evidence supports the key concept of each model. However, they are incongruent with the actual phenomenon, as shown when dealing with different aspects of apatite dissolution\(^9,12\). An integrated explanation is required to understand the interface science/surface chemistry in solid-phase dispersion into the abutting solution.

This study examined the DR/AM of enamel demineralization in the initial phase, comparing it with the Ca/P molar ratio (Ca/P ratio) for reference.

Materials and Methods

The experiment was designed to measure [Ca] and [P\(_i\)] in laetic acid (aq)/media from freshly extracted 1st premolars were measured with dissolution times of 5 and 10 min by ICPS. Despite the underlying complex dissolution phenomena on the enamel surface, (1) the outermost layer/surface of the enamel should be overlaid by amorphous calcium phosphate (ACP) with a Ca/P molar ratio of 2.0–2.5 or 2.0; (2) the solubility of the enamel surface depends on the pH and concentrations of calcium phosphates and other influential ions in the abutting solution, self-regulating the Ca/P molar ratio of ACP possibly by the homo/heterogeneous crystal nucleation and growth.

Key words: Enamel solubility, Ca/P molar ratio, ICPS

Abstract: To understand the solubility of tooth enamel surface/calcium phosphate(s), dissolved [Ca] and [P\(_i\)] in laetic acid (aq)/media from freshly extracted 1st premolars were measured with dissolution times of 5 and 10 min by ICPS. Despite the underlying complex dissolution phenomena on the enamel surface, (1) the outermost layer/surface of the enamel should be overlaid by amorphous calcium phosphate (ACP) with a Ca/P molar ratio of 2.0–2.5 or 2.0; (2) the solubility of the enamel surface depends on the pH and concentrations of calcium phosphates and other influential ions in the abutting solution, self-regulating the Ca/P molar ratio of ACP possibly by the homo/heterogeneous crystal nucleation and growth.