Odontogenesis is the development of teeth: odont = tooth and genesis = origin. The development of the gastrointestinal (GI) tract, including the oral cavity and teeth, is a complex series of events. In the embryo, the GI tract begins as an endodermic tube. In a short period, this structure folds in on itself to form three distinct sections—foregut, midgut, and hindgut. The foregut gives rise to the pharynx, esophagus, stomach, duodenum, respiratory tract, liver, gallbladder, and pancreas. The midgut becomes the jejunum, ileum, cecum, appendix, ascending colon, and part of the transverse colon. The hindgut forms the rest of the transverse colon, rectum, and anal canal. The oral cavity develops from the pharyngeal end of the foregut as the oral plate. From this, the maxilla, mandible, and their associated structures form.

Tooth Formation

Teeth form from the gathering of mesenchymal cells from the ectoderm along the epithelium of the mandible and maxilla at specific sites. A variety of growth factors interacts
with this follicle to form the tooth bud. Additional growth factors create the enamel knot and the cap stage of development when the tooth cells begin to align. During the cap stage, nerves and blood vessels begin to develop and enter the developing dentin, eventually becoming the pulp of the tooth. The bell stage then follows and begins the differentiation into the tooth components of dentin and enamel. In the final, crown stage, enamel forms with the mineralization of odontoblasts. Ameloblasts aid in the creation of enamel toward the outer surface of the developing tooth. Odontoblasts move toward the center of the tooth creating dentin. (Secondary dentin continues to form in permanent teeth throughout life causing a gradual narrowing of the pulp chamber.) Cementoblasts form the cementum in the very late stages of tooth development (Fig. 1.11).

**Eruption**

Many theories exist on the mechanism of tooth eruption. The three current theories are as follows.

**Root formation**

As the tooth root develops, it elongates the tooth pushing it through the gingival tissues; however, rootless teeth develop.

**Alveolar bone remodeling**

Bone formation at the apex of the tooth and resorption of bone at the coronal end of the tooth follicle interact to create penetration of the mucosa.

**Periodontal ligament**

Periodontal ligament formation and renewal are involved in the continuous growth of teeth in some species (i.e., rodents and rabbits); however, this has not been proven in species of animals with only two sets of teeth.

If a path does not create for the eruption of a tooth, it may become impacted or embedded. An impacted tooth is one prevented by bone from erupting. Soft tissue inhibits an embedded tooth’s eruption. If there is a disruption of a tooth bud during development, it may grow in an abnormal location or create a dentigerous cyst (Fig. 1.12).
Primary Teeth

Dogs and cats are diphyodont with two sets of teeth during their lifetime. As permanent teeth erupt, roots of primary (deciduous) teeth are absorbed, become loose, and eventually fall out. Other species, such as most rodents and lagomorphs, have open-rooted teeth that continue to grow throughout their life. Many types of snakes and sharks are polyphyodont and continuously replace teeth as they exfoliate. Table 1.1 shows the tooth eruption schedule for primary teeth of dogs and cats.

Permanent Teeth

Primary and permanent teeth do not fall out and erupt at the same rate. A mixed dentition is often present. Normally, as the permanent tooth emerges, the primary tooth is
lost. If this does not occur, the primary tooth is retained. Two teeth should not occupy
the same space at the same time. Retained primary teeth can lead to rotation and malocclu-
sion of permanent teeth. The close interdigitation of the primary and permanent tooth
prevents normal teeth cleaning causing food and debris to accumulate leading to peri-
odontal disease. This can cause long-term damage to the developing permanent tooth and
potential tooth loss.

Tooth eruption varies with sex, breed, overall health and well-being, body size, and
season of birth. Teeth of females, larger breeds, summer-born, and healthy animals erupt
earlier than their counterparts. Table 1.2 shows the permanent tooth eruption schedule
for dogs and cats.

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Canine (Month of Eruption)</th>
<th>Feline (Month of Eruption)</th>
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<tr>
<td>Incisors</td>
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<td>3–4</td>
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<tr>
<td>Canines</td>
<td>4–6</td>
<td>4–5</td>
</tr>
<tr>
<td>Premolars</td>
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<td>4–6</td>
</tr>
<tr>
<td>Molars</td>
<td>5–7</td>
<td>4–5</td>
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References