6.1 Introduction

G. Schmalz

Cements and ceramics have a very long tradition as dental materials, and they have been used for a great variety of different applications. Cements and ceramics are basically inorganic, nonmetallic, hydrophilic materials, although there are some exceptions. Cements are powder–liquid systems that set via salt or chelate formation. Ceramics are fired, cast, or pressed under heat; subsequently, they are shaped into the desired form, such as by an additional milling or by “sonoerosion.”

The basic components of many types of cement are the following:
- Zinc oxide or silicon dioxide as powder
- Phosphoric acid, polyacrylic acid, or eugenol as liquid (Table 6.1)

Setting calcium hydroxide materials are also usually classified as cements [5]. Calcium phosphate cements are a recent development [4] and are considered to be bioactive (osteocoinductive and osteoinductive). The main disadvantages of calcium phosphate cements are their poor mechanical properties and washing-out effects, which restrict their actual use to bone regeneration and root canal therapy [1]. These materials are discussed in detail in Chap. 7.

In addition to the cements that will be comprehensively described in this chapter, various other similar dental cements have been used in the past. These will not be discussed here in detail because they are of little or no clinical importance today, but they are as follows:

Silicate cements have been used for many years as anterior filling material. However, these materials have been replaced more and more by adhesively applied resin-based composites, not least due to the high risk
of pulp damage that was associated with silicate cements when used without a cavity base [e.g., 7]). However, bacteria proliferating beneath silicate cement fillings on the cavity floor were also deemed responsible for pulp damage [e.g., 3]).

Polycarboxylate cements have primarily been used as luting materials. They reveal good pulp compatibility [7, 10]. The initial pain occurring after luting fixed restorations with zinc phosphate cement was not observed if cast restorations were inserted with polycarboxylate cements. However, these materials shrink more extensively than zinc phosphate cements [9].

Silicophosphate cements (also called stone cement) are a combination of silicate and zinc phosphate cement in which zinc oxide is mixed with glass powder. They have been used as filling material and for cementing indirect restorations. These materials are occasionally recommended by opponents of amalgam as an alternative to amalgam. However, only a small amount of information about their biological characteristics is available in the literature. The solubility of silicophosphate cements is similar to that of silicate cements [11]. A cell culture study showed that silicophosphate cement was much more toxic after mixing and when set compared with a zinc phosphate cement [6, 8]. Silicophosphate cements have caused a chronic pulpitis after application to the vital dentin of experimental animals [6]. Furthermore, comparably inferior technical properties have been measured. Thus, silicophosphate cements are usually classified as inappropriate for definitive restorations, particularly because much better alternatives are now available [2].

### Table 6.1 Basic components of frequently used dental cements

<table>
<thead>
<tr>
<th>Powder</th>
<th>Liquid</th>
<th>Phosphoric acid</th>
<th>Polyacrylic acid</th>
<th>Eugenol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon oxides</td>
<td>Silicate cement</td>
<td>Glass ionomer cement</td>
<td>Polycarboxylate cement</td>
<td>Zinc oxide and eugenol cement</td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>Zinc phosphate cement</td>
<td></td>
<td>Polycarboxylate cement</td>
<td></td>
</tr>
</tbody>
</table>

### References