DENTAL CEMENT

FIELD OF THE INVENTION

The present invention generally relates to a dental cement and, more particularly, to a dental cement improved in solubility which relieves a patient from pain, when applied in his or her mouth for cementing or filling treatments.

BACKGROUND OF THE INVENTION

Many types of dental cements are currently on the market, and have very extensive applications. Typical examples of such cements are zinc phosphate cements obtained by the reaction of zinc oxide with phosphoric acid, carboxylate cements obtained by the reaction of zinc oxide with polycarboxylic acids, and glass ionomer cements obtained by the reaction of aluminosilicate glass with polycarboxylic acids. Other temporary filling and sealing cements are also available. Their primary use is cementing of crowns, inlays, bridges and orthodontic appliance, lining of various cavities and filling such cavity as class I, class III, or class V cavity. In general, these dental cements make use of chemical reactions between acids and bases. In most cases, the acidic components are supplied in the form of an aqueous solution due to their much solubility in water. In some cases, they may be powdered partly or wholly and blended in a cement powder. The basic components are ordinarily by far more difficult to dissolve in water than are the acidic components and, in most cases, are supplied in the powdery form. For use, the dental cements are mixed together to effect reaction between the acidic components and the basic components. Immediately upon mixing, the cement mixtures show considerably strong acidity, and usually change to neutrality with the lapse of time. Thus, the neutralization reaction of the cement mixtures are not yet completed in the initial stage where they are applied in the mouth of patients. To put it in another way, an appreciable amount of the acidic components remains in the cement mixtures. For this reason, when the cement mixture is close to the pulp of the tooth to be treated, the patient may suffer an unpleasant, or even acute, pain due to the strong irritating action of the remaining acids. In particular, the zinc phosphate, silicate and silicophosphate cements markedly hold their acidic irritating action owing to the use of an aqueous solution of phosphoric acid. Although the carboxylate or glass ionomer cements show relatively weaker acidic irritating action as compared with the zinc phosphate cements, yet that irritating action is by no means eliminated.

On the other hand, a major problem with the dental cements applied in the mouth is that they dissolve gradually in the saliva through many years. More specifically, when prosthetics such as crowns or inlays are cemented, a portion of cement filled in the gaps between the prosthesis and teeth dissolve with the lapse of time, resulting in the generating of secondary caries. When the dental cements are filled in the cavities, they start to dissolve from their surface with the resulting in deterioration of their appearance. For this reason, a reduction in the solubility of cement is an important problem to be solved.

In an effort of preparing a dental cement which is substantially free from any acidic irritating action and has a reduced solubility, it has unexpectedly been found that such a dental cement can be obtained by making

use of a small amount of one or more of a tannic acid-protein combination, tannic acid-formaldehyde combination, acetyl tannic acid and a metal salt of tannic acid (hereinafter referred to as the tannic acid derivative(s)) which are difficult to dissolve in water. The dental cement according to the present invention is also found to be effective in relieving the pain during cementing.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The term "dental cement powder(s)" used in this specification refers to the powdery component of those used as the dental cements. More concretely, the powder consists mainly of a basic component, and usually contains a basic oxide. As already mentioned, the basic components may be mixed with a powdered acid component. For the composition of these dental cements, see, e.g., "Kirk-Othmer Encyclopedia of Chemical Technology" Third Edition, Vol. 7 (1979), pages 463–468 (Herman F. Mark et al).

It is well-known in the art that tannic acid is obtained from gallnuts, and it is astringent. However, although the addition of powdered tannic acid to cement powders helps reduce the acidic irritating action, yet soluble tannic acid gives rise to a color change tendency of cement. It has now been found, however, that the addition of sparingly soluble tannic acid derivatives such as protein combinations represses such a color change tendency, and is effective in improving the appearance of set dental cements. It has also turned out that the astringent effect of tannic acid can suffeciently be utilized in spite of the fact that such tannic acid derivatives are sparingly soluble in water.

The term "sparingly soluble tannic acid derivatives" used herein is understood to refer to those which dissolve slightly in water or are difficult to dissolve in water. Mentioned are particularly a tannic acid-protein combination, a tannic acid-formaldehyde combination, acetyl tannate and a metal salt of tannic acid. These combinations may be used alone or in admixture.

Proteins are generally the condensation polymer of amino acids. Either simple or conjugated proteins may be used for the present invention. For instance, we can use simple proteins such as protamine globulin, albumin, glutelin, prolamin and gelatin and conjugated proteins such as nuclear- and phospho-proteins. Among these proteins, particular preference is given to albumin and gelatin.

The metal salts of tannic acid used for the present invention are not critical. For example, use may be made of calcium, alminium, zinc, magnesium and strontiums salts of tannic acid. However, particular preference is given to the aluminium, zinc and calcium salts.

Preferably, 0.005–5% of weight of the tannic acid derivatives difficult to dissolve in water are added to cement powders. When the tannic acid derivatives are used in an amount below 0.005% by weight, neither reduction in solubility nor improvement in physical properties is obtained. Furthermore, any pain-relief effect is not substantially obtained. In an amount exceeding 5% by weight, the manipulation properties and strength of cement are decreased, and a reduction in solubility is not marked. In the present invention, the amount of the tannic acid derivatives is thus limited to a range of 0.005–5% by weight.

According to the present invention, the tannic acid derivatives can be applied to combinations other than a