Cavity Disinfectants

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Cavity disinfection becomes an important step before a dental restorative procedure. The disinfection can be obtained cleaning the dental cavity with antimicrobial agents before the use of adhesive systems.

Keywords: cavity disinfection ; antimicrobial substances ; chlorhexidine

1. Introduction

Dental caries is the most prevalent pathology in the oral cavity, affecting most of the world population. Caries results from the interaction between dental structure and microbial biofilm, highly organized and formed on its surface, being characterized by the alternating phenomena of demineralization and remineralization [1][2][3]. Under pathological conditions, demineralization overcomes remineralization, leading to the dissolution of hard tissues of the tooth, degradation of collagen fibers and impairment of the mechanical properties of dentin, resulting in caries [1][2][4].

In situations where remineralization is insufficient to resolve the pathology, the treatment of dental caries consists in the removal of infected tissue and subsequent rehabilitation. However, during the removal of decayed tissue, there is the possibility of remaining viable bacteria in the cavity, which can compromise the success of rehabilitation, causing the appearance of a recurrence. On the other hand, rehabilitation failure may be related to tooth and/or restoration fracture and secondary caries, which often occurs at the interface between restorative material and dentin [5][6][7][8].

Dentin is considered an intrinsically moist and heterogeneous tissue, which makes adhesion to this tissue a more sensitive adhesive technique when compared to enamel [2][9].

Despite the evolution of adhesive systems, it is known that, over time, the hybrid layer suffers degradation, causing loss of adhesive resistance, which influences the longevity of restorations. The degradation of the adhesive interface is related to several factors, such as oral fluids and bacteria present in situ, leading to degradation of polymers and other organic components. Thus, cavity disinfection becomes an important step prior to the restorative procedure. This is described as cleaning the dental cavity with antimicrobial agents before the use of adhesive systems, making it as innocuous as possible [10].

Among the available disinfectants, chlorhexidine is the most used one. However, despite its beneficial effects, its impact on adhesion is still unclear [3][10][11].

2. Discussion

A cavity disinfectant must be bactericidal and/or bacteriostatic, biocompatible and easy to acquire and handle. It needs to be capable of correctly disinfecting the cavity but without compromising dentin bond strength. Its effect depends on each disinfectants characteristics but also on the type of substrate, adhesive system and restorative material used [12][13][14].

Dental substrates play an important role in the performance of adhesive systems, since the morphological and chemical-mechanical characteristics of healthy dentin are different from those of caries affected dentin [15]. The intertubular dentin of a caries affected substrate is partially demineralized, resulting in a softer and more porous structure, which compromises the adhesive strength [16][17][18]. Moreover, differences between superficial and deep dentin are also identified. Superficial dentin, composed mainly of intertubular dentin, has a higher percentage of collagen and a smaller number of dentinal tubules. The deep dentin, close to the pulp region, is formed mainly by dentinal tubules and presents a reduced percentage of intertubular dentin, mainly after acid etching [19][20][21][22]. As so, deep dentin is more hydrophilic, making disinfectants much more efficient in superficial dentin. In fact, several authors confirmed that adhesion to superficial dentin was significantly higher than that in deep dentin [23][24][19][25][26][21].

In most of the selected in vitro studies, the samples were placed in a storage medium before being submitted to adhesive resistance tests, in order to simulate the clinical aging of a material overtime. The ISO/TS 11405:2015 (Dental materials – testing of adhesion to tooth structure) [27] gives guidance on substrate selection, storage and handling of samples for quality testing of the adhesive bond between restorative materials and tooth structure. This ISO suggests distilled water or a 0.5% chloramine solution as good storage media for a maximum of one week after which the samples should be kept in distilled water at the temperature of 4 °C or under −5 °C. No other chemical agents should be used since it might affect absorption, adsorption, diffusion, and dissolution, and consequently alter the physical properties of dentin [28]. Furthermore, the longer the storage time, the worse the mechanical properties of the teeth (such as decreased microhardness and negative influence on bond strength) [29][30][31].

Although most studies reported the use of distilled water or chloramine as a storage medium, following the recommendations of the ISO, there were several authors using other solutions, such as thymol, which was used in 48 studies [16][18][20][32][33][34][35][36][37][38][39][40][41][42][43][44][45][46][47][48][49][50][51][52][53][54][55][56][57][58][59][60][61][62][63][64][65][66][67][68][69][70][71][72][73][74][75][76].

Given the degenerative changes that take place in dentin proteins, after teeth extraction the ISO/TS 11405:2015 [27] states that when it is not possible to perform experimental procedures immediately after teeth extraction, these should be performed in a time period not superior to 6 months. After the conclusion of all restorative procedures, the samples should be kept in water (ISO 3696:1987, grade 3 [77]) at a temperature of 23 °C.

The ISO/TS 11405:2015 [27] also states that ideally premolars and permanent molars should be used being also preferable to use third molars from individuals with ages ranging from 16–40 years. Almost all authors stated the use of premolars and/or permanent molars except for Yazici et al. [78] that only indicated the use of human teeth without specification on tooth type. However, it was not possible to obtain information regarding the age of the patients.

Regarding disinfectants, there are many available products in the market. In this review only studies that tested, at most, one cavity disinfection method per experimental group were included as a way to try to perceive each disinfectant's true effect regarding bond strength alterations.

3. Conclusions

A variety of different products is available for cavity disinfection prior to adhesive procedures. However, there are only a few that have been tested to a proper extent and with proved in vitro and clinical viability.

Chlorhexidine is a popular disinfectant and it was possible to conclude that it is a safe option for cavity disinfection since results are mainly positive with an adequate preservation of adhesion to dentin. Other disinfectants such as EDTA and ethanol may be promising alternatives but there is a clear need for further studies to safely suggest their use as cavity disinfectants. Also, further research is needed to clarify not only the effect of cavity disinfectants in bond strength but also their efficacy against cariogenic bacteria, their application times, products' concentration, their use before or after acid-etching and their combination with different adhesive systems and dental substrates.

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