Chlorhexidine-loaded relining materials for denture stomatitis treatment

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Introduction

Oral health is an essential element of general health, which is reflected in the quality of life of each individual[1]. Nowadays, despite the evolution and improvement of medical and dental treatments, a considerable number of elderly patients are totally or partially edentulous[2]. Removable prosthesis are a valuable prosthetic appliance used to replace tooth loss and improve oral function, but their use can compromise the equilibrium of the oral cavity microbiome[3,4]. The primary condition denture wearers suffer from is denture stomatitis. Despite the multifactorial etiology of this disease, evidences have been suggesting Candida albicans as the primary cause of infection[5]. The treatment is complex and should aim at denture surface and oral mucosa[6,7].Recently, several studies have been addressing the treatment of denture stomatitis through the release of antimicrobial agents from a delivery system, as relining material[2,3,7,8].

Aim

The aims of this study were to evaluate: i) the capacity of adsorption and subsequent desorption of a common antimicrobial, chlorhexidine digluconate (CHX), from the surface of two different relining materials (i.e., VOCO Ufi Gel® SC and Ufi Gel® hard C), by changing the CHX concentration (i.e., 0.2; 1; 2.5 and 5%) and the incubation time (i.e., 1, 8 and 24 h); ii) the effectiveness of CHX released against C. albicans and iii) the cytotoxicity induced in fibroblasts.

Methodology

The capacity of the relining materials to adsorb and release CHX was evaluated spectrophotometrically, while the maintenance of the antifungal activity of CHX released against C. albicans ATCC 10231 and the cytotoxicity induced in fibroblasts L929 were determined using the agar diffusion test and the MTT assay, respectively.

Results

Results have shown that (1) the surface of the relining materials has the capacity to adsorb and release CHX (Fig. 1), (2) materials incubated with higher concentrations of CHX released higher concentrations of the antimicrobial agent (Fig. 1) and, consequently, (3) showed greater antifungal activity (Fig. 2). These results were higher for the Ufi Gel® hard C material. The conditions that released a concentration of CHX higher than minimum inhibitory concentration (MIC) and lower than cytotoxic values present in the literature (immersion in 1% and 2.5% CHX solutions for 8 h) were further assessed regarding their cytotoxicity with fibroblasts cells exhibiting a concentration-dependent effect (Fig. 3).

Figure 1: Cumulative release of CHX adsorbed onto the material after 1, 8 and 24 h immersion in different CHX solutions (0.2%, 1%, 2.5% and 5%). Different letters denote statistically significant differences between conditions (p < 0.05).

Figure 2: Inhibition zones determined for the CHX released by the surface of the Ufi Gel® SC and Ufi Gel® hard C materials after 1, 8 and 24 h of immersion in different CHX solutions (0.2%, 1%, 2.5% and 5%). Different letters denote statistically significant differences between conditions (p < 0.05). Representative images of the results obtained for each experimental condition.

Figure 3: Cell viability of fibroblasts after 1, 3 and 24 h contact with the CHX released by the surface of the Ufi Gel® SC and Ufi Gel® hard C relining materials, after 8 hours of immersion in different CHX solutions (1% and 2.5%). Different letters denote statistically significant differences between conditions (p < 0.05). * Sample without cytotoxic potential according to ISO 10993-5 (cell viability > 70%). Representative images of the cells after MTT metabolization, for each condition evaluated.

Conclusions

- The CHX released from the surface of the relining materials maintains its effectiveness against C. albicans and its directly dependent on the concentration of the initial immersion solution.
- Ufi Gel® hard C material showed higher CHX delivery capacity than the Ufi Gel® SC material.
- The immersion of the materials for 8 h in a 2.5% CHX solution showed the best results, ensuring the proper CHX concentration capable to prevent the development of a biofilm, with low cytotoxicity.
- The overall results suggest that the delivery of CHX through the adsorption on the surface of relining materials might provide a useful and practical strategy of antifungal action to tackle denture stomatitis.

References