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RESEARCH ARTICLE

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Oral Sugar Clearance in Patients with Various Types of Prosthodontic Reconstructions – An In Vivo Study

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ABSTRACT

Oral sugar clearance is influenced by factors such as food, salivary secretion rate, the volume of saliva before and after swallowing and the oral motor function. Oral health has been viewed in isolation from the general health. The aim of this study was to determine oral sugar clearance in patients wearing various types of prosthodontic reconstructions. This clinical trial comprised 80 subjects. Salivary glucose concentration was measured under the tongue after chewing a glucose tablet in four groups of individuals with first group wearing complete dentures (n=20), second wearing removable partial dentures (n=20), third group wearing fixed partial dentures (n=20) and fourth group with no dentures being the control group (n=20). Salivary glucose clearance was also studied after a mouth rinse with 10% glucose in all the four groups. Saliva samples for the glucose analysis were taken from two different locations one being under the tongue and the other in the labial vestibule near the mandibular first molar region. After the glucose tablet intake it was found that the glucose concentration and clearance time was higher for patients with complete dentures. After the glucose rinse, higher values for the clearance variables were obtained in the vestibule than under the tongue. The data obtained from this study conclude that complete dentures slows down the oral sugar clearance levels and the clearance time for these dentures took longer in the vestibule than under the tongue. Thus it is concluded that the oral sugar clearance was more site dependent in the mouth than the absence or presence of prosthodontic appliances.

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Oral sugar clearance, prosthodontic reconstructions, glucose intake, salivary secretion, sugars.

INTRODUCTION

Oral sugar clearance (OSC) is the reduction in the concentration of sugar in saliva over time. [1] OSC is dependent on the amount of sugar and the efficiency of its removal, depending on the properties of the sugar product and the physiology of the individuals. If there is any physiological impairment it has been proved that there is reduction in oral sugar clearance. [2] Many factors such as oral function, salivary conditions and cariogenic micro-organisms are related to oral sugar clearance.[3] General health is associated with both salivary secretion rate and oral function.[4,5,6,21] The three main factors for salivary sugar clearance are the unstimulated salivary flow rate, the volumes of saliva in the mouth before and after swallowing. The lower the values of the latter two parameters, the faster would be the sugar clearance from the mouth. [8] The volume of saliva present in the mouth before swallowing can be varied experimentally by changing the swallowing frequency. In a study by Lagerlof and Dawes, they showed that by increasing the volume of saliva in mouth before swallowing affected salivary sucrose clearance in the manner predicted by the theoretical model and because sugar clearance was prolonged, a greater pH fall was produced by oral bacteria. [9,22]

In the similar manner one more study performed by van Houte and Russo,1986 it was found that the rate of sugar clearance in saliva was altered by the swallowing frequency and also found that prolonged sugar clearance at low swallowing

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frequencies promoted demineralization of enamel blocks intra orally and covered by a layer of S.*mutans*.[10] The purpose of this study was to determine the oral sugar clearance in patients with prosthodontic reconstructions.

MATERIALS AND METHODS

The present study was a clinical trial carried out to evaluate the oral sugar clearance, clearance time and initial glucose concentration in patients with prosthodontic reconstructions with a total of 80 patients. The informed consent was obtained from all the patients who underwent the procedure. The ethical clearance was approved by the Institutional Ethical Clearance committee, Saveetha Dental College before the study was performed.

The inclusion criteria included subjects who were 18-70 years of age, not suffering from any systemic illness and diseases. The exclusion criteria are as follows subject who did not give informed consent, subjects who were using alcohol or tobacco in any form, and subjects who were using any medication at the time of study or in the period of the last 15 days prior to the study, and subjects who were suffering from systemic illness.

The subjects recruited for this group were four categories; the first being complete dentures (n =20), secondly removable partial dentures (n=20), third group being the fixed partial dentures (n=20), the fourth group being the control group with no dentures (n=20).

EXPERIMENTAL DESIGN

In the first part of the study, all 80 individuals participated. The salivary glucose concentrations was measured after chewing a glucose tablet , weighing approximately 3.4 g and containing 89% glucose.[23] Repeated saliva samples for glucose analysis were taken under the tongue. The second part of the study included 18 of the 20 individuals with CD and 13 of the 20 with RPD. Salivary glucose clearance was studied after a 30 s mouth rinse with 10 ml of a 10% glucose solution, both with and without the dentures. Saliva samples for glucose analysis were taken at two separate locations; under the tongue and in the labial vestibule near the mandibular right first molar. Salivary glucose clearance — The method of HASE et al. (1987) was used. The subject was instructed not to eat or drink later than 1 h before the test, A circular paper disc (diameter; 4 mm), punched from filter paper (Millipore AP 25, Cat. No. AP 2512450), Millipore Corporation, Bedford, MA, USA, capable of absorbing approximately 20 ml of saliva, was placed in the mouth before (0 min) and 1, 3, 5, 7, 9, 11, and 15 min after the glucose intake, as described above. After 10 s, the disc was taken out from the mouth and transferred to a test tube containing 1 ml of distilled water, which was shaken vigorously for 15 s. After 30 min, the disc was removed and the water extract stored frozen at — 20°C until analysed. After thawing, the concentration of glucose was analysed enzymatically (God Perid, Boehringer Mannheim, Mannheim, Germany, Cat. No. 124.036). The "initial salivary glucose concentration" was defined as the salivary glucose concentration (mmol/I) obtained 1 min after the intake and "clearance time" as the time (min) required for the glucose concentration in saliva to drop to 5 mmol/1. This level was chosen because it corresponds to 0.1% as suggested by LANKE [2]. The clearance time was also calculated according to the mathematical formula described by LANKE [2].

Statistical methods - In the first part of the study, Wilcoxon's rank sum test was used to determine differences between the various groups. In the second part, Wilcoxon's signed rank sum test was used to compare the oral sugar clearance variables when the subjects were wearing their dentures or when they were not.

RESULTS

The CD group showed higher values for all these three variables than the other three groups, followed by the RPD group. The initial salivary glucose concentration for the RPD group was higher than for the controls. No significant differences were found between the FPD group and the controls.

Higher values for the initial salivary glucose concentration and clearance time were obtained in the oral vestibule than under the tongue. All the three clearance variables were higher with the experiments were carried out with than without the dentures, especially for the CD group.

DISCUSSION

There are several individual factors affecting oral sugar clearance. The presence of a denture can alter some of these. Firstly, removable dentures, both complete and partial, contribute to an increased surface area in the oral cavity, and probably also to an increased volume of saliva in the mouth before and after swallowing. This may lead to prolonged oral clearance. [4, 5, 16] Another factor affecting the clearance is the salivary flow.[3-8, 16] Although there is no clear evidence that secretion rate is decreased when having dentures [17-19], reduced salivary flow has recently been observed in denture-wearers. [20] If this is true, one can expect that oral clearance is also affected negatively.

Thirdly, it has been shown that individuals with dentures, especially CD, have lower biting and chewing force, as well as less pronounced chewing ability and efficiency, than naturally dentate persons. [9, 10] Furthermore, denture wearers show limited sensory and perceptual oral functions [11-14].

By affecting the muscular coordination and perception ability, removable dentures probably contribute to less effective oral sugar clearance, since the movements of the lips and the tongue, as well as the oral muscular coordination ability, have been found to be important factors for oral clearance [2, 7]. The salivary sugar clearance can be expressed in different ways.

Recent studies have shown that the glucose concentration the very few minutes after the intake is important for the clearance process and thereby for the acid production in dental plaque [8, 29-32]. Thus, we used the "initial concentration" measured 1 min after the intake, as one clearance variable.

Another observation in this study was that there were more differences in clearance between the two locations, under the tongue and in the oral vestibule near the mandibular right first molar, than between the two tested conditions that is with and without the dentures. Therefore, it is probable that salivary glucose clearance is more dependent on the site in the mouth than on the presence or absence of various external appliances, like prostheses.

CONCLUSION

The present study concluded that wearing a prosthetic appliance such as complete denture slows down the oral sugar clearance in elderly people. It is also found that the location in the oral cavity may be a more important factor in this respect than the presence or absence of dentures.

CONFLICTS OF INTEREST

The authors declare there is no conflict of interest.

SOURCE OF FUNDING

Self.

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