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The effect of new acrylic full removable dentures on food taste

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SUMMARY

Objective. To find out how the use of new acrylic full upper removable dentures changes the perception of four basic tastes: sweetness, sourness, saltiness and bitterness, and to evaluate the influence of age and gender.

Material and methods. This study was performed in LSMU MA Faculty of Odontology Department of Prosthodontics during 2017-09-01 – 2018-02-01. All the patients for whom new acrylic upper removable dentures were made were invited to take part. 30 patients have taken part. Sixteen solutions for basic tastes: sweetness, sourness, saltiness and bitterness; were made. The patients were examined without and with their new dentures. The patients were told to rinse an unknown solution starting from the lowest concentration and to identify the taste. Data analysis was performed using SPSS® (IBM®, Armonk, USA) version 23.

Results. Patients with full upper removable dentures felt sweet ($p=0.002$) and sour ($p=0.000$) taste weaker than without them, the same tendency was observed with bitter ($p=0.063$) and salty ($p=0.059$) taste. The time required to identify the taste was longer with removable dentures than without them ($p<0.05$). Identification of saltiness became weaker both with and without removable dentures as the age of the patients increased ($p<0.05$). Bitterness was identified better by women than men both with and without removable dentures ($p<0.05$). Age and gender had no influence on other basic tastes ($p>0.05$).

Conclusion. The results of this study confirm the presumption that acrylic full upper removable dentures weaken the taste perception of the patients.

Key words: taste perception, full upper removable denture, palatal coverage.

INTRODUCTION

Nowadays dentistry offers a lot of choices to restore adentia. The cheapest ones, at least partly restoring chewing, esthetic function and the most financially accessible, especially for elderly people, are removable dentures. During the past decade, the number of elderly people has increased significantly and in the future it will only rise (1). However, patients with removable dentures may face some difficulties, e.g. taste disorders, that can lead to alterations in balanced diet that are especially dangerous for old people with chronic diseases and fluid and/or electrolyte imbalance (2-5). Aim of the work – to find out how the use of new acrylic full upper removable dentures changes the perception of four basic tastes: sweetness, sourness, saltiness and bitterness, and to evaluate the influence of age and gender. This is a base study which is mandatory for differentiation in further studies of age-induced and usage of full removable dentures caused changes in perception of taste, figuring out whether the latter can recover and after what time, whether it is of same nature after using the first prosthesis and after using subsequent ones and whether it depends on the material of the prosthesis. This data is relevant in the search of healthy nutrition advice for the elderly without eliminating their possibility to enjoy food.

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MATERIAL AND METHODS

This study was performed in LSMU Medical Academy Faculty of Odontology Department of Prosthodontics during 2017.09.01-2018.02.01 with the permission of LSMU Bioethics Center (protocol No. BEC-OF-39). All the patients for whom during the study period new acrylic upper removable dentures were made were invited to take part, it was not considered whether it was the first or subsequent prosthesis. After eliminating peo-

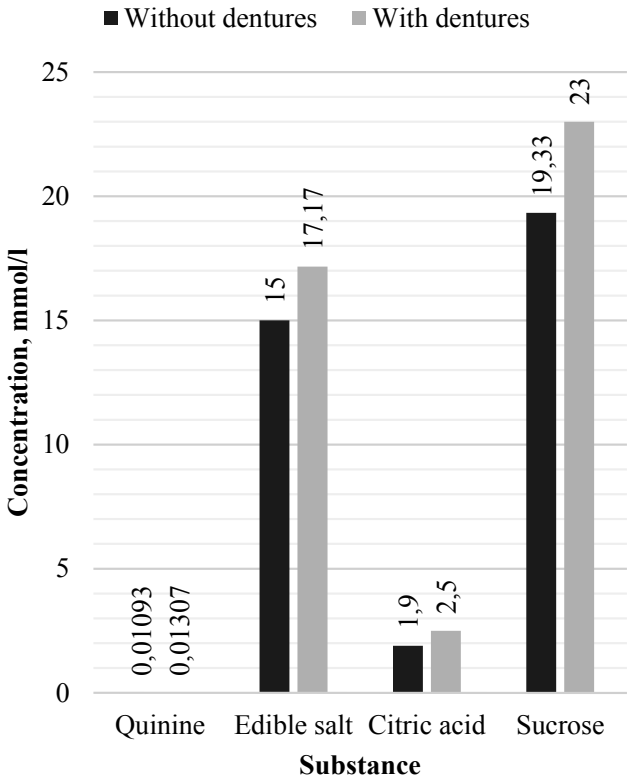

Fig. Threshold concentrations of basic taste solutions felt by patients with and without removable dentures

ple with immunosuppressive disorders, cardiovascular diseases, patients that refused to participate and needed denture relining 30 (55-80 years old) patients have taken part (17 women and 13 men). Sixteen solutions of four different substances (four different concentrations each) for four basic tastes were made (Table 1).

The patients were examined twice: without dentures before having their new ones manufactured and after a week of using their new full upper removable dentures. The patients were told to rinse their mouths for 10 s with 20 ml of unknown solution (prior to each solution the patients have rinsed for 10 s with 20 ml of distilled water) starting from the lowest concentration and to identify the taste. For patients who could not identify the taste, a higher concentration solution was given. An incorrect identification was evaluated as inability to identify the taste. According to T. Wada *et al.* (6) technique, thresholds of concentrations of substances whose taste was identified by patients without and with prostheses were compared. The time required to identify the taste was measured by the patients using a chronometer. According to T. Ghaffari *et al.* (7) technique the time required to identify the taste with and without prostheses was compared. The time was only assessed in cases where the limit of concentration of correctly identified taste was identical both with and without dentures. A 0.95 confidence level (P), 0.05 significance level (p), maximum error of 10% (Δ) were set. Data analysis was performed using Statistical Package for Social Sciences® (IBM, Armonk, USA) version 23.

RESULTS

Assessment of threshold concentrations of solutions

Patients with full upper removable dentures felt sweet (p=0.002) and sour (p=0.000) taste statistically significantly weaker than without them (Figure).

A tendency was observed that with full upper removable dentures patients felt bitter (p=0.063) and salty (p=0.059) taste weaker than without them (Figure).

Table 1. Solutions to reflect the four basic tastes

Basic taste	Substance	Concentration, mmol/l			
Bitterness	Quinine	0.004	0.008	0.016	0.032
Saltiness	Edible salt	5	10	20	40
Sourness	Citric acid	1	2	3	5
Sweetness	Sucrose	10	20	30	50

Table 2. Time required to feel identical threshold concentrations of basic taste solutions during the first and second trial

Basic taste solutions during first (1) and second (2) trial	No. of samples	Average time, seconds	Standard deviation, SD
Quinine (1)	25	9.1168	4.66787
Quinine (2)	25	9.4844	4.11663
Edible salt (1)	25	9.5824	5.93764
Edible salt (2)	25	11.9400	4.89100
Citric acid (1)	15	8.3747	4.55676
Citric acid (2)	15	10.7033	5.59893
Sucrose (1)	20	7.8955	3.69112
Sucrose (2)	20	9.0945	3.87896

Assessment of time required to feel threshold concentrations

The time required to identify the taste was statistically significantly longer with removable dentures than without them ($p \leq 0.05$) (Table 2).

Age and gender influence for gustatory perception

Identification of saltiness became statistically significantly weaker both with and without removable dentures as the age of the patients increased ($p<0.05$). Bitterness was statistically significantly identified better by women than men both with and without removable dentures ($p<0.05$). Age and gender had no statistically significant influence on other basic tastes ($p>0.05$).

DISCUSSION

There were no trials in this study where the taste felt with removable dentures was of smaller concentration than without them or concentrations where the same, thus the data gathered confirms the results of many authors that the perception of taste is worse for patients with full upper removable dentures (8).

According to T. Ghaffari *et al.* (7), the dentures may have impeded natural ventilation between nasal and oral cavities, which was significant for identification of gustatory stimuli in the post-nasal area, and proper mobility of tongue and cheeks, thus disturbing the distribution of moisture, air and heat, required for proper assessment of taste.

The sensation of taste may have altered due to increased salivation when using full upper removable dentures noticed by R. N. Tango *et al.* (9) and due to alteration of chemical composition of saliva (10).

All test participants have identified the taste within 9.52s on average, which was not so different from results obtained by T. Ghaffari *et al.* (7). However, more than one second was required to feel and identify all four basic tastes contradicting the results of referred authors.

According to the results obtained – women felt bitterness better than men and as the age increased the perception of saltness decreased – confirmed the opinion of many authors that age and gender may have influenced sensitivity to taste (11).

There could be a possibility to expand the study including more factors which, according to other authors, may influence perception of taste, including: salivation, olfactory sensibility, chronic diseases, harmful habits, properties of the prosthesis: material thickness, surface smoothness, volume, construction, previous dentures, habits of life, nutrition, hygiene (11). A study of such nature is not hard to perform and only negligibly exhausts the subjects, thus can be successfully expanded by many researchers, especially considering that most subjects are elderly.

CONCLUSIONS

The results of this study confirm the presump tion that acrylic full upper removable dentures weaken the taste perception of the patients.

Patients with full upper removable dentures felt sweet and sour tastes weaker than without them. The same tendency was observed with bitter and salty taste.

The time required to identify the basic tastes: sweetness, sourness, saltiness and bitterness, was ~1.56 seconds longer with full upper removable dentures than without them.

Independently of the use of full upper removable dentures bitterness was identified better by women than men; identification of saltiness became weaker as the age of the patients increased.

Due to impaired taste recognition and perception, patients who use full removable dentures could choose new and rarely consumed dishes, savor their smell and taste and chew them for longer instead of wishing to intensify all tastes, especially sweetening or enlarging the portions of favorite dishes.

STATEMENT OF CONFLICTS OF INTEREST

The authors state no conflict of interest.

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