Satisfaction level and masticatory capacity in edentulous patients before and after new complete dentures

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ABSTRACT

Purpose: Evaluation of the level of satisfaction and capacity, efficiency and masticatory performance in edentulous patients at 5 different times: old complete dentures; at installation day with the new complete dentures; after 2 weeks; 1 month and 3 months of usage. **Materials and methods**: Satisfaction level and masticatory capacity were analyzed using a questionnaire for edentulous patients, while the masticatory efficiency and performance were evaluated using tests performed on artificial chewable material. The patients triturated the material for 20 and 40 seconds (efficiency) and 40 chewing cycles (performance) and the fragments were separated using a system of sieves. Tests were performed in seven volunteers. Data were analyzed descriptively using SPSS 13.0. **Results**: In masticatory efficiency test with 20 s, there was a decrease in the average particle size from 8.33 mm to 6.37 mm. The same occurred for masticatory efficiency test with 40 s (7.09 to 5.12 mm) and for masticatory performance with 40 cycles (6.48 to 4.52 mm). Data from the questionnaires showed an increase in the satisfaction level of 43.99% to 95.5%, as in the masticatory capacity of 42.31% to 94.51%. **Conclusion**: The new rehabilitation increased efficiency and masticatory performance, as well as satisfaction and chewing ability.

Keywords: denture; complete; patient satisfaction; mastication; efficiency; quality of life.

Nível de satisfação e capacidade mastigatória em pacientes edêntulos antes e após novas próteses totais

RESUMO

Objetivo: Descrever as alterações observadas no nível de satisfação e capacidade, eficiência e performance mastigatórias de pacientes usuários de próteses totais convencionais antigas em relação à reabilitação com novas próteses em 5 momentos: prótese antiga, prótese nova instalação, 2 semanas, 1 mês e 3 meses de uso. **Materiais e métodos:** A satisfação e a capacidade mastigatória foram analisadas por meio de perguntas baseadas no questionário específico para pacientes edêntulos, enquanto a eficiência e a performance mastigatórias foram avaliadas utilizando testes mastigatórios

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realizados com material mastigável. Os pacientes trituraram o material por 20 e 40 segundos (eficiência) e por 40 ciclos mastigatórios (performance), sendo os fragmentos separados por meio de um sistema de peneiras. Todos os testes foram realizados em sete pacientes voluntários. Os dados obtidos foram submetidos à análise descritiva utilizando o programa estatístico SPSS 13.0. **Resultados:** Para o teste de eficiência mastigatória com 20 segundos, houve uma diminuição do tamanho médio das partículas de 8,33 mm para 6,37 mm. O mesmo ocorreu no teste de eficiência mastigatória com 40 segundos e no de performance mastigatória com 40 ciclos, sendo de 7,09 mm a 5,45 mm e 6,48 mm a 4,77 mm, respectivamente. Os dados dos questionários mostraram um aumento no nível de satisfação de 43,99% para 95,5%, assim como na capacidade mastigatória de 42,31% para 94,51%. **Conclusões:** A reabilitação com novas próteses resultou em maiores escores de eficiência e performance mastigatórias, assim como índices mais altos de satisfação e capacidade mastigatória.

Palavras chave: prótese total; satisfação do paciente; mastigação; eficiência; qualidade de vida.

INTRODUCTION

Dentistry has always aimed to provide health, function, aesthetics and comfort to the patients. Despite the existence of other treatment options for edentulism as dental implants, the use of conventional dentures is still accepted by some reasons, such as general health condition, economic status or bone availability for most population (1-6).

However, the use of conventional dentures to rehabilitate edentulous patients often produces limited success regarding the retention and stability (7). Furthermore, the loss of teeth and the use of complete dentures can result in a variety of undesirable reactions compromising the quality of life including emotional problems, food choice and enjoyment in eating (6,8-13).

Chewing is the first step in the digestive process when food particles are reduced thanin size so that they can be swallowed, a process that is much more difficult in edentulous individuals since the masticatory efficiency in complete prosthesis users is 6 times lower when compared to a dentate individual (8,14,15).

The masticatory function involves capacity, efficiency, and performance, and can be evaluated by subjective and objective methods. An objective assessment is based on the measurement of the capacity of grinding food testing, mainly by means of fractionation with sieves. A subjective evaluation is performed by using information provided by questionnaires. The OHIP (Oral Health Impact Profile) is a questionnaire developed in Australia by Slade and Spencer in 1994 (16), and several versions of the tool have been developed, one of which was translated into Brazilian Portuguese. The OHIP-EDENT (Oral Health Impact Profile in Edentulous Adults) is a 19-question survey, grouped in functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. This tool detects the impact of oral health on the quality of life of patients who wear complete dentures. There are many studies that use this methodology already established in the literature (7,10,15,17-23).

Thus, considering edentulism as a chronic condition in which is impossible to

provide to the patient the same situation presented before the loss of teeth, properly made complete dentures will improve the chewing function and quality of life (17,24-27).

However, the use of removable dentures requires an adjustment period, often associated with pain in the oral mucosal, difficulties in speech and mastication. The aim of this study was to describe the observed changes in the level of satisfaction and capacity, efficiency and masticatory performance of patients using conventional old dentures compared with new prosthetic rehabilitation in different periods (old prosthesis, installation of new prosthesis, 2 weeks, 1 month and 3 months of wear).

MATERIALS AND METHODS

Edentulous patients seeking care at the Dental School of Federal University of Rio Grande do Sul were selected, using the following inclusion criteria: use of double conventional denture for at least five years, requiring replacement; desire to receive a pair of new conventional complete dentures; ability to understand and respond to the questionnaires proposed. Exclusion criteria comprised: symptoms of temporomandibular disorder; bruxism; systemic neurological disorders; use of medications that diminished salivary flow; pathological changes of residual ridges and debilitating systemic diseases.

From a total of 53 patients, 7 volunteers were selected after applying the selection criteria (women, mean age 64.5 years, prosthesis wear of 11.3 years) who responded to the questionnaire of satisfaction and masticatory capacity and were subjected to the test of masticatory efficiency and performance. All these procedures were performed together in five moments: using the old dentures, on the day of the installation of new dentures, after 2 weeks, 1 month and 3 months of wear. The trial protocol was approved by the Federal University of Rio Grande do Sul (Protocol # 04/07). Participants were informed about the investigation nature and enrolled after written informed consent.

The small group of volunteers was due to several reasons such as financial condition (21), did not use their lower complete denture (12), presence of lower teeth for extraction (7), did not accept to participate in the research (4), gave up during the research (2).

New complete dentures were fabricated according to a conventional method which involved: a preliminary impression using irreversible hydrocolloid in stainless steel stock trays; zinc oxide-eugenol paste final impressions; facebow to transfer the position of the maxillary rim to a semi-adjustable articulator; maxillomandibular relationships; artificial teeth positioned according to a balanced articulation. One dentist performed the clinical procedures on denture fabrication for all patients and the same professional conducted laboratory steps.

The level of satisfaction and masticatory capacity were assessed by responses to 2 modified questionnaires based on previous studies (7,20,26) from the original OHIP-Edent (Oral Health Impact Profile in Edentulous Adults), in accordance with Figures 1 and 2.

Patients were asked to answer questions about functional limitation, pain, psychological discomfort, aesthetics, stability, on a three-grade Likert-type scale, choosing between the responses 0 (never), 1 (sometimes), or 2 (almost always).

Figure 1 – Questionnaire to assess the satisfaction level.

SCORES: 0 = Never; 1 = Sometimes; 2 = Almost always.	**Answer**
1. Did you feel any difficulty in chewing food because of problems with your teeth, mouth or dentures?	_____
2. Did you notice that your teeth or dentures retained food?	_____
3. Did you feel that your dentures were not seated properly?	_____
4. You felt his sore mouth?	_____
5. You feel discomfort while eating because of problems with your teeth, mouth or dentures?	_____
6. You had sore spots in your mouth?	_____
7. His dentures were uncomfortable?	_____
8. Did you feel worried (a) due to dental problems?	_____
9. Did you feel embarrassed because of your teeth, mouth or dentures?	_____
10. You had to avoid eating something because of problems with your teeth, mouth or dentures?	_____
11. Did you feel unable (a) to eat with your dentures because of problems with them?	_____
12. You had to interrupt meals because of problems with your teeth, mouth or dentures?	_____
13. Did you feel disturbed (a) having problems with their teeth, mouth or dentures?	_____
14. You were in some embarrassment because of problems with your teeth, mouth or dentures?	_____
15. You avoided leaving home because of problems with your teeth, mouth or dentures?	_____
16. You were less tolerant with your spouse or family due to problems with their teeth, mouth or dentures?	_____
17. Were you a little angry (a) with other people because of problems with your teeth, mouth or dentures?	_____
18. You have been unable to fully enjoy the company of others due to problems with their teeth, mouth or dentures?	_____
19. Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	_____

Figure 2 – Questionnaire to assess the masticatory capacity.

SCORES: 0 = Never; 1= Sometimes; 2 = Almost always	Answer
1. Have you ever felt unable to chew some kind of food we like to eat?	_____
2. Have you ever had difficulty biting certain foods?	_____
3. You need to do any special preparation to be able to chew food in them (cooking, cut into smaller pieces, moisten)?	_____
4. Do you feel unstable denture when chewing food more consistent?	_____
5- You do force to swallow food after chewing?	_____
6. Do you think that swallows large pieces due to insufficient fragmentation?	_____
7. Do you feel uncomfortable prosthesis to chew food?	_____
8. You need to stop during the meal by a problem with the prostheses?	_____
9. Do you think it takes longer to chew food than others?	_____
10. Do you feel worried during meals due to lack of security and stability of dentures?	_____
11. Do you feel embarrassed to eat in front of others?	_____
12. Are you more angry when you have to feed with others?	_____
13. You is unable to feed because their dentures?	_____

The masticatory efficiency and performance were evaluated by chewing Optocal Plus Modified test food (Table 1).

Table 1 – Components, trademarks, and percentages by weight of the silicon-based chewable test material.

Components	Material	Quantity
Condensation silicon	Optosil Comfort®, Heraeus Kulzer GmbH & Co., KG, Germany	58.3%
Conventional tooth paste	Colgate-Palmolive, Co., Osasco-SP, Brazil	7.5%
Solid vaseline	Rioquímica, São José do Rio Preto, SP, Brazil	11.5%
Common powder of dental plaster	Mossoró , Empresa e Indústria Gesso Mossoró SA, Rio de Janeiro, RJ, Brazil	10.2%
Alginate poder	Jeltrate , Dentsply Indústria e Comércio Ltda., Petrópolis, RJ, Brazil	12.5%
Mint essence	Yod Comércio de produtos naturais LTDA., Campinas, SP, Brazil	3 drops

Patients were oriented to naturally chew 12 dragees, with dimensions of 12 mm diameter and 5 mm height each, corresponding to 3 cm^3 of material. Preparation of Optocal test food has been also already described[28]. The masticatory efficiency test consisted on trituration of the test food during two predetermined time periods, 20 and 40 seconds in this study. The masticatory performance test consisted of grinding the dragees by adopting a pre-determined number of masticatory cycles, which in this study was 40 cycles (22).

Both tests were performed twice in order to obtain more reliable values, assuming the result as the arithmetic average of two tests. All food testing ground was collected in a container, staying 3 hours in an oven at 60° C for saliva evaporation and subsequently sieved. The crushed material was placed on a system of five sieves arranged one over the other with holes of different decreasing diameters (28,29) (4.75, 4.0, 2.8, 2.0, and 1.0 mm, including a last plate without orifice).

To facilitate and standardize the passage of the crushed material through the holes of the sieves, a sieve shaker was used for 2 minutes. Cumulative weight percentages (defined by the amount of sample that could pass through each successive sieve) were calculated for each individual. From these percentages, masticatory efficiency and performance were calculated by the Rosin-Rammler equation, as follows:

$$Q_w = 100\ [1–2^{-(x/x50)b}]$$

Where Q_w is the weight percentage of particles with a diameter smaller than x (the maximum sieve aperture). The median particle size (x50) is the aperture of a theoretical sieve through which 50% of the weight can pass, and "b," a unitless measure, describes the broadness of the distribution (similar to the range) of the particles (29). Results were analyzed descriptively (percentage, mean, standard deviation, minimum and maximum) using SPSS version 13.0.

RESULTS

The size of the crushed particles in masticatory efficiency test with 20 seconds ranged from 8.33 (±1.86) mm to 6.37 (±1.04) mm at old Denture time and 3 months after, respectively (Table 2).

Table 2 – Mean values and standard deviation of masticatory efficiency (20 and 40 s); masticatory performance; satisfaction level and masticatory capacity with the old prosthesis and the new prosthesis in different post-installation times.

Tests	Old Complete Denture	New Denture Installation	New Denture 2 Weeks	New Denture 1 Month	New Denture 3 Months
Masticatory Efficiency 20s (mm)	8.33 (1.86)	7.48 (1.44)	7.37 (1.70)	6.76 (2.41)	6.37 (1.04)
Masticatory Efficiency 40s (mm)	7.09 (1.57)	5.94 (1.96)	5.84 (0.95)	5.45 (1.22)	5.12 (0.82)
Masticatory Performance 40 cycles (mm)	6.48 (1.04)	5.38 (1.58)	5.24 (1.12)	4.77 (1.15)	4.52 (0.90)
Satisfaction Level (%)	43.99 (13.8)	81.59 (8.18)	87.98 (5.23)	94.74 (2.63)	95.50 (3.93)
Masticatory Capacity (%)	42.31 (17.9)	85.72 (7.59)	91.77 (7.82)	92.87 (4.67)	94.51 (3.02)

The masticatory efficiency test in 40 seconds resulted in particles ranging from 7.09 (±1.57) mm to 5.12 (±0.82) mm at old Denture time and 3 months after, respectively (Table 2).

In the test of masticatory performance with 40 cycles, crushed particles ranged from 6.48 (±1.04) mm to 4.52 (0.90) mm at old Denture time and 3 months after, respectively (Table 2).

The satisfaction level ranged from 43.99 (±13.8)%, 81.58 (±8.18)%, 87.98 (±5.23)%, 94.74 (±2.63)% e 95.49 (±3.93)%, for old Denture, new denture installation, 2 weeks, 1 month and 3 months after, respectively (Table 2).

For masticatory capacity, the rates ranged from 42.31 (±17.9)%, 85.72 (±7.59)%, 91.76 (±7.82)%, 92.86 (±4.67)% e 94.51 (±3.02)% for old Denture, new denture installation, 2 weeks, 1 month and 3 months after, respectively (Table 2).

DISCUSSION

Complete dentures are and will remain the mainstay of treatment for the vast majority of edentulous patients and will continue to play a central role in the rehabilitation of edentulism. Thus, research, teaching and specialist training in complete denture prosthodontics must continue, and in fact be intensified rather than reduced (4,11).

Within this context, the masticatory efficiency and performance tests are useful tools for observing changes in the degree of food fragmentation, turning it into small particles (5,15,19,25). In this study, patients rehabilitated with new complete dentures had higher crushing values of the artificial food test when compared to old dentures, obtaining therefore smaller particle sizes as the time of post-installation increased.

The results of the masticatory efficiency test with 20 seconds showed a progressive reduction in mean particle size (Table 2). Following the same trend, the masticatory efficiency test with 40 seconds had similar reduction but with greater intensity, since in this case the time available for chewing was higher (Table 2). According to Kapur (15), the masticatory efficiency, or chewing by a predetermined time, must result in smaller particles, by increasing time. Patients with complete dentures performed the largest number of chewing cycles to achieve a material fragment as compared to patients with implant rehabilitation. In other words, the masticatory efficiency is, to a certain extent, compensated by an increase in the number of cycles.

The masticatory performance can be defined as the fragmentation of the test food for a determined number of chewing cycles (5,15). The results of this test in the present study also showed that the average particle size decreased after replacing the old dentures as well as over time, and, with higher intensity obtained even smaller particles.

The largest particle fragmentation in masticatory performance test when compared to masticatory efficiency test occurred because, to carry out 40 cycles (performance), patients needed more time compared to the efficiency test, resulting in even smaller particles, as found by Cunha et al (11) in their study. In addition to increased fragmentation of artificial

food after the installation of new dentures in both tests (performance and efficiency), there was also continuous reduction in mean particle size. This fact can be explained by physiological adaptation to the new condition, provided by the post-installation time up to 3 months, together with improved retention, stability and occlusal balance of the new occlusal appliances (1).

The questionnaire responses showed that the satisfaction level and masticatory capacity increased after replacing the old dentures, keeping a gradual increase until the last evaluation period (Table 2). Based on the results it can be observed that the satisfaction and masticatory capacity are related to the prosthesis's comfort and stability, as well as the patient's perception regarding mastication, esthetics, wellness and social interaction (3,10,20,23). It is interesting that patients with complete dentures feel satisfied about their prostheses and their self-evaluation tends to be optimistic compared with the assessment made by a clinician because exhibit low expectations resulting from the experience of friends and relatives about the need for change in eating habits, as commonly found for complete denture wearers (5,11,12,22).

Once the relationship between masticatory efficiency and the subjective chewing experience is weak or absent, thus, masticatory function must be evaluated in both manners, especially in edentulous patients, because the psychological aspect is fundamental for the successful rehabilitation with complete dentures (5).

Due to the long time use of the dentures, the prostheses showed excessive wear of teeth and acrylic resin base, as well as patches, irregularities and small fractures. The reduced vertical dimension and lack of retention and stability also were observed. These factors may have contributed significantly to achieving better results in the questionnaires (satisfaction and capacity) than in the objective masticatory tests.

The subjective evaluation obtained with questionnaires showed that patient's perception about aesthetic factors, emotional, comfort and chewing aspects determined the results close to the maximum possible, while the objective evaluation, conducted through masticatory tests (efficiency and performance), showed that there was actually a greater fragmentation of food testing, however without reaching such high levels (as in subject evaluation) because the masticatory function of the patients that wear complete denture is about 6 times smaller than a person with complete natural dentition (15,24). Interpersonal and psychological factors may be more important determinants for satisfaction than clinical or anatomical factors, and sometimes, technical aspects of prosthesis, although important, are not sufficient to predict the success of rehabilitation in patients' point of view (1,19,22).

CONCLUSIONS

According to the limitations of this study, we can conclude that:

- Replacing old dentures with new ones resulted in smaller food testing particles, suggesting improvement in masticatory function, being continuous throughout the 3 months of observation.

- Patients had higher satisfaction levels after replacement of the prosthesis, as well as over the three months. The same happened to the level of chewing ability.

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