Original Article

Analysis of masticatory cycle efficiency in patients with old and new dentures

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ABSTRACT

Background: The loss of vertical dimension of occlusion, wear of acrylic teeth and the maladaptation of old complete dentures on the tissues can influence chewing of edentulous individuals. The aim of the present study was to analyze the masticatory efficiency in patients with old complete dentures and after 6 months with new complete dentures. **Methods:** Twenty four edentulous patients between the ages of 65 to 80 years, with old complete dentures (maxillary and mandibular) and without temporomandibular dysfunction were selected. The patients included had decreased vertical dimension of occlusion and deficient dental occlusion. Each patient received artificial food fragments weighing 3 grams and chewed for 35 cycles. The food particles were expelled in granulometric meshes with openings of 2.0, 1.08, 0.42 and 0.20 mm. The analysis occurred with old complete dentures and after 6 months with new complete dentures. **Results:** Analysis of variance (ANOVA) and Tukey test with 5% significance were performed. After 6 months of wearing new complete dentures, the masticatory efficiency was significantly increased with 0.42 mm mesh, whereas the other meshes did not show increased masticatory efficiency. **Conclusion:** In general, there was no improvement in the masticatory efficiency of the edentulous individuals after 6 months with new complete dentures.

Key words: *chewing cycle, complete denture, masticatory efficiency*

In 2015, the number of people aged 65 or older was 8.5% of the 7.3 billion of the world population. It is estimated that by 2050, the population aged 65 and over will increase to 16.7% based on a world population of 9.4 billion population [1]. Edentulism may be related to people aged 50 years or older [1, 2]. Tooth loss can lead to extensive bone resorption, temporomandibular dysfunction, and muscle hypotonicity, and these factors may affect the chewing process [3]. According to Tyrovolas et al, the edentulism can affect facial appearance, nutrition and the ability to eat, speak and socialize [2]. The implant-supported complete dentures is one of the possibilities of treatment for edentulous patients [4]. However, due to financial issues, many patients do not have access to this treatment and therefore conventional complete dentures remains the treatment of choice [3, 4].

According to Oliveira et al, discomfort, difficulty in chewing foods, oral pain, age, gender, duration of edentulism, oral conditions, and previous experience with complete dentures influence the masticatory efficiency. A low masticatory efficiency of complete denture wearers is usually compensated by longer chewing of the food and swallowing larger food particles [5]. To evaluate masticatory efficiency, the artificial test food (ATF) is more indicated than natural food because the physical properties,

shape and size of the particles are more reproducible [6]. Hence, this present study was undertaken with an aim to analyze the masticatory efficiency in patients with old complete dentures and after 6 months with new complete dentures.

MATERIAL AND METHODS

This study was approved by the Ethics Committee for the study with humans (116/05 - "Julio de Mesquita Filho" São Paulo State University).

Twenty four edentulous patients (14 women and 10 men) with old acrylic complete dentures (maxillary and mandibular) were selected for the study. All patients presented with severe bone resorption, particularly of the mandibular arch. Patients who belonged to ASA I and ASA II category according to the American Society of Anesthesiologists [7], bimaxillary edentulous patients between the ages of 65 to 80 years, wearing the same pair of acrylic dentures for at least 10 years, patients with decreased vertical dimension of occlusion and deficient dental occlusion and individuals with cognitive ability to follow instructions were included in the study [3, 8].

Patients with temporomandibular dysfunction verified by the Research Diagnostic Criterion questionnaire [3], individuals wearing damaged dentures that prevented chewing, individuals with polymethylmethacrylate allergy, users of medications, drugs and alcohol that could interfere in the muscular activity and patients diagnosed with tumor, neurological illnesses and psychiatric problems were excluded from the study.

The artificial food was prepared according to Optocal-ATF [3, 9] and fragmented according to the method by Slagter et al [6]. Each patient received 3 grams of artificial food. The food was chewed by the patient for 35 chewing cycles [5, 10]. The patients were instructed to chew the food with slight movements and not to swallow it. The cycles were monitored by an operator and timed in seconds by a digital watch (Ikea, China). Patients were allowed to select the chewing side. After mastication, the chewed particles were expelled into a set of four sieves stacked on top of each other. The dentures were washed with water, and patients were asked to rinse the oral cavity to remove the remaining particles. The particles were expelled into the same receptacles. Subsequently, an intraoral inspection was performed to certify that no residual food fragments remained in the oral cavity.

The particles present in the sieve were washed with water and dried in an autoclave at 50◦C for 1 hour. After drying, the sieve system was put into a vibrator for 60 seconds, and the food particles were separated according to granulometric meshes with openings of 2.0, 1.08, 0.42, and 0.20 mm, sequenced in decreasing order of size. Each mesh was weighed separately on an analytical balance (BEL Equipamentos Analíticos, Brazil) [3]. The masticatory efficiency was evaluated with old complete dentures and after 6 months with new complete dentures. The analysis of variance (ANOVA) and Tukey test were used with significance level of 5%.

RESULTS

Comparing old dentures with new dentures, there was no statistical difference in the amount of food retained in the sieves with openings of 2.0, 1.08 and 0.2 mm ($p>0.05$). However, after 6 months with new complete dentures, for sieve with opening of 0.42mm, the masticatory efficiency was significantly increased ($p<0.05$) (Table 1).

Table 1: Mean weight (g) and standard deviation (SD) of chewed food retained in the sieves with old dentures and after 6 months with new dentures.

Sieve opening	Old dentures	New dentures (After 6 months)
2.0mm	2.7100±0.162 Aa	2.5702±0.1540 Aa
1.08mm	0.1302±0.0653 Ba	0.18424±0.062 Ba
0.42mm	0.0954±0.055 BCa	0.14870±0.046 Bb
0.2mm	0.07080±0.052 Ca	0.08380±0.054 Ca

*Tukey test with 5% significance. Different uppercase letters in the rows indicate statistically significant difference. Different lowercase letters in the columns indicate statistically significant difference.

Table 2: Percentage mean of food that passed through the 2.0-mm sieve before, and after 6 months with new dentures.

Sieve opening	Old dentures	After 6 months with new dentures
2.0mm	9.88%	13.89%

Comparing the old dentures with the new ones, there was an increase (%) in the passage of the food through the sieve with opening of 2.0 mm after 6 months with new complete dentures (Table 2). In this study, it was possible to observe that the time required to perform 35 chewing cycles with the old dentures ranged from 35 to 40 seconds. Six months after insertion of new dentures, this time was shorter and ranged from 32 to 36 seconds.

DISCUSSION

The present study was undertaken to analyze the masticatory efficiency in patients with old complete dentures and after 6 months with new complete dentures. In general, there was no increase in masticatory efficiency of the patients after 6 months with new complete dentures, there was only a tendency for improvement in the masticatory efficiency. The results of the present study corroborate the study conducted by Goiato et al, who observed that a period of 5 months was not sufficient to improve the masticatory efficiency of edentulous individuals [3]. However, after 1 year with the new complete dentures there was an increase in the masticatory efficiency of the individuals. Therefore, five and six months are not enough periods to improve the masticatory efficiency in complete denture wearers.

In most cases, masticatory efficiency did not increase significantly, however the little increase observed in the masticatory efficiency may be related to the reestablishment of the vertical dimension of occlusion, establishment of bilateral balanced occlusion and the presence of cusps. It is possible that the lack of muscular ability of the individuals and premature occlusal contacts of the new complete dentures after 6 months may have negatively influenced during chewing of the food [3]. This study evaluated the masticatory efficiency of individuals with new complete dentures only after a period of 6 months, which is a limitation. We recommend studies to evaluate masticatory efficiency after 7, 8, 9, 10 and 11 months intervals.

CONCLUSION

Factors such as discomfort, difficulty in chewing foods, duration of edentulism, oral conditions, and previous experience with complete dentures influence the masticatory efficiency. A low masticatory efficiency of complete denture wearers is usually compensated by longer chewing of the food and swallowing larger food particles. In the present study, we did not find an improvement in the masticatory efficiency of the edentulous individuals after 6 months of wearing new complete dentures.

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