EVALUATION OF MASTICATORY CAPACITY AND EFFICIENCY IN TOTAL AND PARTIAL EDENTULOUS PATIENTS IN ARARAQUARA

Patricia Aleixo dos Santos Domingos[1], Ana Luísa Botta Martins de Oliveira[1], Ariellen Amanda dos Reis[2]

1 Universitary Center of Araraquara, Araraquara, SP, Brazil
2 Herminio Ometto Universitary Center, Araras, SP, Brazil

CORRESPONDING AUTHOR: patyaleixo01@yahoo.com.br

ABSTRACT

Aim: This study aims to compare masticatory performance between total prosthesis users and individuals with partial or total natural dentition to evaluate masticatory capacity and efficiency in individuals in Araraquara/SP.

Material and Methods: 31 individuals between 55 and 99 years old were evaluated, both genders, frequent users of Dentistry Clinic of the University of Araraquara (Uniara) and residents at Recanto Feliz, in the same town. A cognitive evaluation was carried out through a mini mental state examination in order to define inclusion criteria to individuals of sample. Next, a questionnaire was applied, with pre-coded questions on the masticatory capacity and an efficiency test, through the grinding test, where patients received 5 almonds to be grinded and not swallowed. The fragments were poured in granulometric sieves (2mm, 4mm and 4,75mm) to analyze the food fragmentation under tap water. Participants were divided into 3 groups: G1 (n=13) – superior and inferior total prosthesis user, or total or partial edentulous; G2 (n=4) – Total prosthesis user and/or partial removal prosthesis user (PRP) or partial dentition; and G3 (n=14) – complete or partial dentition or PRP user.

Results: Efficiency test results showed the G1 patients presented good efficiency and 8 were considered poor; G2 patients were all classified as poor, and G3 patients were 9 poor, 2 regular and 3 good. Regarding to the questionnaires, most patients from the 3 groups felt impossibility to masticate some food, and need special preparation to chew. On take more time to masticate when compared to other people, all patients from G2 answered affirmatively, while only 46.1% G1 and 50% G3 gave the same answer.Just 15.4% G1 and 28.6% G2 are not satisfied with the tame they take.About avoid in front of other people, most patients from G2 and G3 use to, however, 69.2% G1 answered negatively. Regarding to the masticatory capacity self-evaluation, they answered regular.

Conclusions: Masticatory efficiency of people using removable prosthesis did not achieve the ideal of a complete dentition. However, it is still better than in individuals with partial dentition or not rehabilitated.

KEYWORDS: efficiency, mastication, dental prosthesis
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INTRODUCTION

Aging of Brazilian population is a life expectancy increase reflection, due to the advances on health fields and low birth rate.The elderly population increased number has provoked a significant increment on studies which propose investigate human aging phenomenon.[1,2]

In senescence evolution, teeth tend to a progressive wear, resulting in extraction. This dental loss influences several aspects, among them, the mastication. In this case, dental prosthesis usage is necessary to avoid changes on the stomagnathic system. Allied to the aging process, complications will follow it, with factors like edentoulism and dental prosthesis bad adaptation, which interfere directly in good feed performance, decreasing the pleasure in eat.[1]

Mouth health is considered an essential health component for people welfare, because improves the self-image, quality of life and nutrition. One of the factors that decreases the general health in elderly is related to the possibility to ingest good nutrients, which commonly requires health natural teeth or functional prosthesis.[3]

When they are not in good work conditions and food crushing, prostheses change food habits, and as consequence, there is anorganic impoverishment and increase digestion problems due to an inappropriate presentation of semi-digested food. A change for pasty or soft diets to overcome mouth problems is far from solve the problem, and might aggravate elderly nutrition status, especially among who are institutionalized, due to the lack of an appropriate nutritional monitoring.[4]

To the masticatory process occurs appropriately, there are Paramount factors, like skeleton relations, occlusion type, and functional teeth. On the other hand, some factors may complicate this process, like different type of food to crush and swallow, mouth ulcers, ulceration, other changes in mucosa, dental mobility and some medicine usage that compromise the neuromuscular capacity.[5]

In satisfactory occlusion, there should be distribution of occlusal forces in work zone because of the higher number of teeth, and dental contact should be simultaneous and stable among teeth, and in a functional balance with the temporomandibular articulation and neuronal mandibular system.[6]

The importance of mastication with effects from dental loss reflects directly on digestion process function, considering the masticatory function depends on teeth participation, or substitutions able to cut and crush food. Several studies have investigated the relation between dental loss and masticatory efficiency[1]. Before the arguments exposed, we observe that the literature on the matter reports a direct relation between food selection and masticatory quality, e and the change on the food selection is associated to the decreased number of teeth. Then, we can state the increased number of teeth lost result in significant changes on hematological status for some nutrients, what might affect systemic health of an individual.[7]

In this context, performing this study is justified and considered necessary to evaluate the masticatory capacity and efficiency in individuals with lost some or all the teeth along their lives, with possibility to substitute them or not by prosthesis.

MATERIAL AND METHODS

For this research, 31 elderly both genders, from 55 to90years old, users of the Dentistry Clinic of the University of Araraquara – UNIARA and residents at the "Recanto Feliz"in the same town.

Inclusion criteria of sample voluntary were: do not be allergic to almond; being functionally independent or partially dependent, with no significant cognitive changes. To define this inclusion criteria, a cognitive evaluation test was adopted, The Mini Mental State Examination– MMSE.

Data from MMSE were analyzed according to some aspects present in questions on time orientation (5 points), report (3 points), attention and calculation (5 points), remember and memory (3 points), language (8 points) and visual constructive capacity (1 point). MMSE score varies from the minimum (0) to the maximum total (30).

Any score equal or above 25 (from the total 30) is effectively normal (intact). Below it, the score can indicate severe cognitive loss (≤9 points), moderate (10 to 20 points) or slight (21 to 24 points). Gross score needs adjustment according to the schooling and age. Low or very low scores are strongly related to dementia, while other mental disturbance might also lead to abnormal results in MMSE.

Participants were grouped according to similarities presented in the mouth condition regarding to the dental loss and rehabilitation.

Therefore, all the patients who presented edentulism, rehabilited or not, were selected to the group 1. Then, 13 patients composed this group: 8 with superior and inferior removable prosthesis, 2 with Superior TP and inferior arch edentulous, and 3 total edentulous patients.

Edentulous in one arch and with partial dentition in the other, rehabilitated or not, were selected to. This group was composed by 4

participants, with superior TP and inferior RPP (1), and superior TP and inferior partial dentition (3).

Individuals with non-rehabilitated natural dentition, regardless total or partial, in both dental arches, were grouped in. From 14 people, 11 were partially toothed on superior and inferior arches; 1 was partial superior toothed and inferior edentulous, and finally 2 had complete dentition.

Methodology for masticatory efficiency used in this work was based in researches reported in the literature by several authors.[8-10]

Food used to be masticated were almonds, because they are insoluble, non-perishable, in uniform size and hardness and low cost.[8,10]

Sieves in different orifices composed sieving system used: 2 mm, 4 mm, 4.75mm (Granutest) standardized and accepted by ABNT to use in researches with sieving.[8-10]

The sieves were used according to the orifice size, to the fragmented samples could pass through orifices in a progressive way using water.

Fragmented particle sizes were classified according to the orifices sizes of sieves, and the classification of masticatory efficiency according to Franciozi et al.[8] (2013), Lima et al.[9] (2009) and Matiello et al.[10] (2005), as described: (1) particles A: size up to 4.75mm, therefore, the fragments did not pass through the orifice 4.75mm; (2) particles B: size smaller than 4.75mm and bigger than 4 mm; (3) particles C: size smaller than 4 mm and bigger than 2 mm, then the particles did passed through the orifice 4 mm and did not by 2 mm one.

For each patient were solicited chewing five almonds in different situation, with and without prosthesis, according to the protocol: (1) First almond: patient chewed the almond until report the food was ready to swallow. The time from the first bite until the patient report the food fragmented enough was called 'mastication time'. The quantity of bites was also calculated in this period, called quantity of masticatory cycle; (2) Second almond: patient chewed the almond for ten seconds and up next, poured the fragmented food using water for help; (3) Third almond: patient chewed the almond for 20 seconds, and then poured the food using water for help; (4) Forth almond: patient chewed the almond for 40 seconds and next poured the food using water for help; (5) Fifth almond: patient was asked to chew naturally the almond, but no swallow any portion. After five masticatory cycles stipulated, the food should be dispended using mouthwash in a sifting system.

The whole sifting system was washed under water for 60 seconds for fragments separation by the sieves.

After obtaining quantity and measures of fragments, masticatory efficiency was classified under the following criteria: (1) Excellent – absence of particles A and presence of few particlesB after almond second fragmentation; (2) Good – optimum exclusion with absence of particles A and few particles b after third almond fragmentation; (3) Regular- Excellent and good exclusion with few particles A and B after almond third fragmentation; (4) Bad –When no classification above was possible, observing particles A after fifth almond fragmentation.

Masticatory capacity was evaluated through a pre-code questionnaire with questions on natural teeth and prosthesis performances.

Masticatory efficiency and dental prosthesis use was evaluated through buccal clinical and prosthesis examination with data analysis regarding to the conditions of support tissue, acceptation, prosthesis characteristics, mastication, esthetics, comfort, hygiene and need of professional intervention.

Patient's self-evaluation was also observed regarding to the prosthesis quality, including appearance; retention; masticatory and speaking capacity and comfort.

The prosthesis examination considered aspects such as retention and stability, speaking capacity and comfort, esthetics, tooth presence, occlusion, adaptation of acrylic bases and metal frames, prosthesis hygiene and time for confection.

Data obtained were tabulated and underneath descriptive statistical analysis through frequency distribution presented in tables and frames.

RESULTS

The sample was composed by 31 individuals: 61.3% women and 38.7% men, with medium age at 75 years, varying from 55 to 90 years.

Regarding to the elderly cognitive performance, according to the mini mental state examination (MMSE), and in a general way, major patients, it means 23 (74.2%) were in normal cognitive condition, while 4 (12.9%) presented mild cognitive impairment. It shows that all of them could be included safely to apply the method.

Results regarding to the masticatory efficiency obtained from the method when patients chew the almond are presented in Table 1.

Concerning the questionnaires on the masticatory capacity, the results are exposed on the Frame 1. In the groups 3, most (G1 – 76.9%, G2 – 100% and G3 – 71.4%) feel unable to chew the food; and need special preparation for food in order to masticate (G1 – 61.5%, G2 – 75% e G3 – 64.3%).

About take more time than other people to chew, all the individuals from the G2 answered affirmatively, while only 46.1% of G1 and 50% G3 did it; only 15.4% G1 and 28.6% G2 are not satisfied with the time they take (Frame 1).

Table 1 . Patients' masticatory efficiency in absolute (n) and relative (%) distribution frequency, according to the size particles after the almond text (Araraquara, 2014).

Classification	**Frequency (%)**		
Particles Fragmentation	**Group 1**	**Group 2**	**Group 3**
Excellent	-	-	-
Good	-	-	3 (21.4)
Regular	5 (38.5)	0 (0.0)	2 (14.3)
Bad	8 (61.5)	4 (100.0)	9 (64.3)
Total	13	4	14
	(100.0)	(100.0)	(100.0)

Regarding to avoid eating in front of other people, most G2 (100%) and G3 (71.4%) use to do it. However, 69.2% G1 answered no. Concerning the self-evaluation on masticatory capacity, G1 participants considered good (46.1%) or bad (38.5%), while G2 answered regular or bad (50% and 50%, respectively). Higher frequency on regular option for answer was observed on G3 (57.1%) (.

DISCUSSION

In Brazil, last Epidemiological survey shows Brazilians within the age from 65 to 74 years have lost 93% of their teeth (Ministério da Saúde, 2004). This picture revealshealth precariousness in Brazilian elderly population and denounces lack of care along this individuals' life[11].

Absence of natural teeth leads to unbalance of stomatognathic system, what can be perpetuated by dissatisfactory prosthesis which increases discomfort, pain and difficulty in its use, as well as lesions emergence in buccal cavity.[12]

Andrade and Seixas[13](2006) affirmed edentoulism reduces masticatory capacity, leading to change eating habits to select those easier to process and chew, which not always have the nutrients necessary in a balance diet. Total prosthesis technically correct may improve masticatory performance, but does not feel the need for nutritional orientation and monitoring users should receive after the prosthesis installation.

According to Lima et al.[14] (2007) and Fonseca e Rizzotto[15] (2008), there is direct correlation between dental loss and masticatory commitment. What reflects on damage to senile population due to only ingest food easy to chew.

It is known that teeth wear progressively in senescence, and it can result in extraction. This dental loss influences negatively several functions from stomatognathic system, mastication among them. Then, dental prosthesis usage for rehabilitation and adjust teeth function in the buccal cavity is necessary[15].

Toothless elderly with no prosthesis rehabilitation or with just one (superior or inferior), as well those with less than 20 natural teeth present low nutritional results and clearly inferior, when compared to those with 20 or more natural teeth, mixed dentition or total prosthesis, reflecting the positive impact from buccal health on individual's life.[7]

Sousa et al.[2] (2003) affirmed that elderly, in general, face difficulties from the aging process itself, and it is common this negative impact in daily activities. Some Morphological changes caused by aging are orofacial motricity, voice, audition, language and swallowing.[16] Relevant difficult for food trituration (almond) was observed in this study, presented by the 3 groups, classified as Bad masticatory efficiency (61.5%, 100% e 64.3%, respectively). It shows that no matter on complete or partial rehabilitation, even a person with natural dentition can present masticatory difficulties associated to other factors further the teeth, but masticatory cycle muscular strength and balance.

In this context, Whitaker et al.[17] (2009) detached the efficiency classification in excellent, regular, bad and terrible, which provides data on how is the masticatory function according to the characteristics observed in each aspect, once the masticatory efficiency is the final result of the whole mastication. At the end of the study, he authors verified that despite the literature

investigation, clinical evaluation is very important, because there is few standard tests and sample characteristics. Studies are very often based on subjective criteria, whose depend on professional experience, what turns unfeasible compare results from researches performed by different researchers and research centers. It evidences that new studies in this area are necessary.

Frame 1. Frequency distribution for answer from the questionnaire on masticatory capacity for elderly who participate in the research (Araraquara, 2014).

Questions/Answers	Frequency n (%)		
	GROUP 1	GROUP 2	GROUP 3
Do you feel enable to chew any food you like to eat?			
Yes	10 (76.9)	4 (100.0)	10 (71.4)
No	3 (23.1)	0	4 (28.6)
Do you need any special preparation in your food to chew (cook longer, cut in small pieces)?			
Yes	8 (61.5)	3 (75)	9 (64.3)
No	5 (38.5)	1 (25)	5 (35.7)
When compared to other people, do you take more time to chew during the meals?			
Yes	6 (46.2)	4 (100)	7 (50)
No	7 (53.8)	0	7 (50)
Are you satisfied with time you take to chew during the meals?			
Yes	11 (84.6)	4 (100)	10 (71.4)
No	2 (15.4)	0	4 (28.6)
Do you avoid eat in front of other people because of masticatory problems?			
Yes	4 (30.8)	4 (100)	10 (71.4)
No	9 (69.2)	0	4 (28.6)

Clinical result presented in the efficiency test was coherent with elderly perception, because when they were questioned on feel difficulty to chew some type of food, an important part of sample answered affirmatively (76.9%, 100% and 71.4%, respectively).

In a study performed by Cassol et al.[16] (2012), great percentile of

participants who answered initially do not have masticatory difficulty, answered affirmatively for difficulty in chew hard food. Incoherence on answers may be in possible acceptance of aging or dental deterioration as a natural and unavoidable process. Besides, the authors suggest these individuals betake to strategies for masticatory facilitation like cook food longer can result in absence of difficulty to crush food.The present study showed similar behavior, once many participants affirmed prepare more consistent foods for longer before this consumption. Elderly perceive mastication is not performed naturally and comfortable, and select a type of food or the way to consume them through strategies to facilitate digestion is necessary.[11]

Frame 1. Frequency distribution for answer from the questionnaire on masticatory capacity for elderly who participate in the research (Araraquara, 2014). (continuation)

Questions/Answers	Frequency n (%)		
	GROUP 1	GROUP 2	GROUP 3
How do you classify your mastication?			
(Excellent) chew all kind of food with no restriction	1 (7.7)	0	1 (7.1)
(Good) There are restriction for some food, but you are satisfied and it is not a problem or discomfort	6 (46.1)	0	3 (21.5)
(Regular) There are restriction for some food, it bothers and discomfort, but it is not the main complaint	1 (7.7)	2 (50)	8 (57.1)
(Bad) There are restriction for several food, it is the main complainand dissatisfaction	5 (38.5)	2 (50)	2 (14.3)
TOTAL PARTICIPANTS	13(100.0)	4 (100.0)	14 (100.0)

Regarding to prosthesis rehabilitation and masticatory efficiency by participants on this research, we observed that individuals from the group 1, who were most rehabilited (61.5% with superior and inferior TP), there was significant percentile of group classified as regular masticatory efficiency (38.5%). In the group 2, all the participants were rehabilited (superior TP and inferior RPR or superior TP and inferior partial natural dentition), performance was not appropriate, because 100% presented bad mastication.When analyzing the group 3, in which 92.8% presented partial or total dentition, there was 21.4% who was framed on good mastication category and 14.3% on regular one, which summed up together showed similar results observed on individuals rehabilited. Then, we suggest that, inside sample limitations in this study, the use of total prosthesis ensure appropriate conditions for masticatory function to the patient, further adjust phonation and esthetics. However, it is only possible when the prosthesis is in good stability, retention

and occlusal adjust conditions.

According to Cabrini et al.[12] (2008) total prosthesis replaces natural teeth and has three main functions: restoring masticatory capacity, provides nice appearance and ensure appropriate phonetics. Thereunto, the authors suggest when the evaluation is performed on the prosthesis quality by the professional, it must be careful in search objective factors, like retention, stability, adaptation, vertical dimension and esthetics, which are factors normally associated to patients' complaints. According to Franciozi et al.[8](2013), the balance on occlusal contacts is a significant factor on total prosthesis intervention over stomatognathic system.However, there is no occlusal standard which incorporate all the variables required by patients who need total removal prosthesis.

In the study carried out by Franciozi et al.[8]in 2013, the type of double prosthesis which interfere on masticatory performance was verified, also what results were found in new prosthesis. The better masticatory efficiency was observed when prosthesis presented bilateral balanced occlusion. This is the reason for many authors recommend periodical evaluation on prosthesis and hard and soft adjacent tissues.[11]

On the other hand, users of maladapted prosthesis or people who did not replace artificially their lost teeth may be committing their general health by masticatory efficiency loss, further also risk their nutritional diet. It was also proved with tests performed in this study. Likewise, psychological factors which involve people who lost their teeth must be considered, giving attention to psychic and social damage which involve this situation and are seldom clearly verbalized for health professional. Masticatory efficiency of patient who uses total prosthesis is straightly linked to his/her quality of life, because food digestion process starts by mastication.[11]

In the study performed by Lima et al.[14] (2007) to evaluate mastication, statistically significant difference was found among the groups regarding to the food cutting. This result may be due to the bite strength, which is decreased by prosthesis users when compared to natural teeth individuals. Another possibility to be considered is the grip instability for food due to the removal prosthesis.

Matiello et al.[10] (2005) verified that patients who use total superior and inferior prosthesis have lower masticatory efficiency than those with natural complete dentition, because they can crush less the food particles.

Cabrini et al.[12] (2008) reinforced that despite it appears obvious data, as less time of total prosthesis use, worse its quality. Defective and unsatisfactory prosthesis from technical view point can cause disorders for elderly people who show fear or have difficulty to access a dentist, and it generates significant loss in their quality of life. Thereunto, some authors consider time of use as influence on general quality of total prosthesis, and clinical items which suffer more influence are color and shape (esthetic), retention and stability of inferior and finally occlusal relation, which are basis for restoration and maintenance of stomatognathic system balance.

When participants in this research were questioned on prepare food in a way to facilitate their mastication, and thus chancing the consistence, independent on the group they belong, most participants informed perform a special preparation to the food become softer or pasty. In the literature, a work performed by Schmiedel et al.[18] (2013) found, when participants were questioned on the possibility to interfere on food consistency, 52.4% of sample affirmed the viability, and 47.6% referred that it was not possible for them. However, in a posterior question, when they were asked if they had any preference regarding to the food consistency, from the 22 elderly who referred eating in all consistencies, 14 reported prefer pasty consistency and 8 on solidone. It is important detaching the controversy on the answers from the group which referred there was no difficulty on this request. There is the assumption when they questioned on the difficulty, initially, elderly tended to ignore some deficits. However, when the answers had to become more specific (liquid, pasty, solid), every subject answered in a more aware way, limiting their real conditions for feed. Then, 80% of the sample studied by the authors confirmed resistance to the solid consistency.[18]

Dias-da-Costa et al.[4] (2010) reported the masticatory capacity referred as unsatisfactory is mainly conditioned to tooth loss, by the high levels on edentoulism and high prevalence on caries and periodontal diseases. Despite that information is self-referred, the authors found high prevalence on dissatisfaction in almost half participants. Then, it can be considered, together the tooth loss, one of the bigger problems in public health in Brazil within this age.

Schmiedel et al.[18] (2013) searched food satisfaction and observed only 3participants on the study chosen excellent as classification; most part of sample interviewed(22 subjects) chosen Good; 14 used Regularas classification, and 3 made the option Bad.No elderly classified his or her feed as Too bad. Analyzing these findings, elderly self-

perception on their food is realistic, because a small number considered his/her food as the best possible classification (excellent) and no one considered as the worse possible (Too bad), It keeps the group in an intermediate position for satisfaction, with some reservation on the food process. These data are straightly linked to the elderly awareness on their actual difficulties or necessary adaptations for enough feed.This finding is Paramount on successful prevention and self-knowledge and self-care.

Oral health plays an important role on quality of life, in prevention of diseases, on nutritional condition and social interaction for elderly. According to Montenegro et al.[19] (2007), one of factors for decrease the quality of life and general health among elderly is closely related to the possibility for eating good nutrients, which generally requires healthy natural teeth or well adapted dental prosthesis. When the prostheses are not in good work conditions to crush food, elderlies change their eating habits.

Findings from this study linked to data from the literature on the subject reinforce the certainty on awareness elderly on the importance of periodical revision to evaluate the prosthesis, regarding to stability and retention aspects and because the possibility for inappropriate adaptation generates damage on hard and soft tissues in the mouth.

CONCLUSIONS

According to the methods used is possible conclude: (1) masticatory efficiency found in all the groups studied was bad for most patients; (2) total prosthesis users group showed a significant parcel of regular masticatory efficiency, as in the group of total toothed patients; (3) good masticatory efficiency was found in the group with complete or partial natural dentition patients; and (4) masticatory efficiency of individuals with removable prosthesis did not achieve the ideal for a complete dentition, but it still better than in individuals with partial dentition or not-rehabilited.

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