

Original articles

The influence of implant-supported dentures on the nutritional status of elderly individuals

A influência de dentaduras implanto-suportadas sobre o estado nutricional de indivíduos idosos

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ABSTRACT

Purpose: the aim of this study was to evaluate the nutritional status of elderly individuals submitted to surgical-prosthetic oral rehabilitation procedures.

Methods: fifteen patients completely edentulous aged 60 years or more were assessed (10 women and 5 men). All individuals wore removable dentures in both arches and had their mandibular dentures replaced by implant-supported prostheses, were submitted to nutritional evaluation comprising anthropometric aspects, biochemical blood analysis and dietary evaluation before surgery and at three and six months after surgery.

Results: statistical analysis of the anthropometric evaluation did not reveal significant difference between the study periods, for all parameters investigated. The biochemical evaluation revealed a significant increase in albumin three months after dental treatment, returning to lower levels after six months. The dietary evaluation evidenced that the caloric intake, macronutrients proteins and carbohydrates was not altered after dental treatment. Conversely, the ingestion of lipids were lower six months after dental treatment compared to the previous results.

Conclusion: therefore, the placement of implant-supported complete dentures in the elderly individuals investigated in this study did not modify the nutritional condition in the short term, suggests that the subjects maintained the previous dietary characteristics.

Keywords: Nutritional Status; Aging; Denture, Complete; Dental Prosthesis, Implant-Supported

RESUMO

Objetivo: avaliar o estado nutricional de indivíduos idosos submetidos a procedimentos de reabilitação oral cirúrgico-protético.

Métodos: foram avaliados 15 pacientes completamente edêntulos com idade igual ou superior a 60 anos (10 mulheres e 5 homens). Todos os indivíduos usaram prótese removível em ambos os arcos e tiveram suas próteses mandibulares substituídas por próteses com implante, foram submetidas à avaliação nutricional, compreendendo aspectos antropométricos, análise bioquímica do sangue e avaliação dietética antes da cirurgia e três e seis meses após a cirurgia.

Resultados: a análise estatística da avaliação antropométrica não revelou diferença significativa entre os períodos de estudo, para todos os parâmetros investigados. A avaliação bioquímica revelou um aumento significativo da albumina três meses após o tratamento odontológico, voltando a níveis inferiores após seis meses. A avaliação dietética evidenciou que a ingestão calórica, macronutrientes proteínas e carboidratos não foram alterados após o tratamento odontológico. Por outro lado, a ingestão de lipídios foi menor seis meses após o tratamento odontológico em comparação com os resultados anteriores.

Conclusão: portanto, a colocação de próteses dentárias completas implantadas nos idosos investigados neste estudo não modificou a condição nutricional no curto prazo, sugere que os sujeitos mantiveram as características alimentares anteriores.

Descritores: Estado Nutricional; Envelhecimento; Prótese Total; Prótese Dentária Fixada por Implante

INTRODUCTION

During ageing, the masticatory function may be impaired due to physiological modifications and reduction in the number of teeth¹. The ingestion of nutrients and the caloric adequacy are proportionally decreased with the damage to oral health^{2,3}. Also, the masticatory inefficiency leads to a reduction in the ingestion of fiber foods⁴, which may be related to the occurrence of several gastrointestinal disorders⁵⁻⁷, systemic^{8,9} and chronic diseases¹⁰ in elderly individuals.

Studies concerning the impact of dental status on the nutritional condition of adults showed greater ingestion of calcium, vitamin A, ascorbic acid¹¹ and folate¹² in individuals with natural dentition compared to denture wearers. Conversely, the studies of Sebring et al.¹³ (1995) and Moynihan et al.¹⁴ (2000) showed that the ingestion of nutrients is not different between the different types of dental treatment (removable and fixed dentures), suggesting that the success of prosthetic oral rehabilitation does not necessarily result in a more satisfactory diet¹⁵⁻¹⁷.

With respect elderly individuals, the presence of natural teeth results in greater nutritional gain in the diet compared to those wearing partial and complete dentures¹⁸ with less risk of malnutrition³ and better consumption of adequate amount of fruit and vegetables^{10,19,20}. The improvement of dentures benefits the masticatory ability with positive impact on the nutritional status²¹, increasing body weight and albumin level²² without changes on intake of energy and nutrients²³. Moreover, the treatment with implanted-supported dentures can modify the function of stomatognathic system²⁴ and the nutritional status of edentulous elderly individuals, thus enhancing their anthropometric²⁵ and biochemical evaluation²⁶.

Therefore, the presence, number, quality and distribution of natural teeth, as well as some specific oral disorders can directly interfere with the masticatory capacity of individuals, consequently affecting the ingestion of several nutrients, the nutritional status^{3,17,27-29} and the quality of life³⁰. Thus, this study aimed to determine the influence of placement of mandibular implant-supported dentures on the nutritional status of elderly individuals.

METHODS

This study was reviewed and approved by the Institutional Review Board of University of Sagrado Coração, protocol number 001/2003.

Patients

Fifteen elderly individuals were selected, by non-probability convenience sampling, being ten women and five men, aged 60 to 76 years, with median of 64 years, who attended the Maxillofacial Surgery and Traumatology, Prosthodontics and Implantology Clinics of the Dental School at the aforementioned university. How inclusion criterion all individuals had good general health, were edentulous, wore complete removable dentures, and presented good clinical conditions of the maxillary arch and mandibular bone structure that allowed placement of implants with minimum length of 10mm.

Individuals with history of neurological diseases, head and neck tumors, psychological and psychiatric disorders were excluded, as well as smokers, alcoholics and individuals with abnormal maxillomandibular relationship, such as mandibular prognathism or retrognathism.

The individuals were evaluated at three different periods: before (Pre), three months (Post1), and six months (Post2) after the surgical-prosthetic procedure.

Surgical-prosthetic procedures

Before surgery, the conditions of maxillary and mandibular complete dentures worn by the patients were evaluated. Dentures considered as inadequate were replaced.

The patients were submitted to the surgical protocol suggested by Branemark et al.³¹ (1977), comprising placement of five endosseous implants with 4, 4.5 or 5-mm diameter with smooth surface in the mandibular arch. After implant placement, the abutments were fixed to the implants, followed by procedures for preparation, finishing, polishing and fitting of dentures. The time interval between the insertion of implants and placement of the dentures was no longer than 24 hours, characterizing the immediate load procedure. The same dentures previously worn by the patients were used.

Nutritional evaluation

The nutritional evaluation of patients comprised anthropometric measurements, blood biochemical analysis and blood count.

The **anthropometric data** collected included weight, measured in kilograms (kg) using a calibrated anthropometric electronic scale, Tanita model, platform type, with capacity of 150 kg and precision of 0.1 kg.

The height was measured in meters using a fixed, inextensible and graduated vertical bar; subjects were measured standing up, barefooted and with their heads positioned at the Frankfurt plan. The arm circumference (AC) and waist circumference (WC) were measured in centimeters using a fiberglass tape measure.

The subscapular, suprailiac, tricipital and bicipital skinfold thicknesses were obtained on the right side of the body using a Lange Skinfold Caliper, with scale up to 65mm and precision of ± 1 mm, according to the technique of Lohman et al.³² (1988). The values of these measurements allowed calculation of the body mass index (BMI) using the following formula: [weight(kg)/height(m²)]; percentage of body fat (%BF), by adding the value of the four skinfolds (tricipital, bicipital, subscapular and suprailiac) using the equation of Durnin & Rahaman³³ (1967); the muscle arm area (MAA), calculated according to Frisancho³⁴ (1981), using the formula $[(C \text{ (cm)} - (\pi \times T \text{ (cm)}))^2 / 4 \pi]^2$, in which c represents the arm circumference (in mm) and T the tricipital skinfold thickness.

For the **biochemical blood analysis** and **blood count**, blood samples were collected from the patients after ten to 12 hours of fasting. The seric albumin was

analyzed by the spectrophotometric method. The blood count comprised the total count of lymphocytes, determination of the hemoglobin and hematocrit values using automated equipments.

For the **dietary evaluation**, the food intake was analyzed using the 24-hour recall, in which the interviewer asked the individual to remember all foods and beverages consumed during the day before the interview, using models of foods, cups, glasses and measuring spoons to achieve an estimate of the size of food portions³⁵. The caloric and macronutrient intake was then calculated using a specific software.

Statistical analysis of the data was performed using mean, standard deviation, median and total half-amplitude parameters. For the quantitative variables the analysis of the variation in the periods was performed through the analysis of variance to a criterion for repeated measures. A significance level of 5% was adopted for all tests.

RESULTS

The results of the nutritional status concerning the anthropometric and biochemical aspects are presented in Tables 1 and 2, respectively.

Table 1. Results (mean and standard deviation) obtained on the anthropometric evaluation of the nutritional status, before (Pre), three months (Post1) and six months (Post2) after dental treatment

Anthropometric measurements	Period			Result of statistical test (ANOVA)**
	Pre	Post1	Post2	
Weight	66.81 \pm 16.39	67.80 \pm 17.00	66.73 \pm 16.01	P > 0.05
BMI	26.56 \pm 5.23	26.93 \pm 5.36	26.53 \pm 5.07	P > 0.05
Sum of skinfold thicknesses *	54.00 \pm 47.00	49.00 \pm 57.00	54.00 \pm 43.00	P > 0.05
AC	30.09 \pm 3.36	30.55 \pm 4.50	30.13 \pm 3.82	P > 0.05
MAA	50.14 \pm 7.93	52.71 \pm 11.66	51.11 \pm 10.31	P > 0.05
WC	89.10 \pm 9.85	90.47 \pm 10.62	88.67 \pm 10.31	P > 0.05
% BF	21.14 \pm 7.97	27.53 \pm 8.04	26.69 \pm 8.14	P > 0.05

* Median \pm total semi-amplitude

**Analysis of Variance (ANOVA)

Table 2. Results (mean and standard deviation) obtained on the biochemical evaluation and blood count of the nutritional status, before (Pre), three months (Post1) and six months (Post2) after dental treatment

Biochemical evaluation	Period			Result of statistical test (ANOVA)**
	Pre	Post1	Post2	
Hemoglobin (g/dL)	14.10 \pm 1.92	14.14 \pm 1.17	14.10 \pm 1.17	p > 0.05
Lymphocytes (mm ³)*	1840.00 \pm 1645.00	1626.00 \pm 550.00	1748.00 \pm 624.00	p > 0.05
Hematocrit (%)	40.79 \pm 2.43	41.16 \pm 3.37	40.75 \pm 3.19	p > 0.05
Albumin (g/dL)	4.37 \pm 0.46 a	4.81 \pm 0.55 b	4.17 \pm 0.23 a	p < 0.01

* Median \pm total semi-amplitude

Different letters indicate statistically significant difference between periods.

**Analysis of Variance (ANOVA)

Statistical analysis of the anthropometric evaluation did not reveal significant difference between the different study periods, for all parameters investigated. It should be noticed that, with regard to weight, the mean results observed after three months revealed a mean gain of one kilogram compared to the pretreatment values, yet returning to the initial values six months after dental treatment.

The biochemical evaluation revealed a significant increase in albumin three months after dental treatment, returning to lower levels after six months.

Table 3 presents the results of the total caloric intake (TCI), as well as the ingestion of macronutrients calculated by analysis of the 24-hour recall, at the different study periods.

Table 3. Results (mean and standard deviation) of the dietary evaluation, obtained by the 24-hour recall, before (Pre), three months (Post1) and six months (Post2) after dental treatment

Dietary evaluation	Period			Result of statistical test (ANOVA)**
	Pre	Post1	Post2	
TCI (Kcal)	1422.21 \pm 293.51	1467.30 \pm 270.86	1416.85 \pm 251.57	p > 0.05
Proteins (g)	57.91 \pm 21.17	60.70 \pm 17.22	59.72 \pm 18.70	p > 0.05
Lipids (g)	51.33 \pm 15.28b	50.94 \pm 14.16ab	47.42 \pm 14.51 ^a	p < 0.05
Carbohydrates (g)	187.65 \pm 31.83	195.66 \pm 39.17	189.61 \pm 38.72	p > 0.05

Different letters indicate statistically significant difference between periods.

**Analysis of Variance (ANOVA)

As observed in Table 3, statistical analysis of the dietary evaluation evidenced that, after dental treatment, the caloric intake was not altered, as well as the macronutrients proteins and carbohydrates. Conversely, the ingestion of lipids was lower six months after dental treatment compared to the previous results.

DISCUSSION

Tooth loss in elderly individuals, combined to other physiological modifications related to the ageing process, contributes to masticatory and swallowing difficulties^{1,3} that can influence the nutritional aspects², quality of life^{29,30}, as well as the functional conditions of the stomatognathic system. The effect of different

alternatives of oral rehabilitation on these aspects is variable. This study analyzed the influence of implant-supported dentures in the mandibular arch on the nutritional status and dietary profile of edentulous elderly individuals.

The treatment effects on the nutritional status revealed that, both in the first and second periods after treatment, no statistically significant changes were found in the parameters analyzed compared to the preoperative period, except for albumin, which was increased three months after oral rehabilitation, yet returned to the preoperative values after six months. To some extent, these results are surprising and should be thought over. Authors as Greska¹¹ (1995) and Papas et al.¹⁶ (1998) evaluated the impact of oral rehabilitation

using conventional dentures and did not find good nutritional adequacy compared to the results obtained on individuals with natural teeth. Similarly, Sebring et al.¹³ (1995) verified that edentulous individuals are more prone to present insufficient ingestion of fiber, calcium and vitamins, independently of the type of dental treatment. Moreover, according to Moynihan et al.¹⁴ (2000), the oral rehabilitation process using removable or fixed dentures does not improve the quality of diet of the individuals. Conversely Wöstmann et al.²¹ (2008) observed enhancement in the nutritional conditions of individuals in relation to adequacy of the dentures, a fact verified by mini evaluation of the nutritional status and determination of the blood levels of albumin and zinc. Kanehisa et al.²² (2009) also found higher levels of serum albumin for individuals who used partial dentures compared with non-users six months after prosthodontic treatment. De Marchi et al.¹⁰ (2010) and Tsakos et al.²⁰ (2010) found greater fruits and vegetables intake in dentate or denture users elderly in comparison to edentulous. Morais et al.²⁶ (2003), considering the effect of implant-supported oral rehabilitation on nutritional, anthropometric and biochemical parameters (seric albumin, hemoglobin and B12 vitamin) of elderly individuals, verified improvement in the investigated aspects after dental treatment, what was assigned to modification of the dietary habits and greater facility to eat vegetables and fruits. Recently Borges et al.²⁵ (2010) verified better masticatory performance three months after prosthetic rehabilitation with improvement on nutritional status and decrease of number of patients with malnutrition risk six months later.

Although there is not a definite explanation for the present results, the lack of increase in the total daily caloric ingestion in the postoperative period, in the ingestion of proteins and carbohydrates, as well as a decrease in the ingestion of lipids, suggests that surprisingly the subjects maintained the previous dietary characteristics, which would obviously result in conservation of the nutritional status. These findings agree with the study of Sandström and Lindquist¹⁵ (1987), who did not find modifications in food selection, except for a mild increase in the ingestion of bread and fruits after mandibular implant-supported rehabilitation. More recently, Allen and Mc Millan¹⁷ (2003) and Gunji et al.²³ (2009) verified that the success of oral rehabilitation did not result in dietary adequacy, in agreement with the present results. Besides, it is important to consider that the mandibular fixed denture may interact negatively with the maxillary denture prosthesis and unbalance

the neuromuscular coordination involved in the masticatory process²⁴, influencing the dietary intake.

Therefore, the placement of implant-supported complete dentures in the elderly individuals investigated in this study did not modify the dietary habits in the short term, partly explaining the lack of effect on the nutritional status. To test this hypothesis, it would be necessary to investigate the reasons why the dietary habits did not change and also to follow the individuals longitudinally, besides establishing educational programs with a view to influence the dietary habits, similar to the study of Bradbury et al.¹⁹ (2006), in which the dental and dietary intervention were performed simultaneously, improving the dietary behavior of individuals and increasing the ingestion of fruits and vegetables.

CONCLUSION

The placement of implant-supported complete dentures in the elderly individuals investigated in this study did not modify the nutritional condition in the short term, suggests that the subjects maintained the previous dietary characteristics.

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